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Abstract

During the nineties, workers began to spurn secure jobs in large organizations, which were formerly considered prestigious. They developed more positive attitudes towards jobs in small, innovative startups, although these involved less job security. Our model identifies some of the economic forces behind this trend. Small firms with little capital at stake take excessive risk. They realize more of their workers' risky ideas, which allows to poach creative workers from better capitalized firms. This advantage increases if a) workers receive easier credit access, and b) technological progress raises the payoff from new ideas. As small firms take excessive risk, average enterprise profitability in the affected sectors decreases, while bankruptcy increases. Moreover, large firms react through inefficient organizational changes.

Keywords: Occupational choice, spin-offs, sorting in labor markets, organizations and markets, financial development

JEL Classification Numbers: L2, G3

I Introduction

The nature of the firm has changed substantially in the last decade. Asset-intensive and highly vertically integrated firms with tight control over their employees have become old-fashioned. Instead, human capital and skills of workers have become the key element in determining corporate success (Rajan and Zingales, 2002). Not surprisingly, firms have entered into fierce competition for the most talented employees. However, retaining talented workers has proved to be a difficult task because their preferences for different types of jobs have been changing over time.

Surveys during the nineties show that workers expected opportunities for personal growth from their jobs, and that "the organization encourages to challenge the way things are done" (Stum, 1998). Cappelli (1999)[1] reports that an increasing number of MBAs from top U.S. business schools were declining job offers with the highest pay and positions in investment banking and consulting firms in favor of jobs at small companies and start-up ventures.[2] They became more willing to forgive job security and take a risk for gaining the "possibility of hitting it big" at an entrepreneurial venture. Talented workers began to spurn secure jobs in large and stable organizations,[3] formerly considered prestigious. Cappelli concludes that MBAs "willingness to roll the dice for a big reward" increased, a trend that was not restricted to MBAs: In 1989, 94 percent of U.S. workers of very different skills answered that they considered job security important or very important. In 1997, only 90 percent thought so. Similar tendencies were observed in other countries such as the U.K (International Social Survey Programme, 1989, 1997). It seems that the *supply of talent* shifted from large to small firms.

Changes in worker attitudes coincided with decreasing average firm size, in particular, in the high-tech sectors of OECD countries (Pryor, 2001). Large firms, in the attempt to attract the most skilled workers, tried to imitate the way small firms operate by creating spin-offs (Lawler et al., 1995; Michaels et al., 2001).[4] Some of these attempts were of rather short-term nature. After the burst of the new economy bubble, large firms have become more attractive again. Similarly, some of the most extreme changes of the nineties have been reversed and large companies are dismantling their corporate venture funds (*The Economist*, 2001).

[1] For more details, see Cappelli (1999, p. 228)

[2] Cappelli (1999) also reports that confronted with the hypothetical alternative between a risky job involving a possibly big payoff or a secure one, MBAs became increasingly prone to the risky choice, even if compensation in expected value was just slightly higher than the secure job.

[3] The mortality rate of firms is decreasing with age and size (Caves, 1998).

[4] A prominent example of this "small-is-beautiful" tendency was the Bertelsmann Group, which even created its own venture fund (Day et al., 2001).

The goal of our paper is to understand some of the driving forces causing changes in worker attitudes towards large and small firms, and the shift in the supply of talent. The economic profession following Zingales (2000) has recognized that decreasing firm size and organizational change have been driven by financial development and the relaxation of financial constraints to small firms and start ups. Although the relevance of this mechanism is undeniable, changes in worker attitudes towards different organizations remain unexplained. An increase in the number of start-ups – and, consequently higher demand for talent from small firms – could account for the increasing employment share of small firms. However, it does not imply that talented workers begin to spurn large organizations and the security they offer. If anything, these jobs, being scarcer, should have become more desirable and should have faced stronger competition to attract talent than large firms, but the empirical evidence suggests that the supply of talent to small firms increased. This is very important as the availability of human capital appears at least as important for innovation as the availability of financial capital (see, for instance, Mohnen and Roeller (2004)).

We argue that financial market development and technological progress may explain the shift in the supply of talent and the changes in worker attitudes towards jobs. We show that as a consequence of financial market development, small firms gain a competitive advantage on the labor market: they do better in attracting more creative workers. Better access to consumer credit makes talented workers less averse to the income risk involved in working in less capitalized organizations that are more likely to default. As these organizations are more inclined to fund risky projects, they acquire a competitive edge and poach the most creative workers from well-capitalized large organizations that screen new ideas more intensively. Technological progress has similar effects. Our model shows that when the expected payoff from realizing workers' new ideas increases, small firms become relatively more attractive to creative workers.

In the model, the key to the comparative advantage of small firms is risk-taking. Large firms tend to have more self-financed assets than small firms. As has been highlighted by Jensen and Meckling (1976), less capitalized firms have stronger incentives to choose riskier projects in order to maximize shareholder value. As funding a worker's idea involves the risk of losing the initial investment, the more own assets, reputation, or future cash flows of other projects a firm risks, the less prone it will be to fund the ideas of workers. For this reason, larger firms are more careful in screening their employees' ideas.[5] As a result, large firms are more likely to reject ideas that could have a positive net present value. This is *ex post* optimal from the point of view of maximizing

[5] We support these claims in subsection V.B that presents empirical evidence.

the return to investment, but it has important *ex ante* implications on the attractiveness of jobs in large firms. Small firms can use their higher propensity to realize workers' ideas in a similar way as variable pay, the positive effect of which on sorting of workers has been highlighted by Lazear (1986 and 2001). Large firms cannot commit themselves to offer jobs in which workers realize as many of their ideas as they could in small firms. This is particularly important for the most creative workers. They are the most concerned to see their ideas realized, in order to show their ability and to receive higher wages. They may, however, appreciate jobs in large firms as they are less likely to default.

Workers thus face a trade-off between better insurance and lower probability of realizing their own ideas. How this trade-off affects the choice of workers between jobs in small or large firms depends on the possibility of insurance offered by the financial market and on technological change.

First, if liquidity constraints of households are relaxed – as has been the case during the last decade[6] – the propensity of creative workers to work in large firms decreases. In fact, if their idea turns out to be bad and their firm defaults, they can borrow against their future income, while looking for a new job. This implies that better access to household credit, be it owing to financial development or to expansive phases of business cycles,[7] makes the insurance offered by large firms less desirable. Small firms thus gain a competitive edge over larger firms in attracting creative workers.

Second, technological change raises the expected payoff from realizing new ideas. We show that this negatively affects the capability of large firms to attract the most talented workers, if it remains difficult to distinguish profitable ideas from loss-making ones. In this case, large firms erroneously reject ideas that may have positive net present value, and the most talented workers prefer to work in small firms even though the entry wage differential between large and small firms may increase.

The main contribution of the paper is to show that financial market development affects corporations not only through financial markets, but also through the labor market. Rajan and Zingales (2002) argue that better developed financial markets decrease collateral requirements and thus make it easier for start-ups to access external finance. Hurst and Lusardi (2004) show that this common wisdom is, surprisingly, not supported by data. They find that availability of initial capital, proxied by an individual's initial wealth, does *not* affect the decision to become an entrepreneur and argue

[6] The eighties were characterized by a process of financial deregulation that made consumer access to credit markets easier. As a consequence, the liabilities of households increased substantially over the nineties, especially in the US. See Guiso et al. (2002) and Sullivan (2001) for empirical evidence.

[7] During expansions, for instance, the value of real estates is generally higher and workers can increase more easily their mortgages.

that this is easy to rationalize given the small amount of capital necessary to start a new business. Our model suggests another channel why financial development may matter: it shows that access to consumer credit also affects the choice of workers to sort into small or large firms and may harm large firms because of a *labor-stealing effect*. Interestingly, workers' choices between small and large firms may change over the business cycle if the level of access to consumer credit changes.

An important implication of the model is that better access of households to capital markets may reduce average enterprise profitability in sectors in which worker talent is important. In our model, better access to credit raises the number of ideas that are funded, as small firms are less choosy in accepting new projects. In equilibrium, too many ideas are funded, the variance of small firms' profits increases, and there are more bankruptcies. The source of this inefficiency is that small firms do not fully internalize the cost of investment. This is *sub*optimal from the point of view of maximizing gross output, but benefits the more creative workers.

The model also implies that the desire of creative workers to realize their ideas may spur capital structure and organizational change in the wrong direction. Large and well-capitalized firms lose their most creative workers and become less profitable, although their conservative behavior in project selection is good for the economy. Small risk-loving firms may have higher profits than large firms, because they attract more creative workers. The loss of competitiveness of large firms may force them to change their organizations. In particular, in order to commit to adopting less intensive screening processes, large firms may buy back stocks and increase leverage in order to operate more similarly to small firms. Additionally, and perhaps more importantly, large firms may have an incentive to create spin-offs that – being less capitalized – behave more like small firms.

In this respect, our paper contributes to the literature studying the conditions under which it is optimal to decentralize production. We show that when workers are differing in creativity, companies may have an incentive to spin off some of their activities not only to affect workers *ex post* incentives to provide efforts, as for instance in Scharfstein and Stein (2000) and Gromb and Scharfstein (2002), but also to influence workers' *ex ante* occupational choice. Our paper is also related to Laux (2001). In his model, spinning off a highly indebted subsidiary is a device for the principal to commit to monitor the manager of the subsidiary. We show that if *ex ante* sorting and occupational choices rather than *ex post* incentives are important, the contrary may be true: spin-offs funded with external funds may be a commitment device *not* to screen projects too intensively (in order to attract creative workers).

In our model, large firms lose their competitiveness in the labor market because they screen

too carefully, that is, they acquire "too much" information relative to small firms. This is related, but not identical, to the effect pointed out by Crémer (1995): more information of the principal about the type of a worker reduces the commitment to be tough if output is low.[8] Less information can then be better as it strengthens the worker's incentives. In contrast, in our model, information acquisition is always optimal with respect to maximizing the return to investment. It also does not adversely affect the payoff of the idea, which is exogenous. Nonetheless, more information acquisition may be bad for a firm as it makes it harder to recruit talented workers. It may then be optimal to spin off units, because this is the only way to commit to increased risk-taking as desired by the most creative workers.

The remainder of the paper is organized as follows: Section II describes the model; Sections III and IV derive the equilibrium and its implications and discuss some extensions. Section V presents original empirical evidence and other empirical evidence in support of the model and Section VI concludes.

II The Model

Both workers and firms are heterogenous. Workers differ in their creativity, while firms differ in the amount of internally financed assets. We assume that large firms are better capitalized and fund more assets internally than small firms. Workers decide in which firm to work, that is, they "make their occupational choice" taking as given the wages firms offer, and their own beliefs about the probability of realizing their idea in large vs. small firms. Workers are risk-averse and maximize expected utility that depends on how easily they can access consumer credit and on their lifetime income. This in turn depends on the basic wage offered by the firm when they are recruited and on the additional remuneration that will accrue if they have a successfully realized idea.

It is crucial that firms cannot commit to realize workers' ideas with some probability, but *ex post* choose optimally whether to screen an idea according to their capital structure. The screening decision affects the probability of realizing a worker's idea.

We will show below that the creativity of workers and the expectations on the firm screening decision determine their occupational choice. More creative workers, who are more likely to have an idea, are more inclined to work in small firms as these offer better chances to realize ideas.

In what follows we present more detailed explanations about the timing of the game, workers,

[8] A similar point, applied to internal capital markets, is made by Stein (2002).

firms, and the supply of capital. We then define the equilibrium.

A Timing

First Period

- At $t = 0$, firms offer a wage contract.
- At $t = 1$, workers make their occupational choice. After choosing between small and large firms, workers are randomly matched with a firm of their favored type.
- At $t = 2$, each worker has an idea with probability ϕ, and communicates it to her employer.
- At $t = 3$, firms choose whether to screen the idea submitted by their employees. A firm that does not screen, always funds an idea as they have positive net present value. A firm that screens decides whether or not to fund the worker's idea on the basis of the screening outcome. In the absence of internal funds, external financiers provide capital. If the idea is not funded, the firm employs capital and worker using an alternative, "traditional" technology.
- At $t = 4$, stochastic output is realized if the firm funded the worker's idea. If the idea was successful, worker and firm share the surplus and repay the external financiers. If a firm goes bankrupt, workers do not get any wage. If the worker (capital) has been employed in the traditional technology, safe returns $\underline{w}$ (r) are realized. After receiving their wages (or nothing), workers can borrow up to an exogenously fixed amount. Then, they consume.

Second Period

- At $t = 5$ (in the second period of their life), all workers and assets are employed in the traditional technology. For sake of simplicity, no further ideas emerge. Production provides safe returns r and $\underline{w}$. Workers consume.

B Workers

There is a set of workers of mass 1 who live for two periods. All workers have the same productivity when employed in the traditional, risk-free technology, but they differ in creativity. A worker's creativity is ϕ, the probability of having an idea, which is uniformly distributed on the support $[0, 1]$. A worker's idea consists of a process or product innovation that may increase the expected

profits of the firm where the worker is employed.[9] It is important for our results that firm and worker are complementary in the realization of the idea. The worker cannot realize her idea outside of the firm, and the firm needs the worker to realize the idea. Ideas can be either profitable (good) or not (bad). For the sake of simplicity, we assume that the quality of the idea is not correlated with the worker's creativity. Workers know their type ϕ. Prior to recruitment firms cannot identify ϕ, and workers cannot signal their type.

Workers make their occupational choice (at $t = 1$) by maximizing their expected utility that depends on their lifetime wage profile. This depends on the decision to work in a small or a large firm and on whether or not the worker has an idea. Thus, the worker maximizes her expected utility over two periods, $E_1(U)$, by choosing what type of firm to work in, subject to two budget constraints and the liquidity constraint:

$$\max_{\{c_1,c_2,b,f\}} E_1(U) = E_1\left(u(c_1) + \frac{1}{1+\delta}u(c_2)\right) \tag{1}$$

$$s.t. \widetilde{w}_1(f,i) - b = c_1 \tag{2}$$

$$\widetilde{w}_2(f,i) + (1+r)b = c_2 \tag{3}$$

$$b \geqslant -B. \tag{4}$$

Workers are risk averse: $u' > 0$, $u'' < 0$; and δ is the intertemporal discount rate. The worker's consumption (wage) in period t is denoted c_t (w_t). Wages $\widetilde{w}_t$ are random variables the probability distribution of which depends on the type of firm where the worker is employed, $f \in \{S, L\}$, for large and small firms respectively, and on whether the worker will have an idea ($i = 1$) or not ($i = 0$). Workers' first-period savings (bonds) are $b \equiv \widetilde{w}_1 - c_1$, and r is the risk free interest rate at which a worker can borrow and lend. Workers decide on first-period consumption and whether to borrow or save after the first-period wage is realized.

Because $u(.)$ is concave, workers want to smooth their consumption over the two periods. As we assume $\delta = r$, there are no incentives to borrow and lend other than consumption smoothing. The liquidity constraint, $b \geqslant -B$, implies that in $t = 1$, workers may not be able to borrow as much as they want against future wage. In this setup, we can model the impact of financial market development in a straightforward way: the easier is access to consumer credit, the larger is the amount B that workers can borrow against their future wages. Clearly, an increase in B affects the

[9] In organization theory it is common to interpret value-improving innovations in a broad sense, which include all improvements of the processes for getting things done. See, for instance, Rotemberg and Saloner (2000).

consumption path and occupational choices only if the borrowing constraint is binding, that is, if $\widetilde{w}_2(f,i) \geq B$. Otherwise, the worker would not be able to repay a loan larger than the second-period wage. In what follows we assume that the borrowing constraint is binding.

C Firms

There is a set of large firms of mass γ and an *a priori* indeterminate number of small firms. Firms are run by a manager who maximizes expected profits. Managers take two decisions: first, what wages to offer ($t = 0$); second, whether or not to screen and to fund worker ideas ($t = 3$).

Large firms have an initial amount of self-financed assets equal to A^L. As will become clear below, these initial assets may be interpreted as physical assets the firm owns, intangible assets such as reputation or, more broadly, as the cash flows of other concurrent projects that may be jeopardized if the worker's project turns out to be a failure.[10] The number of workers large firms employ, and, thus, the capital per worker will be determined in equilibrium. For the sake of simplicity, we assume that small firms have no assets in place ($A^S = 0$).[11] Similarly to large firms, this can be interpreted as a small firm having no concurring projects the surplus of which may be lost if one of them fails.

In equilibrium, the number of small firms equals the number of workers who choose to be employed by a small firm. To this extent, workers in small firms may also be interpreted as entrepreneurs who go to a venture capitalist or a bank: In this case, the model would imply that an entrepreneur would realize more of his ideas, without a thorough screening, even if there are no private benefits.

Firm assets can be employed in a risky or in a risk-free, traditional technology. Capital and labor are perfect substitutes in the traditional technology, yielding return r ($\underline{w}$) per unit of capital (per worker). As everyone can access the risk-free technology, we assume that $\underline{w}$ is the economy-wide reservation wage. A worker cannot be employed in the traditional technology if her idea is realized.

Workers' ideas are risky. If the worker's idea is good (G) and the firm funds it investing I, it generates revenue Y, while if it is bad (B), it generates zero return. The prior probability of an idea being good is α. We assume that new ideas have positive net present value. They generate an output that is in expected value larger than the output from employing the worker and the capital

[10] We discuss this issue in subsection IV.B.

[11] It will become clear in subsection IV.A that the results do not depend on this assumption.

in the traditional technology, i.e., $Y > \frac{I(1+r)+\underline{w}}{\alpha}$. In order to invest in the risky technology (i.e. to fund a new idea), a firm needs I units of capital and an idea that can only be supplied by a creative worker. Small firms always need to raise outside capital, as they have no assets. The amount of outside finance necessary to fund an idea in a large firm depends on the number of ideas a firm decides to realize, x, which is related to the number of workers employed by the company and to their creativity. We define the amount of self-financing for a project of a large firm as $a^L = A^L/x$, where x and therefore a^L will be determined in equilibrium.

C.1 Screening

At $t = 3$, firms choose whether to screen ideas. If firms screen, they receive a signal about the quality of the idea based on which they decide whether or not to realize it. The signal can take value "good" ($s = g$) or "bad" ($s = b$). We denote the probability of receiving a good signal when the idea is good $p_1 \equiv prob\,(s = g \mid G)$ and the probability of receiving a good signal when the idea is bad $p_2 \equiv prob\,(s = g \mid B)$. For the signal to be informative about the idea we require that $p_1 > p_2$. Screening involves a cost c.

After observing the signal, firms update their beliefs on the quality of the idea. In particular, the probability that an idea is good after a good signal is:

$$h_1 \equiv h_1(g) = \frac{\alpha p_1}{\alpha p_1 + (1-\alpha)p_2};$$

and the probability that an idea is good after a bad signal is:

$$h_2 \equiv h_2(b) = \frac{\alpha(1-p_1)}{\alpha(1-p_1) + (1-\alpha)(1-p_2)}.$$

As the signal is informative but involves errors, the following inequalities hold:

$$0 < h_2 < \alpha < h_1 < 1.$$

To make the screening decision non-trivial, we also assume that a bad signal is sufficiently informative. Hence financing an idea after a bad signal has negative net present value: $Y < \frac{I(1+r)+\underline{w}}{h_2}$. Firms decide whether to screen and to fund an idea in order to maximize their expected profits. In the next section, we show that firms investing little or nothing of their own assets have

an incentive to fund ideas regardless of the signal. Hence they do not screen at all. Firms that risk their own assets to a larger extent, instead, find it optimal to screen and not to fund ideas after a bad signal. This involves the possibility of disregarding a good idea (the first-type error) with probability $(1 - p_1)$.

Throughout the paper we assume that firms are unable to commit themselves to a screening decision. This captures the fact that the way a firm examines the quality of an idea, and its decision whether or not to fund the idea are inherently intra-organizational issues. It is hardly conceivable that these things could be made contractible. Hence, firms make the *ex post* optimal screening decision. We show in the next section that as firms differ in the amount of internally financed assets, they have an incentive to choose different screening policies. In particular, larger firms with more assets at risk optimally want to have more precise information about the profitability of an idea before funding it. In contrast, small firms with fewer assets are more likely to realize workers' ideas (but they are also more likely to default if the idea turns out to be unsuccessful).

C.2 Wage contracts

At $t = 1$, firms offer wages. Firms cannot screen workers prior to employment. Hence, contracts take a simple form: contracts specify w^f, a fixed wage the firm pays to the workers employed in the firm. Firms can credibly commit themselves to honor the contracts unless the firm defaults. Then, the firm pays a wage of nil. Thus, workers incur a loss in the wage income, as they have to wait until the second period to be employed in another firm.

Second, the worker and the firm have to divide the surplus of a successfully realized idea. In our model, an idea can be any different way of "getting things done within the organization". The profitability of these process or product innovations, whose nature is very vague when the contract between the worker and the firm is signed, is only revealed in the future. For this reason, we assume that the division of surplus is not contractible *ex ante*. This is necessarily the case, for instance, if the worker and the firm are complementary in the realization of the idea, and their respective inputs, necessary for its successful completion, are not known *ex ante*. What we have in mind is very similar to Grossman and Hart (1986): "a situation in which it is prohibitively difficult to think about and to describe in advance how all potentially relevant aspects of the production allocation should be chosen as a function of the many states of the world." Formally, we assume that the worker receives an exogenously fixed share λ of the net present value of her idea – i.e., the return of the idea in excess of the traditional technology net of any cost of external funds –,

which summarizes the effect of many exogenous institutions and of workers' and firms' bargaining powers.[12]

For simplicity of notation, we assume that λ is equal in large and small firms. We believe that, if anything, workers may have more bargaining power in small firms, against which it may be easier to bring legal suits and which may be more dependent on the skills of an individual worker for the realization of projects. In this case, our results would be stronger as small firms would be even more preferable for creative workers than we assume. However, even if it were the case that workers' bargaining power was higher in large firms, the labor-stealing effect we show in this paper would still exist. The only difference would be that the set of workers who choose to work in small firms would be smaller.

We assume a rather narrow set of wage contracts. Wages cannot be made contingent on the decision of a firm to fund an idea. Rather, a worker's remuneration depends only on the realized output of an idea and on whether or not the firm defaults. These assumptions concerning wages are consistent with the one that firms cannot commit themselves to a screening intensity. We are aware that these assumptions are restrictive, but we believe them to make sense: intra-organizational issues, such as the process to realize an employee's ideas are hardly contractible. Our model aims to capture the effect of this distortion on occupational choice and risk-taking.

While the assumption about the inability of committing to a screening intensity is essential for our results, assumptions concerning wage contracts can in principle be relaxed. In particular, the wage contract imposes an important restriction on large firms that do not necessarily default after funding an unsuccessful new idea. These firms could thus have an incentive to offer different wages to workers who do not come up with an idea, whose idea is not realized, and whose idea turns out to be bad. At the end of subsection (III.C) it will become clear that if one allows such contracts to exist, one adds computational complications but no new economic insights.[13]

[12] More generally, we could assume that realizing the idea outside the firm (without the worker) entails a consistent loss for the worker (the firm), like in Gromb and Scharfstein (2002) and Hellmann (2002). As our objective is to analyze how individuals sort in different organizations and not whether the ideas are funded within the firm or in a new start up, we summarize reservation utilities in one parameter, λ.

[13] It is also irrelevant that the second-period wage does not enter in the contract: an increase of the first-period wage of a given amount in present value can achieve at least the same effect as an increase of the second-period wage, since workers can save and earn the risk-free interest rate.

D Supply of capital

Capital is supplied by an infinite number of risk-neutral investors, who have access to a risk-free asset with return r and have an infinite amount of capital.[14] Both workers and firms have access to this market, as long as they provide investors an expected return equal to r. As in our model ideas either fail or succeed once their are funded (i.e., there are only two states of the world), different forms of external finance are equivalent. For the same reason, the relative seniority of the claims of external financiers, the worker and the firm management is irrelevant, as all of them receive a positive payoff only if the idea is successful. Therefore we will talk simply of external funds.

What is crucial for the results of our model is that some firms have an incentive to take excessive risk, because they internalize the downside of a project to a lesser extent than the investors. To put it differently, our theory holds provided that firm management does not completely internalize the cost of default, as it provides only a small fraction of the initial capital. This excludes a standard equity contract, in which external financiers contribute a share of the initial capital and acquire the right to enjoy an *equal* share of future cash flows. We are not too concerned about this: In our model, small firms have no capital and therefore a standard equity contract would not be possible. More generally, a standard equity contract is not desirable if the management of a firm has to put effort into the realization of the project and has little initial wealth. In addition, the empirical evidence shows that standard equity contracts are generally not used by venture capitalists (Kaplan and Stromberg, 2002).

Formally, we assume that investors provide capital to firms to realize their workers' ideas, after a firm has decided whether or not to realize it. We assume that investors do not observe the screening decision, but can only distinguish between large and small firms. Firms would want to declare to their investors that they have screened intensively, but this is not credible.[15] This is consistent with our basic idea that screening and realization of ideas are intra-organizational issues and that this applies both to the relationship between worker and firm, and to the relationship between investors and firm.

In case the idea turns out to be bad, investors recover nothing if they funded a small firm, as the assets of small firms are consumed in realizing the project. The nominal value of their claim,

[14] The infinitely elastic supply of capital implies that the sector of the economy we are looking at is small with respect to the overall economy. Such an assumption is common in small open economy models and general equilibrium models analyzing specific sectors of the economy like ours (see Michelacci and Suarez, 2003).

[15] To put it differently, entrepreneurs have no incentive to share both good and bad signals on the quality of the project with the financiers. All of them would have an incentive to stress the good news to obtain funding.

D^S, must satisfy the participation constraint of investors. The nominal value of investors' claims towards large firms, D^L, also depend on the risk of default.

Workers can borrow an amount equal to $b = \max\{-B, -\underline{w}\}$ at $t = 1$. We assume that loans up to the amount $\max\{-B, -\underline{w}\}$ are perfectly enforceable and therefore consumers can borrow at the risk-free interest rate, r. In this context, an increase in B represents an improvement in the market for consumer credit, provided that the borrowing constraint is binding.

E Equilibrium

The equilibrium is defined as follows:

- Workers maximize their expected utility by making consumption and occupational decisions. They take wages as given.
- Both large and small firms offer wages that maximize their expected profits. They take the wages of other firms as given but internalize the effect of their wages on occupational choice.
- Both large and small firms choose whether to screen and fund an idea to maximize the expected profits from the implementation of an idea, after it has been submitted by the worker. They take the cost of external funds as given.
- The labor market clears. In particular, the number of workers employed by large firms is such that all the workers who prefer to work in a large firm are, in equilibrium, hired by large firms.
- The capital market supplies any amount of capital demanded, provided that the expected return equals the return of the risk-free asset. The external financiers do not observe whether firms screen ideas.

In equilibrium, workers sort themselves into large and small firms. Then, the workers are randomly matched with the type of firms they choose. We consider only symmetric equilibria, in which all large firms hire the same number of workers.

The most important feature of the equilibrium is that firms *cannot* commit themselves *ex ante* to realize a worker's idea with a certain probability. The *ex post* decision may then be *ex ante* inefficient, because it discourages the most creative workers from taking jobs in large firms.

The capital market provides firms with any amount of capital demanded, if the investors' participation constraint is satisfied. This assumption helps to focus on the distortion created by

ex post screening decision on the occupational choice of workers. It also helps to show that the distinction between large and small firms matters even if the latter have access to external funds. An important assumption here is that external financiers cannot observe the screening decision, but they know whether they are dealing with a large or small firm. This implies that when firms screen ideas, they do not internalize the effect of less intensive screening on the cost of external funds.

It is worth noticing that the allocation of workers in small and large firms matters in this model because small firms depart from the first-best investment decision, which would take into account the full labor and capital cost of investing in an idea. In a first-best equilibrium, where the optimal screening decision could be enforced it would be totally irrelevant for the maximization of the output whether ideas are realized in small and large firms. This follows trivially from the fact that small and large firms differ only in their incentives to screen.

III Equilibrium and its implications

We solve the model backwards. We first investigate large and small firms' respective screening decisions. Then, we look at workers' occupational choice. Finally, we determine what wages firms offer.

A Screening of ideas and the cost of external funds

For a small firm, the payoff of a successful idea is:

$$\lambda \left[Y - D^S \right].$$

The payoff if the idea fails is nil, because the firm has no own capital and pays no wage when it defaults. Hence, if

$$\lambda \left[Y - D^S \right] > 0, \tag{5}$$

small firms would fund an idea even after a bad signal as they make positive expected profits. As small firms take the same decision – realize ideas – regardless of the outcome of the screening process, and because screening is costly, small firms optimally decide to fund any worker's idea without screening.

Incentives to screen and realize ideas are different for large firms. In order to determine under what condition large firms would want to screen, note first that independently from whether or not the firm invests in the safe technology or in the risky idea, it has costs of

$$\min\left\{a^L, I\right\} + w_1^L,$$

where the first term is the investment and the second term the wage that the firm is committed to pay to the worker.

If the firm decides to invest in the safe project, the output is

$$(1+r)\min\left\{a^L, I\right\} + \underline{w}.$$

Put differently, capital yields a return of r, and the worker produces $\underline{w}$ that partially covers w_1^L in equilibrium.

If the firms decides to realize the project of a worker, and the idea is successful, it receives a benefit of:

$$\lambda\left(Y - D^L - (1+r)\min\left\{a^L, I\right\}\right) + (1+r)\min\left\{a^L, I\right\} + w_1^L.$$

The first term is the firm's share of the total surplus of realizing a successful idea, that is, the gross revenue minus payments to investors, the repayment of its own invested capital and the return the firm would have received had it invested in the risk-free technology. The second term represents the reimbursement of invested capital plus the return of the risk-free technology, which is taken from the gross surplus Y. Finally, we assume here that the worker does not receive any other compensation than her part of the surplus. That is, the firm saves the wage it would usually pay to the worker.[16]

If the idea fails, the firm receives nothing and loses its investment.

We can now derive the condition for screening to be optimal for the large firm. Provided that the project has positive net present value, the firm always invests if it does not screen. It hence receives the expected payoff:

[16] Notice that this is only one possible way to write the gains of a successful idea – which is consistent with table 1, page 18. One could alternatively consider that the worker receives a fixed wage in all states of the world, and reduce the worker's share of the total surplus to keep expected compensation of a successful idea constant.

$$\alpha\left[\lambda\left(Y-D^L-(1+r)\min\left\{a^L,I\right\}\right)+(1+r)\min\left\{a^L,I\right\}+w_1^L\right]-\min\left\{a^L,I\right\}-w_1^L,$$

because the idea is successful with probability α.

If the firm decides to screen, it gets an additional signal and updates its beliefs about the project. In order for screening and the information generated by it to be relevant for the firm, it must be true that the firm realizes the project if the signal is good, while it invests in the safe technology if the signal is bad. Hence, the payoff is:

$$\begin{aligned}\left[\alpha p_1+(1-\alpha)p_2\right]h_1\left[\lambda\left(Y-D^L-(1+r)\min\left\{a^L,I\right\}\right)+(1+r)\min\left\{a^L,I\right\}+w_1^L\right]+\\ \left(1-\left[\alpha p_1+(1-\alpha)p_2\right]\right)\left[(1+r)\min\left\{a^L,I\right\}+\underline{w}\right]-\min\left\{a^L,I\right\}-w_1^L-c.\end{aligned}$$

Notice that the first term is the probability of receiving a good signal.

Comparing the payoffs with and without screening and using the definition of h_1, we find that screening is optimal if:

$$\begin{aligned}\left[\alpha(1-p_1)+(1-\alpha)(1-p_2)\right]\left[(1+r)\min\left\{a^L,I\right\}+\underline{w}\right]>\alpha(1-p_1)*\\ \left[\lambda\left(Y-D^L-(1+r)\min\left\{a^L,I\right\}\right)+(1+r)\min\left\{a^L,I\right\}+w_1^L\right]+c\end{aligned}$$

Dividing everything by the first term on the LHS and using the definition of h_2, the condition can be rewritten as:

$$(1+r)\min\left\{a^L,I\right\}+\underline{w}>h_2*\left[\begin{array}{c}\lambda\left(Y-D^L-(1+r)\min\left\{a^L,I\right\}\right)\\ +(1+r)\min\left\{a^L,I\right\}+w_1^L\end{array}\right]+\frac{c}{\alpha(1-p_1)+(1-\alpha)(1-p_2)}. \tag{6}$$

This condition has a simple intuition. Screening is only useful if the firm would implement a bad project in its absence. The LHS represents the value of not making that error (the first-type error). The RHS captures the value of the second-type error, as the firm implements less good projects, while the last term represents the cost of screening that are multiplied by the inverse of the probability to receive a bad signal, because it is only then that screening is useful for the firm.

Lemma 1 *Small firms never screen and always fund workers' ideas. In contrast, if inequality (6)*

is satisfied, large firms always screen and realize ideas only after a good signal.

In what follows, we assume that inequality (6) is satisfied in equilibrium.

In section IV.A, we will generalize the analysis to the case in which small firms have a positive amount of assets. According to Lemma 1, better capitalized firms that risk a larger amount of their own assets per worker are more choosy in the decision to realize a project than less capitalized firms. Thus, small firms accept both more good and more bad ideas, while large firms are more conservative because they risk more of their own assets. This is a common result in the corporate finance literature (see, for instance, Jensen and Meckling, 1976): limited liability coupled with the use of external funds suboptimally increases risk-taking. Large firms' screening decision is optimal because the cost of investment is internalized to a larger extent. This notwithstanding, the lower probability of realizing a worker idea can reduce large firms' profits in equilibrium, because it affects occupational choices. We show this in the next subsection.

Here, it is important to note that investors have correct beliefs on firms' screening and funding decisions. Hence, the return on investment they require to small and large firms depend on the probability with which they expect them to fund bad ideas. The nominal value of external financiers' claims on small firms is:

$$\alpha D^S \geqslant (1+r)I. \tag{7}$$

Given that investors behave competitively, their participation constraint is satisfied with equality in equilibrium. The nominal value of external financiers' claims on large firms (which finance externally only $I - a^L$) is determined analogously.

B Occupational choice of workers

We here show that workers with an expected creativity above some ϕ^* prefer a job in a small firm, while workers with a creativity below ϕ^* prefer to work in a large firm.

For the sake of simplicity, in deriving the results we assume that large firms do not default, that is, in equilibrium they have enough capital to pay wages w_1^L to all their workers even if all ideas fail. To put it formally: $A^L \geq x(I + w_1^L)$.[17] Thus, large firms do not recur to external finance.

A worker decides which firm to work for based on the following pieces of information: his or her probability of having an idea; the wages and assets of all firms. In the second period, all workers

[17] This is a simplifying assumption, generalized in subsection IV.A.

earn $\underline{w}$, as we assume that workers are not creative in the second period. The following table summarizes the probabilities of different states of nature and first-period wages paid by large and small firms.

	Idea realized, succ.	Idea realized, fail.	Idea rejected	No idea
Probability in large firm	$\phi\alpha p_1$	$\phi\left(1-\alpha\right)p_2$	$\phi\left[\begin{array}{c}\alpha\left(1-p_1\right)+\\ \left(1-\alpha\right)\left(1-p_2\right)\end{array}\right]$	$1-\phi$
Probability in small firm	$\phi\alpha$	$\phi\left(1-\alpha\right)$	0	$1-\phi$
Payoff in large firm	$\left(1-\lambda\right)\left(Y-I(1+r)\right)$	w_1^L	w_1^L	w_1^L
Payoff in small firm	$\left(1-\lambda\right)\left(Y-D^S\right)$	0	–	w_1^S

For convenience we here assume that when a worker has an idea, she enjoys a fixed share of the surplus and receives no wage. Nothing would change if a share of the remuneration in this state of the world would be paid as a fixed wage. This would decrease the surplus from the ideas and affect the worker bargaining power, $1-\lambda$. Moreover, we define the indirect utility functions in different states of nature as:[18]

$$U_{suc}^L = U^*\left(\left(1-\lambda\right)\left(Y-I(1+r)\right)\right); \tag{8}$$

$$U_{suc}^S = U^*\left(\left(1-\lambda\right)\left(Y-D^S\right)\right); \tag{9}$$

$$U_{fail}^S = U^*(B). \tag{10}$$

Expressions U_{suc}^L; U_{suc}^S; U_{fail}^S represent the indirect utility function when the respective lifetime resources are $\left(1-\lambda\right)\left(Y-I(1+r)\right)+\underline{w}$; $\left(1-\lambda\right)\left(Y-D^S\right)+\underline{w}$; $\underline{w}$. Here B is the maximum amount that may be borrowed at $t=4$. Also notice that $U_{fail}^L = U^*(w_1^L)$, because we have assumed that the large firm has enough capital to always pay at least w_1^L. Below, $U^*\left(w_1^L\right)$ and $U^*\left(w_1^S\right)$ are defined analogously. Given the above wage profile, workers borrow only if they are employed in a small firm, their idea is realized and it fails. As intertemporal utility maximization implies that workers want to consume the same amount in both periods of their life, we can conclude that they will want to borrow $\frac{w}{2}$. Therefore the borrowing constraint is binding in equilibrium only if $B < \frac{w}{2}$.

Proposition 1 describes the occupational choices of workers with different levels of creativity. We define ϕ^*, the level of creativity at which a worker is indifferent between working in a small or

[18] This takes into account that for given income a worker can choose the time path of consumption.

in a large firm.

Proposition 1 *Workers with a creativity $\phi \leq \phi^*$ choose large firms. Workers with creativity $\phi > \phi^*$ choose small firms. The level of creativity at which a worker is indifferent between a large and a small firm is defined as:*

$$\phi^* = \frac{U^*\left(w_1^L\right) - U^*\left(w_1^S\right)}{\left[\left(\alpha U_{suc}^S + (1-\alpha)U_{fail}^S - U^*\left(w_1^S\right)\right) - \alpha p_1\left(U_{suc}^L - U^*\left(w_1^L\right)\right)\right]}. \tag{11}$$

Proof. The proof is simple and provides some intuition for the proposition. The cutoff level of creativity in Proposition 1 is determined by equating the expected utility from working in a large and in a small firm, which can be written as:

$$\begin{aligned}&\phi\left[\left(\alpha U_{suc}^S + (1-\alpha)U_{fail}^S - U^*\left(w_1^S\right)\right) - \alpha p_1\left(U_{suc}^L - U^*\left(w_1^L\right)\right)\right] = \\ &U^*\left(w_1^L\right) - U\left(w_1^S\right).\end{aligned} \tag{12}$$

The left-hand side (LHS) of this equation represents a worker's advantages of working in a small firm, owing to the higher probability of realizing one's idea (large firms realize ideas with probability $p_1 < 1$). On the right-hand side (RHS), the advantages from working in a large firm consist of the additional utility from the wage differential between large and small firms and the utility loss associated with default of the small firm when a bad idea is funded. A necessary condition for the set of workers who want to work in large firms being non-empty is:

$$\begin{aligned}&\left[\left(\alpha U_{suc}^S + (1-\alpha)U_{fail}^S - U^*\left(w_1^S\right)\right) - \alpha p_1\left(U_{suc}^L - U^*\left(w_1^L\right)\right)\right] > \\ &U^*\left(w_1^L\right) - U\left(w_1^S\right).\end{aligned} \tag{13}$$

Put differently, the benefits from working in a small firm must exceed the costs for the most creative worker ($\phi = 1$). As stated before, there is only one benefit from working in a small firm: the probability of realizing a successful idea is larger. This is only sufficient to ensure that there are workers willing to work in a small firm if $(1-\lambda)\left(Y - D^S\right)$ is large enough, relative to w_1^L. In fact, $U_{suc}^S < U_{suc}^L$: The higher financing costs for small firms reduce the surplus generated by the idea as $(Y - I(1+r)) > \left(Y - D^S\right)$. Therefore, contingent on having a successful idea, the

worker receives less in a small than in a large firm, an effect that, again, works against the small firm. However, this is more likely to be unimportant if Y is large, because the utility is concave. A marginal increase in income when the idea is successful hence does not generate a high increase in utility. In contrast, the expected utility increases linearly in the probability that a successful idea is realized, which is key for large levels of the expected profits.

Under the assumption that inequality (13) is satisfied, it is obvious from equation (12) that the LHS increases in ϕ faster than the RHS. This implies that the expected utility from working in a small firm is larger than the expected utility from working in a large firm for all workers with creativity $\phi > \phi^*$. ■

Proposition 1 implies that more creative workers prefer small firms because the higher probability of firm default is more than compensated by the larger chances of realizing their own ideas. Our result is common in the literature on entrepreneurial choice (see, for instance Lucas, 1978), which has established that the most productive workers choose to become entrepreneurs (i.e., to realize their ideas). In our model, creativity is equivalent to expected productivity. As expected, we find that workers with higher expected productivity choose organizations where they have higher chances to realize their ideas.

Proposition 1, together with the assumption that the creativity of workers is distributed uniformly on the support $[0, 1]$ implies that the expected creativity of a worker employed at a large and a small firm are, respectively:

$$E(\phi^L) = \frac{\phi^*}{2};$$

$$E(\phi^S) = \frac{1 + \phi^*}{2}, \tag{14}$$

where ϕ^* is defined as in Proposition 1.

C Wage determination

We now investigate how large and small firms set their wages. Firms here take into account the effect of wages on the occupational choice of workers, analyzed in the preceding section. Through its wages, a firm affects its probability of realizing workers' ideas that bear risk but have positive expected surplus. Wages are thus used to sort workers according to their productivity, as in Lazear

(1986).

The wages firms offer affect ϕ^*, and therefore the expected productivity of the workers they employ: When w_1^L increases, both the numerator and denominator of ϕ^* increase, but the numerator increases faster. Hence, ϕ^* increases. When w_1^S increases, the numerator of ϕ^* decreases, while the denominator increases. Hence, ϕ^* decreases.

At $t = 0$, a large firm maximizes the total expected profits per worker by choosing w_1^L:

$$\max_{w_1^L} \left(1 - E\left(\phi^L\right)\right)\left(rI + \underline{w} - w_1^L\right) + E\left(\phi^L\right) E\left(\pi_1^L\right). \tag{15}$$

In (15), the first term represents the expected profit from a worker who does not generate an idea. It is the return from employing the firm's assets and the worker in the traditional technology net of the wage paid to the worker. The second term is the probability that the large firm attracts a worker with an idea, $E\left(\phi^L\right)$, multiplied by the firm's respective expected profit in excess to the return of the traditional technology, $E\left(\pi_1^L\right)$. Before the screening process, the expected surplus from screening and realizing an idea after a good signal is:

$$\begin{aligned} E\left(\pi_1^L\right) \quad = \quad & \left[\alpha p_1 + (1-\alpha) p_2\right] h_1 \left[\lambda\left(Y - (1+r) I\right) + (1+r) I + w_1^L\right] + \\ & \left(1 - \left[\alpha p_1 + (1-\alpha) p_2\right]\right)\left[(1+r) I + \underline{w}\right] - I - w_1^L - c. \end{aligned} \tag{16}$$

Equation (16) represents the sum of the expected gains when a good (bad) signal is observed, minus the investment, the wage and the cost of screening. Function (15) is maximized subject to the constraint that the expected utility of working in the large firm exceeds the utility of working both periods in the traditional sector, that is, $w_1^L \geqslant \underline{w}$.[19] If this constraint were not satisfied, the worker would not accept the job offer and would prefer to be self-employed in the traditional technology, which is freely available. In what follows, we assume that the constraint is not binding.

The expected total profits of a small firm are :

$$\max_{w_1^S} \left(1 - E\left(\phi^s\right)\right)\left(\underline{w} - w_1^S\right) + E\left(\phi^s\right) E\left(\pi_1^s\right) \tag{17}$$

and are subject to the same constraint as large firms. Notice that $E\left(\pi_1^s\right) = \alpha\lambda(Y - D^S)$. The next Proposition provides the solutions for the programmes of large and small firms, respectively.

[19] The results of the model would remain qualitatively unchanged if firms could offer a wage less than $\underline{w}$.

Proposition 2 *Large firms offer a wage* $w_1^L \geqslant \underline{w}$. *Small firms offer a wage* $w_1^S = \underline{w}$.

Proof. The first-order condition of a large firm determines w_1^L as follows:

$$-\left(1 - E\left(\phi^L\right)\right) + \frac{dE\left(\phi^L\right)}{dw_1^L} E\left(\pi_1^L\right) + E\left(\phi^L\right) \frac{dE\left(\pi_1^L\right)}{dw_1^L} \leq 0 \tag{18}$$

The last term is negative, but as $\frac{dE\left(\phi^L\right)}{dw_1^L} > 0$, (18) may be satisfied with equality. This implies that the constraint $w_1^L \geqslant \underline{w}$ is not always binding. Hence, a large firm may offer a wage larger than the productivity of the worker in the traditional sector in order to attract a pool of more creative workers. It is easy to show that if (18) is satisfied with equality, the second-order conditions are always satisfied. The first-order condition of a small firm determines w_1^S:

$$\frac{dE\left(\phi^S\right)}{dw_1^S} E\left[\pi_1^S\right] - 1 + E\left(\phi^s\right) < 0. \tag{19}$$

Hence, small firms want to set wages as low as possible because the expected profits decrease in w_1^S. ■

Proposition 2 implies that large firms may find it optimal to offer wages higher than the reservation wage to attract creative workers and enjoy some of the surplus created by the realization of successful ideas. This is not the case for small firms whose expected profits decrease in the wage offered to workers: small firms find it optimal to differentiate themselves from large firms as their comparative advantage consists in adopting more relaxed screening policies. It is interesting to know that the expected number of ideas a large firm funds at $t = 3$ is : $E(x) = \frac{E\left(\phi^L\right)(\alpha p_1 + (1-\alpha) p_2)}{\gamma}$. Therefore, our simplifying assumption that large firms do not fail (i.e. $A^L \geq x(I + w_1^L)$) holds, provided that $E\left(\phi^L\right)$ is small enough in equilibrium, or if the set of large firms, γ, is large.

Remarks: First, as pointed out in subsection II.C.2, relaxing some of the assumptions concerning wages is feasible but does not generate new insights. If the wages of large firms could be made contingent on the funding of a worker's idea, large firms would have an incentive to commit themselves to offer a wage higher than the reservation wage, $\underline{w}$, even if a realized idea turned out to be bad. In fact, offering more insurance, the large firm can make its jobs relatively more attractive to more creative workers. Depending on parameter values, the wage paid if an idea is funded would, in general, be different from the wage large firms offer to workers whose ideas are not realized. However, none of the conclusions regarding occupational choices would change. For the same reason, large firms would find it optimal to commit to offer a positive wage even if the

idea fails.

Second, we have assumed that a firm continues to pay its wages unless it defaults. Thus, the firm does not renegotiate the wage contract of workers without ideas or whose ideas are realized and subsequently fail. The results do not depend on this assumption. If the wage contract could be renegotiated, large firms may become less conservative. At the same time, they could become relatively less attractive for creative workers, because they would offer less insurance. However, as long as $a^L > 0$, there exist parameter values such that large firms are more conservative than small firms. This is all that we need for the results of our model to hold.

D Comparative statics

We now investigate the impact of better access to capital markets and of technological changes on the occupational choice of workers.

D.1 Better access to credit

Access to consumer credit increased dramatically in the second half of the eighties and during the nineties (Guiso et al., 2001). Moreover, Sullivan (2002) shows that U.S. households have increasingly being able to borrow using unsecured debt, such as credit card debt, during unemployment spells. Proposition 3 shows that these developments in the financial markets affect occupational choice and firm profitability. In particular, we show that financial markets affect the willingness of workers to take on risks – through the level of the borrowing constraint B.

Proposition 3 *If B increases, the set of workers employed in small firms increases.*

Proof. First, an increase in B affects ϕ^* because the liquidity constraints affect large and small firms asymmetrically. As assumed in subsection (II.C), workers in small and large firms receive the same wage, $\underline{w}$, in the second period, because they are employed in the traditional, risk-free technology. Moreover, workers in large firms continue to receive their wage in the first period if their idea fails and therefore the workers have no incentive to borrow. The borrowing constraint is relevant only for workers in small firms in case an idea fails. In fact, the borrowing constraint becomes binding if the ideas fail, because small firms go bankrupt and workers receive no wage. In this situation, workers would like to borrow against their future income to smooth their consumption but they encounter a binding borrowing constraint if $B < \frac{w}{2}$. Hence, when B increases, U^S_{fail} increases. This implies that ϕ^* decreases, and for given wages, more workers want to

be employed in small firms. The wages of small firms do not change, as is clear from the first-order condition to the small firms' profit maximization programme, stated in the proof of Proposition 2. To see how large firms adjust, consider the respective first-order condition of Proposition 2. An increase of B increases $\frac{dE\left(\phi^L\right)}{dw_1^L}$, the marginal effect of large firm wages on the expected creativity of workers employed in large firms, and decreases $E\left(\phi^L\right)$. Large firms may increase or decrease wages following an increase in B, if the first order-condition is satisfied with equality. However, the average creativity level of workers employed by large firms, $E\left(\phi^L\right)$, decreases unambiguously, even if w_1^L increases, because otherwise large firms would not have been maximizing profits in the initial equilibrium (as they could have employed more talented workers at a lower wage gaining the same profits from each idea). ■

An increase in B affecting occupational choices has other important effects on the number of ideas that are realized in equilibrium and on firm profitability. These can be summarized as follows:

1. Large firms employ less creative workers and realize fewer projects. Thus, large firms' profits per worker decrease.

2. Small firms also employ on average less creative workers. Thus, small firms' profits per worker also decrease, because there are more workers without ideas who work with the traditional technology and make zero profits.

3. More ideas are realized in equilibrium, because small firms realize ideas with larger probability. This implies that there are both more second-type errors (more bad ideas of workers are financed) and less first-type errors (less good ideas are rejected).

4. The aggregate output of the affected sectors decreases. Small firms do not internalize the waste of investing assets in bad ideas and take excessive risk. This problem is less acute for the project selection of large firms.

5. The expected utility of creative workers employed in small firms increases, because they have a higher probability of second-type error than average workers. They only risk their first-period wage when having their idea funded. Hence, provided that they can borrow a sufficient amount against their future income if their idea turns out to be a failure, they prefer to be employed in small firms. Also, the utility of workers employed in large firms can increase, because w_1^L may increase. Expected firm profits obviously decrease.

D.2 Increase in the expected payoff of ideas

The nineties have also been characterized by an increase in the expected payoffs of ideas, which accompanied the high-tech bubble. In our model this may be characterized either through a higher probability of success (α) or through a higher output in case of success (Y). In this subsection we show the effect of this change on occupational choices.

Proposition 4 *If large firms continue to find it optimal to screen after the increase in the expected payoff of ideas, an increase in α or Y increases the set of workers who prefer to work in small firms.*

Proof. We can focus on the reaction of large firms, as small firms do not change their screening behavior. If large firms continue to screen when α or Y increase, the proof is very similar to the one of Proposition 3. In this case, the probability of realizing an idea at a large firm is unchanged; ϕ^* decreases as α or Y increase, becau se the denominator increases. Therefore, also $E\left(\phi^L\right)$ decreases. In equilibrium, as before, large firms may or may not increase their wages, depending on $\frac{dE\left(\phi^L\right)}{dw_1^L}$, as in Proposition 3. For the same reasons as before, however, we can unambiguously determine that the set of workers employed in large firms decreases. Whether this is the case in equilibrium depends on how firms adjust their screening behavior. This in turn depends on whether inequality (6) continues to be satisfied. If the expected payoff from realizing an idea increases to the point that this inequality does not hold any longer, it may become optimal for the large firm not to screen. In this case, it also may become optimal for more workers to work at large firms (i.e., ϕ^* increases). ■

If, following an increase in the expected payoff of new ideas, large firms continue to screen, the probability of realizing an idea at a large firm remains constant, but realizing an idea becomes even more important for workers. Therefore, fewer creative workers will be employed in large firms. Their expected profits decrease relative to small firms, because fewer of their workers have innovative ideas. This implies that if large firms are not able to change the procedure they use to screen new ideas, they cannot fully benefit from the improvement in technology as they are lacking creative workers. As before, their profitability will decrease in equilibrium, and more ideas, both good and bad, will be realized by small firms.

However, if large firms do not find it optimal to screen any longer, large firms and small firms become equal. This is less likely to happen if large firms have a sufficiently good screening technology.

IV Further implications and extensions

We here highlight implications of our analysis for organizational change and dynamics.

A Dynamics

If we look at the model from a dynamic point of view, firms can lose and gain the competitive edge in attracting creative workers. Obviously, low-capitalized small firms that generate cash flow from the realization of good ideas accumulate assets, and unlucky large firms can decumulate assets. Our simplifying assumptions that $A^S = 0$ and $A^L \geq x(I + w_1^L)$ become restrictive. The results of our model continue to hold provided that the difference between internally financed investment at large and small firms is large enough. In particular, small firms will not screen if:

$$(1+r)\,a^S + \underline{w} < h_2 * \left[\lambda\left(Y - D^S - (1+r)\,a^S\right) + (1+r)\,a^S + w_1^S\right] + \frac{c}{\alpha\,(1-p_1) + (1-\alpha)\,(1-p_2)}.$$

This is essentially condition (6) rewritten for a small firm that accumulates assets, pays wages in any state of the world and hence internalizes the opportunity cost of not employing the worker in the traditional technology. Therefore, in terms of attractiveness for creative workers, small firms may grow "too" large (i.e., they may become too cash rich) and become too conservative in the selection of the ideas that they fund. The most creative workers may then turn their back on these firms and choose younger, less capitalized companies. Conversely, unlucky large firms can acquire competitiveness, because they lose part of the assets and find it optimal to adopt less intensive screening technologies.

B Simultaneous projects

So far we have interpreted A^L as firm assets, which are used to fund ideas internally. The main difference between small and large firms was therefore whether and to what extent they used external funds. In this subsection we show that our model can be readily extended to a case in which large firms do *not* use internal funds to realize new ideas, but have other, concurrent, projects. This is important because the future cash flows generated by these projects increase the probability of being able to repay external financiers. This in turn provides incentives which are very similar to the ones created by the use of internal funds.

To see this, assume that a large firm does not have internal funds but is running another project that will generate a positive cash flow X at the end of the first period. If $X \geqslant (1+r)I$, the firm will be able to repay $(1+r)I$ to external financiers with certainty at the end of the first period. Consequently, the programme for the determination of the optimal screening intensity is identical to the one of a firm that funds workers' ideas internally. Since all results of our model follow from small and large firms' different incentives in the choice of screening intensity, it follows that large firms may incur difficulties in attracting creative workers not only if they use internal funds but also if they run simultaneously other projects that increase their probability of delivering a positive return to external financiers. A diversified firm with low probability of default internalizes fully the cost of investment and is as conservative as a firm that uses internal funds in the decision to realize workers' ideas. The evidence presented in Section V.B further supports the view that diversification may cause a competitive disadvantage for firms that wish to attract creative workers.

C Organizational change and capital structure

We have shown that the profits of large firms may drop relative to small firms, if the liquidity constraints of workers relax, or if the expected output from new ideas increases. Depending on parameter values, the return on assets of well-capitalized large firms may be lower than the return on assets of low-capitalized small firms.

An asset-intensive firm can react by creating a spin-off, that is, a low-capitalized separate legal entity. The manager of a spin-off considers the capital provided by the headquarters as external funds and is less conservative in realizing the ideas of workers. Thus, large firms can commit themselves to carry out less intensive screening by spinning off units. This means that large firms may find it optimal to create incentives to take excessive risk by using organizational change. A similar effect can be achieved using changes in capital structure: a large firm can distribute dividends (or buy back equity) and increase leverage. Indeed, there is evidence that this happened during the nineties (Economist, 2002). However, when new ideas are realized within the existing firms, their cash flows are mingled with the firm's other cash flows. Therefore, for large firms with many simultaneous projects it may not be optimal to choose a capital structure that allows to change the incentives with respect to one project without affecting adversely the incentives with respect to other projects. For this reason, we believe that our implications for organizational change are more relevant.

The implications of our model are in line with the way innovation is promoted in sectors in

which worker creativity is crucial for success. In biotechnology for instance, innovation often takes place in small independent start-ups that have contractual ties to large asset-intensive firms in the pharmaceutical industry (Lerner and Merges, 1998). Biotechnological research involves the application of ideas within the organization, just as in our model. The dark side of this kind of organizational change is that firms pursuing a policy of decentralization in order to attract talented workers, may take on too much risk and, ultimately, may default.

D Bad ideas

So far we have assumed that prior beliefs are such that ideas are profitable and worth investing even without screening. In terms of the parameters of our model, this means that: $\alpha Y \geq (1+r)I$. If this assumption does not hold, and the prior is that ideas are not profitable, small firms lose their comparative advantage in attracting workers and their ability to fund ideas is impaired. In fact, if $\alpha Y < (1+r)I$, screening is necessary to identify ideas that are profitable and, therefore, worth investing. Yet, small firms, which do not risk internal funds and do not expect to repay external financiers in case of default, would have an incentive to choose not to screen. This is apparent from the fact that inequality (5) does not change if ideas are not profitable *ex ante*. As a consequence, the participation constraint of external financiers could not be satisfied. If firms cannot commit to screen and external financiers cannot observe the screening decision, investors would not provide funds. Ideas could not be realized in small firms.

Consequently, if ideas are *a priori* not profitable, large firms, which risk a sufficiently large amount of their internal funds, gain a competitive advantage in attracting creative workers. In conclusion, if expectations on ideas become pessimistic or in sectors where there is a very large proportion of bad ideas, creative workers will spurn small firms because they lack both internal and external funds to invest in innovation. Alternatively, specialized lenders, such as venture capitalists, which are able to observe at least imperfectly the screening intensity adopted within an organization are necessary to fund innovative projects.

V Empirical evidence

We here provide empirical evidence for our theory's implications on occupational choice and firm organization and profitability.

A Workers' occupational choice

Our theory stresses that the willingness to take risks is a major driving force of workers' attitude towards jobs. The propensity to take risks depends on the jobs' upside and downside. The tightness of liquidity constraints matters for the downside of risky jobs as it determines the consumption level when an idea turns out to be bad. The upside of realizing one's own risky ideas had temporarily increased during the nineties. As we discuss in the next subsection, this can explain some of the more extreme changes in workers' preferences. However, changes in workers' attitude towards jobs and occupational choice seem to have a more secular trend[20], which can only be explained by the progressive relaxation of liquidity constraints over time that we point to.

There is indeed evidence that liquidity constraints for households have been relaxing over time in several countries (Jappelli and Pagano, 1994). Especially in the U.S. during the nineties, households have been able to increase their indebtedness. The U.S. household balances on unsecured loans, such as credit cards and overdraft provisions on checking accounts, have doubled in real terms between 1984 and 1999, and unsecured debt has helped households to smooth consumption during unemployment spells (Sullivan, 2002). In addition, increasing housing prices have allowed households to increase their mortgage, contributing to less tight liquidity constraints. Anecdotal evidence supports that the linkage between relaxed liquidity constraints and occupational choice that we stress is relevant. For instance, Cappelli (1999) reports the former director of Wharton's career and placement office saying that, as the downside has become much less of a problem, MBAs have become much more prone to take risky jobs.

To make our argument stronger, we go beyond the anecdotal evidence and show that liquidity constraints indeed affect occupational choice. Our empirical strategy takes into account that individuals differ not only in respect to their creativity, as the model assumes, but also in other characteristics affecting their ability to receive consumer credit. Other things equal, workers with less tight liquidity constraints are expected to be more likely to sort into risky jobs. We exploit this individual heterogeneity in access to credit to test whether liquidity constraints affect occupational choice at a given point in time.

The first challenge is to find a suitable proxy of liquidity constraints, which are not observable. We overcome this problem by following the methodology of Guiso, Jappelli, and Terlizzese (1996) who have studied the effect of liquidity constraints on individuals' holdings of risky assets. The *Bank of Italy Survey of Household Income and Wealth (SHIW)* is to the best of our knowledge the

[20] See, for instance, Malone (2003).

only source of data providing information about households that were denied credit or discouraged from borrowing. Defining these households as liquidity constrained, Guiso, Jappelli and Terlizzese estimate the probability that households in the 1987 sample are liquidity constrained, conditional on a vector of household characteristics. The estimated coefficients are then used to predict the probability that households in the 1989 sample are constrained. The predicted probability is used as a proxy for liquidity constraints to study household stockholding decisions.

We follow this methodology using the 1998 and 2000 versions of the *SHIW*; Table 1 provides descriptive statistics for the main variables. We investigate occupational choice rather than stockholdings. In the first stage, we estimate the probability that households in the 1998 sample are liquidity constrained as a function of household characteristics. Then, using the estimated coefficients, we compute the predicted probability that households in the 2000 sample are liquidity constrained. In the second stage of the regression, this predicted probability is used as a regressor to explain individuals' occupation in the 2000 sample.

In the first stage, we use household wealth including real estate and financial assets net of any liabilities, the number of household members who work, the number of household members who do not work, and 20 regional dummies as regressors. The dummies capture differences in financial system development across Italian regions. Table 2 shows that – as expected – richer households are less likely to be credit constrained while households with more non-working members are more likely to be credit constrained.

For the second stage, we classify occupations according to their income risk: self-employment is considered a risky job, while jobs in private and public organizations are more secure.[21] We regress the individual probability of having a risky job on the predicted probability of liquidity constraints. We control for differences in regional labor demand and industrial structure by including five regional area and five sectoral dummies, which aim to capture labor market differences. We also control for education level of the individual, sex, marital status and parenthood by including dummy variables. The results in Table 2 indicate that higher probability of being liquidity constrained is associated with lower probability of holding a risky occupation. The effect is not only statistically but also economically significant as a one standard deviation increase in our proxy of liquidity constraints decreases by more than 3 percent the probability that an individual is self-employed. In the absence of our theory it would be hardly conceivable that liquidity constraints matter for

[21] We drop observations relative to blue collars because they are often self-employed for necessity (eg, lack of skills), as they would not be regularly hired by the employer. Additionally, they are not the sort of talented workers our model is about.

occupational choice in this way. Rather, one may expect that individuals who hold safer jobs and have a stable flow of income have easier access to credit as banks consider them safer borrowers.

An alternative explanation for our results is that individuals who belong to households who are less likely to be liquidity constrained have easier access to start up capital. Hence they would be more likely to be self-employed because they are able to make the initial investment. To evaluate whether the data support this alternative explanation we proceed as follows: First, we exclude from our regression individuals who run family businesses with potentially large investment requirements to focus on the effect of liquidity constraints on occupational choice. Our estimates remain qualitatively the same. Second, we control for household income and wealth,[22] which measure more precisely access to start up capital than the probability of being liquidity constrained. Individuals who belong to richer households are indeed more likely to be self-employed, but this does not affect our previous findings: the more likely a person is liquidity-constrained, the lower the probability of having a risky occupation.

Finally we look at the probability of choosing the safest job of all, public sector employment. The choice to work in the public sector cannot be driven by access to start up capital as a job in the private sector does not require an initial investment as well. Yet, if liquidity constraints affect occupational choice, as we argue, the more liquidity constrained workers should prefer a safer income profile. We find that, indeed, individuals with a higher probability of being liquidity constrained are more likely to work in the public sector. We believe this to be rather strong support for our theory, because one would expect that financial intermediaries were more willing to lend to individuals with safer and highly verifiable salaries, just like public sector employees. Hence, if anything, our regressions may underestimate the actual effect of liquidity constraints on occupational choice. Interestingly and in accordance to our conjecture that access to start capital should not affect the propensity to be a public sector employee, wealth does not enter significantly in the regression.

Not only are our findings confirmed by these robustness checks, but a number of other papers are consistent with our interpretation of the empirical evidence: Guiso, Jappelli and Terlizzese (1996) show that liquidity constraints affect risk taking in financial markets. Fuch-Schundeln and Schundeln (2004) provide closely related evidence; they show that the limited predictive power of precautionary saving theories in empirical tests may be owing to the fact that more risk-averse

[22] In the second stage we use the logarithm of income and wealth with values censored at zero to avoid quasi-multicollinearity problems (as we use income to predict the probability of being liquidity constrained in the first stage).

individuals self-select in secure jobs. Gollier (2000) shows that liquidity constraints make individuals more risk averse, which is also in line with our argument. Even more relatedly to us, Guiso and Paiella (2001) show that not only is individual risk aversion positively related to liquidity constraints, but also less risk averse individuals are more likely to be self-employed.

Additionally, occupational choice is known to be influenced by other institutional factors that affect downside risk in a way similar to liquidity constraints. Fan and White (2003) and Berkowitz and White (2004), for instance, study for the U.S. the effect of bankruptcy exemptions that reduce downside risks in a way similar to relaxed liquidity constraints. Bankruptcy exemptions provide partial wealth insurance for potential entrepreneurs, who are risk-averse. Empirically, in states with higher bankruptcy exemptions, access to credit for small firms and households is more difficult and small firms are more likely to be denied credit. Also, when loans are made, they are smaller and interest rates are higher. Nonetheless, the probability of owning a business is higher when exemption levels are higher. This suggests that incentives for risk-taking, whether they are owing to bankruptcy exemptions or liquidity constraints – as in our model – may be equally important as access to credit for start ups in explaining entrepreneurial activity, and in general, for occupational choice.

In conclusion, as the empirical evidence suggests that workers sort in jobs according to their probability of being liquidity constrained, an increase in the supply of consumer credit can explain workers' increased propensity to choose risky jobs.

B Firm organization and risk-taking

Our model posits that differences in the attitude of firms towards the realization of new ideas depend on what companies have at stake. This is in the spirit of Sah and Stiglitz (1988) who argue that, when considering new projects, organizations require a minimum consensus level – equivalent to the intensity of the screening procedure – that depends on what the organization has at stake. Companies can risk internal funds, future cash flows from concurrent projects, but also reputation and other intangible assets such as their customer base. Naturally, large firms have more at stake than smaller and younger firms. This may explain why large firms generally adopt more centralized and bureaucratic structures (Child, 1973), which involves a more accurate screening of workers' ideas before implementation.

There exists direct empirical evidence that what firms have at stake influences their willingness to realize their workers' ideas. Harberg (1963) finds that in contrast to small firms, the indus-

trial laboratories of large companies are only minor sources of inventions. Even research-minded companies wallowing in large profits from previous projects are reluctant to realize new ideas and concentrate on improving old products, an activity that resembles the traditional technology in our model. In large industrial laboratories, the research director spends much effort in developping research programmes for the entire team, in which each worker is assigned a prearranged task. Innovative ideas are subject to careful screening, as they could jeopardize the company's profits from previous projects and its assets. Hence, Harberg argues, despite good salaries and security, elaborate facilities and technical aids, the most creative scientists shy away from industrial laboratories.

Harberg's interpretation of the empirical evidence can readily account for more recent circumstances. For instance, the *Wall Street Journal* (2002) reports that science and engineering Ph.Ds at General Electric felt frustrated by the fact that were spending too much time in "fixing turbines or tweaking dishwashers" instead of pursuing broader ideas. General Electric is highly diversified and one of the largest companies in its sector, which supports the interpretation that the more a company has at risk, the lower is the probability that its employees are able to pursue their ideas. Zenger (1994) presents survey evidence that for this very reason small firms attract superior talent in the labor market for R&D personnel. He shows that "individuals with exceptional ability and skills" – the most creative workers in our model – seek the independence small firms offer, precisely because their abilities and skills are more likely to be rewarded with the successful realization of their ideas.

Our theory argues that the relaxation of liquidity constraints accentuated this phenomenon and made it relevant in other contexts than industrial research. *Fortune*'s survey of America's best employers provides anecdotal evidence on this point. In the 1980s and the early 1990s, the main concern of workers was job security, but at the end of the century, talented workers did not "...want to be plugged in some large machine. They want the chance to be innovative in their positions and to work in environments that can totally captivate." The "Fortune 100 Best Companies to Work For" in 1999 were delegating more than ever and their employees felt delighted not to have to ask for the consensus of their superiors and to be trusted of their own decisions. Many small non-listed companies thus earned a spot on the Fortune list. Not surprisingly, while 64 percent of the employees of the Fortune Best Companies declared to be able to influence what happens in the organization, only 34 percent of the employees in companies that did not make it to the list declared so.

Survey evidence shows that in this context "large companies lost so many talented people that their ability to compete had been severely damaged" (Fortune, 1999). Large companies that maintained their competitiveness in attracting talented workers tried to operate like small ones. Valikangas, Magnotta and Fowler (2003) describe vididly the key elements in innovation management:

> "How many people in your firm today can describe your business concept in a way that opens up opportunities for innovation? What is crucial here is that a market is inherently a non-hierarchical, open environment. Anyone who can attract either people to work with them or capital to support an idea should have the right to do so."

It appears that the underlying perception was that non-hierarchical organizations were better suited to fostering innovation because they screen ideas that have *a priori* positive net present value less intensively. Consequently, they could attract more creative workers able to innovate. Large companies reacted differently to the increased competion for talent. A few of them, which considered innovation at the core of their business, like General Electric, have decentralized by breaking up units and creating spinoffs. Others have continued to offer job security. Our theory suggests that this is part of the comparative advantage of companies that optimally choose to maintain their centralized organization, attract less creative workers and hence are less innovative.

Rajan and Wulf (2003) go beyond the anecdotal evidence. Using a survey among 300 listed companies, they find that hierarchies have become flatter during the nineties, that is, employees have been granted more decision power and more room to work on their ideas without having to recur to the approval of supervisors. The authors also show that it is mainly companies with less physical assets per employee, i.e., the companies with less at risk, that are becoming flatter. They argue that organizational changes are likely to depend upon the increasing competition for employees' talent. As we have argued before, this does not only depend on the ease of finding start up capital, but also on the willingness to choose jobs with riskier income profile. It is also interesting to note that Rajan and Wulf (2003) also find that companies where employees are granted more responsibility, have higher volatility of earnings. In our theory, this is a consequence of the organizational change implying the realization of more ideas.

The failure of many high-tech start ups and the experience of Enron are stunning examples of how organizational change may have increased corporate volatility. Over the 1990s, Enron transformed from a traditional power distribution company to the most innovative company in the

sector. Organizational change and management of talent had an important role in its transformation as the case study of Bodily and Bruner (2002) and interviews with the CEO (Michaels et al., 2001) show. The company abolished several management layers, presumably decreasing the quality of the screening of new projects, and funded most of the projects through external partnerships. Its incentives to take on risk were reinforced by recourse to high leverage. This reorganization and apparent success were eventually followed by the filing of bankruptcy procedures.

A few of these changes – but definitively not all of them, as employees' creativity and the realization of ideas are a vital feature of companies comparative advantage – appear now a fad provoked by the high tech bubble (Malone, 2003). Our model implies that lower expectations on the payoffs of realizing ideas and tighter access to consumer credit during recessions reduce workers' propensity to risk taking. In fact, large firms have been dismantling their corporate venture funds (*The Economist*, 2001). In its latest survey, *Fortune* notices substantial movements on the list: "Only 16 high-tech companies made it, opposed to 22 five years ago." More traditional organizations, such as hospitals offering no-layoff policies, were instead included in the list. Job security seems to have acquired again some importance. At the same time, however, workers are no longer willing to bargaining security/and or money for a piece of their souls as they were used to do in the seventies and still want to realize their ideas.

VI Conclusions

We have shown that financial market development affects organizational structure and innovation by relaxing the liquidity constraints of workers and, indirectly, by changing their attitude towards job security. Better access to credit induces workers to take on more risk. Only organizations that have less self-financed assets at risk and screen less intensively can attract workers who want to realize their ideas. This points to a new channel through which access to credit matters, beyond the one that the financial revolution relaxes collateral requirements and hence favors small firms (Rajan and Zingales, 2002).

Our paper shows that financial development has its dark sides: it may create excessive volatility and reduces average profits of firms. Small firms are not necessarily good for the economy just because they are innovative: since they do not have many assets or cash flows from other projects at risk, they recklessly fund new ideas and steal the most creative workers from large firms. Although large firms' cautious screening policies would be optimal, large firms may adopt policies to commit

themselves to be less conservative, in order to attract creative workers and not lose the profits from financing new ideas: the creation of spin-offs and the increase in leverage may be seen as attempts to stop small firms from stealing the most creative workers.

There are extensions of the model in which having excessive risk-taking may be optimal. For instance, if workers exert effort *ex ante* to generate profitable ideas, firms would want to commit themselves to realize ideas with high probability to increase incentives for workers. In this context, capital structure may be seen as an alternative solution to the one by Rotemberg and Saloner (2000), namely to hire a visionary CEO, who has a positive bias toward realizing certain ideas. Whether or not excessive risk-taking spurs innovation and is beneficial for the overall economy is ultimately an empirical issue. We see our contribution in pointing out a channel through which financial development may matter and its implications on occupational choice, organizational change, and corporate volatility.

The model also shows that the relative competitiveness of large vs. small firms may be different over the business cycle. During expansions, for instance, the value of housing increases. Like in the most recent US experience, individuals find it easier to borrow by increasing their mortgage. In this situation, an increasing number of creative workers will choose small firms. The contrary is true in contracting phases of the business cycles. If household access to credit becomes more difficult, because real estate prices decrease or because households are too indebted, a stable income becomes more important than upside opportunities. This effect is reinforced because during recessions it becomes more difficult to find new jobs and, as a consequence, income losses after firm defaults are larger, because workers stay unemployed longer. Lower expectations on the expected value of new ideas in recessions would have analogous consequences. In all these cases, jobs in large firms once again become what they used to be: safe havens for workers.

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Table1
Descriptive statistics

Panel A describes some characteristics of the *Bank of Italy Survey of Income and Wealth*, SHIW, (2000). Risky occupation is a dummy equal to 1 if an individual is self-employed and equal to zero otherwise. Risky occupation-I is a dummy equal to 1 if an individual is self-employed but does not run a family business; the dummy is equal to zero if the individual is an employee. Public sector employee is a dummy equal to 1 if an individual is a public sector employee and equal to zero otherwise. Proxy for liquidity constraints is the predicted probability of the household being credit rationed. Wealth is the household financial and real wealth net of any liabilities in thousand of Lire. Income is the household labor and capital disposable income in thousand of Lire. N_WOR is the number of the household's working members. Household components is the number of household members. Observations on 5180 individuals are included.

Variable	Mean	Std. Dev.	Min	Max
Risky occupation	0.34	0.47	0	1
Risky occupation -I	0.28	0.45	0	1
Public sector employee	0.28	0.45	0	1
Proxy for liquidity constraints	0.03	0.01	0	0.11
Wealth	434446.8	721736	-842000	11300000
Income	78500.61	53460.2	-33430	918010.8
N_WOR	2.08	0.84	1	7
Household components	3.42	1.17	1	9

Table 2
Occupational choice and liquidity constraints

In the first stage, the dependent variable is equal to 1 if the household has been denied credit or if it has been discouraged from applying for a loan by the fear of being rejected. It is set equal to zero otherwise. N_NOT_WOR is the number of household members without labor income, obtained subtracting the number of working members from the number of household members. All remaining explanatory variables are defined in Table 1. The equation includes a constant term and 19 regional dummies whose coefficient is not reported. The regression has been estimated using a logit model. In the second stage, dependent variables are defined as follows: In the probability of having a risky occupation, the dependent variable is a dummy equal to 1 if the individual is self-employed and equal to zero otherwise. In the probability of a risky occupation-I, individuals who run an incorporated company have been excluded. In the probability of working for the public sector, the dependent variable is a dummy equal to 1 if an individual is a public sector employee and equal to zero otherwise. The proxy for liquidity constraints is the predicted probability for the 2000 sample of a household being liquidity constrained using the estimated coefficients of the 1998 sample. Second stage regressions also include a constant term and the following dummies whose coefficients are not reported: 4 dummies for different age groups; 7 dummies for individuals with different educational achievement; 5 dummies for different geographical areas; 3 dummies for the individual marital status; a gender dummy; and 4 sectoral dummies. Second stage regressions are estimated using a probit model and the marginal effect on the probability calculated at the mean, instead of the estimated coefficients, are reported. Standard errors are White-corrected and errors have been clustered for individuals belonging to the same household.

	Probability of being liquidity constrained (First stage)	Probability of having a risky occupation (Second stage)	Probability of having a risky occupation-I (Second stage)	Probability of having a risky occupation (Second stage)	Probability of working in the public sector (Second stage)
Proxy for liquidity constraints		-3.58	-2.86	-2.9	1.5
		(-7.14)***	(-4.27)***	(-3.64)***	(3.38)***
Wealth	-0.6			0.02	-0
	(-2.14)***			(3.91)***	(-0.23)
Income				-0.05	0.00
				(-3.09)	(0.13)
N_WOR	-0.05				
	(-0.58)				
N_NOT_WOR	0.21				
	(3.83)***				
Observations	6683	5180	4904	5180	5180
LR	49.20	1132.9	1025.9	1111.33	886.48