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FIGHTING FOR TALENT: RISK-TAKING, CORPORATE VOLATILITY AND ORGANISATION CHANGE*

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We show that access to finance may affect firms through the labour market. Talented workers want to realise their ideas but also seek insurance against income risk. Large firms default less often than small firms but they investigate more thoroughly and reject more good ideas. With easier access to consumer credit, talented workers become less averse to the income risk of working in small firms. Thus, small firms gain an advantage on the labour market, their profit volatility increases and large firms react by creating spin-offs. Existing and original empirical evidence is consistent with the implications of our theory.

The nature of the firm has changed substantially in the last decade. Asset-intensive, highly vertically integrated firms with tight control over their employees have become old-fashioned. Instead, human capital has become crucial in determining corporate success (Rajan and Zingales, 2001). Firms have thus entered into fierce competition for the most talented and creative employees. However, attracting 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 1990s show that talented workers began to expect opportunities for personal growth from their jobs (Stum, 1998) and to spurn secure jobs in large and stable organisations, formerly considered prestigious (Malone, 2003).[1] Changes in worker attitudes and occupational choice coincided with an increase in small firms' employment and decreasing average firm size, in particular, in the high-tech sectors of OECD countries (Pryor, 2001). Large firms, attempting to attract the most skilled workers, tried to imitate the way small firms operate by creating spin-offs (Day *et al.*, 2001; Lawler *et al.*, 1995; Michaels *et al.*, 2001). 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 1990s have

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[1] For instance, an increasing number of MBAs from top US business schools were declining job offers with the highest pay, such as positions in investment banking and consulting (Cappelli, 1999). Rather they were taking jobs in small companies and start-up ventures. MBAs became more willing to forgo job security in order to gain the 'possibility of hitting it big'. Cappelli 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 the expected compensation was not much higher than in the secure job.

been reversed and large companies have been dismantling their corporate venture funds (*The Economist*, 2001).

This article aims to identify the driving forces behind the changes in worker attitudes towards large and small firms. In our theory, talented workers care for realising their ideas because this can increase their lifetime income but they also wish to be insured against income risk. Large firms are less likely to default (Caves, 1998) and thus offer a safer income stream than small firms (Guiso *et al.*, 2002). But they also investigate ideas more thoroughly before funding them: the ideas of workers have risky payoffs and large firms have more of their assets, reputation or future cash flows of other projects at stake than small firms when implementing an idea. The investigation produces valuable but noisy information about the success probability of ideas. For this reason, large firms are more likely to reject good ideas than small firms. This entails a particularly high cost for the most creative workers, who are the most concerned to see their ideas realised, in order to receive higher compensation. Nonetheless, a worker also values the insurance that jobs in large firms can provide. Workers thus face a trade-off between better insurance and lower probability of realising their own ideas.

How this trade-off affects workers' choice between small and large firms depends on the insurance offered by the financial market and on the expected payoff of ideas. First, if household borrowing constraints relax – as happened in the US during the 1990s[2] – the propensity of creative workers to work in large firms decreases. In fact, if their firm defaults, they can borrow against their future income, while looking for a new job. This implies that better access to household credit makes the insurance offered by large firms less desirable. Small firms thus gain a competitive edge over large firms in attracting creative workers. Similarly, the model implies that workers' choices between small and large firms may change over the business cycle when access to consumer credit changes. Second, when the expected payoffs of ideas increase, workers' expected loss when an idea is erroneously rejected increases. The most talented workers then prefer to work in small firms even though the entry wage differential between large and small firms may increase.

Our model implies that better access of households to capital markets and technological change may reduce average enterprise profitability in sectors in which worker talent is important. Better access to credit and technological change raises the number of ideas that are funded, as small firms are less choosy in accepting new projects. When too many ideas are funded, the variance of small firms' profits increases and there are more bankruptcies because small firms do not fully internalise the cost of investment. We thus provide a new rationale for why easier access to consumer credit may increase the volatility of the economy.[3]

The desire of creative workers to realise their ideas may also spur changes in capital and organisational structure. The thorough investigation to which large firms submit workers' ideas is *ex post* optimal from the point of view of maximising the return to

[2] The process of financial deregulation made consumer access to credit markets easier. As a consequence, the liabilities of households increased substantially, especially in the US. See Guiso *et al.* (2002) and Sullivan (2008).

[3] The macroeconomic literature has stressed that easing liquidity constraints, by favouring indebtedness of households, has made them more sensitive to changes in the interest rate, income, and asset prices (Debelle, 2004).

investment but it has *ex ante* implications on the attractiveness of jobs in large firms. Large firms cannot commit themselves to offer jobs in which workers realise as many of their ideas as they could in small firms. For this reason, they lose their most creative workers and may become less profitable than small firms. The loss of competitiveness may induce large firms to change their organisations. In particular, to commit themselves to fund new ideas without a thorough investigation, large firms may attempt to reduce what they have at stake by buying back stocks and by increasing leverage. Perhaps more importantly, large firms may have an incentive to create spin-offs that – being less capitalised – behave more like small firms. We thus show that companies may have an incentive to spin off some of their activities not only to affect workers *ex post* incentives to provide effort, as, for instance, in Scharfstein and Stein (2000) and Gromb and Scharfstein (2002) but also to influence workers' *ex ante* occupational choice.[4]

The main contribution of this article is to show that the availability of finance affects corporations not only through financial markets but also through the labour market. A better understanding of the determinants of the supply of talent to small firms is important as human capital plays a similar role for innovation as financial capital (Mohnen and Roeller, 2005). Our theory thus complements others that stress the importance of financial development for the availability of capital to small firms and start-ups; see, for instance, Zingales (2000) and Rajan and Zingales (2001). The relevance of this mechanism is undeniable but it does not explain the documented changes in worker attitudes towards large and small firms. An increase in the number of start-ups induces higher demand for talent from small firms and could account for their increasing employment share. However, it does not explain why talented workers would spurn large organisations and the security they offer because the wage growth in large firms has equalled or exceeded that in small firms (Hu, 2003). Beyond these observations, we also provide direct empirical evidence supporting the mechanism of our theory. In particular, we show that individuals with less tight credit constraints are more likely to be employed in small firms thus confirming that access to insurance is important for occupational choice.

The remainder of the article is organised as follows: Section 1 describes the model; Section 2 derives the results. Section 3 discusses some existing empirical evidence in support of our theory, while Section 4 presents new empirical evidence. Section 5 concludes. All proofs are in the Appendix.

1. The Model

We first describe the essentials of the model, the timing and the definition of equilibrium. A more specific description of investors' payoffs and strategies is given in Section 2.

[4] Relatedly, Crémer (1995) and Aghion and Tirole (1997) point out that less information acquisition by the principal can be desirable as it strengthens worker incentives. In our model, information acquisition is always optimal with respect to maximising 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.

1.1. *Essentials*

There is a set of workers of mass 1, one large firm and free entry of identical small firms. All firms are risk-neutral. Workers are risk-averse, impatient with discount rate r and can borrow against their future income up to an exogenously fixed amount B.

There are two alternative production technologies. First, a risk-free traditional technology yields return r ($\underline{w}$) per unit of capital (per worker). All workers have access to this technology. Since capital and labour are perfect substitutes, $\underline{w}$ can be interpreted as the reservation wage.

Second, a firm can decide to fund an idea if a worker after being hired turns out to have an idea.[5] Ideas are risky projects that require investment I; they produce positive output Y with probability α and output zero otherwise. If the firm decides to realise her idea, the worker cannot work with the risk-free technology. Firm and worker are complementary in the realisation of the idea: neither can the worker realise the idea outside of the firm, nor can the firm do without the worker. Since we want to explore how large and small firms compete to fund profitable innovation, we assume that new ideas have positive expected net present value. This is the case if funding an idea has a higher expected return than employing the capital and the worker in the risk-free technology, that is, $Y > [I(1 + r) + \underline{w}]/\alpha$.

Since ideas are risky, firms may investigate their prospects before investing by observing an informative but noisy signal about the probability of success. An idea that is going to be successful generates a positive signal with probability $p \equiv \text{prob}(s = g \mid Y)$, where $1/2 < p < 1$. For simplicity, we assume that ideas that are bound to fail generate a positive signal with probability $\text{prob}(s = g \mid 0) = 0$. For the same reason, we assume that the cost of observing the signal is positive but negligible.

Contracts are assumed to be incomplete in the sense of Grossman and Hart (1986). First, the signal and the technology in which the worker is employed are not verifiable and cannot be incorporated in either financial or labour contracts. Second, as the precise nature of the idea is unknown, any of its aspects are non-contractible before the idea actually occurs. Thus, the large (a small) firm offers workers a fixed wage $w_1^L(w_1^S)$ provided that it does not default. If *ex post* the worker has an idea that turns out to be successful, however, firm and worker share its output. The firm receives a share λ, and the worker $(1 - \lambda)$ of the output.[6] We treat λ as an exogenous parameter.[7] One may think that λ depends on the bargaining power of the firm and the worker after the idea occurs. Note that in equilibrium our model implies a lower bound for λ due to the fact that small firms fund the idea only if $\alpha\lambda Y > I(1 + r)$, and an upper bound due to the fact that the worker finds it optimal to communicate the idea only if $(1 - \lambda)Y$ is larger than her fixed wage.

[5] A worker's idea consists of a product or process innovation that may increase the expected profits of the firm. This is in line with the broad interpretation of value-improving innovations in organisational economics. See, for instance, Rotemberg and Saloner (2000). Workers (or firms) cannot pretend to have an idea if they do not.

[6] Our parameteriation implies that the worker does not receive the fixed wage if the idea is successfully realised. It would be equivalent if the worker received a fixed wage in all states of the world plus a share of the output if the idea were successfully realised.

[7] This is common in models of entrepreneurial finance because large parts of the returns are distributed in later investment rounds through *ex post* bargaining. See Sorensen (2007) for a discussion.

The worker's compensation resembles common job contracts that generally involve both an explicit wage and some expectations about the probability of being promoted and receiving higher compensation in the future (here, associated with the possibility of realising one's own idea). These expectations, however, are not bargained about *ex ante*. The worker's compensation follows naturally from our assumptions, because when the worker is hired, the firm cannot make compensation contingent on success or failure of the idea (or on any other aspect of the idea); these contingencies are impossible to define before the idea actually occurs.[8]

We assume that the large firm has an initial amount of self-financed assets A^L which is sufficient to finance internally any number of ideas. The number of workers in the large firm is determined in equilibrium. To model the insurance function of the large firm as simply as possible, we assume that the large firm never defaults. Rather, it has enough capital to pay wages w_1^L to all workers even if all ideas fail: $A^L \geq (I + w_1^L)$.[9]

A small firm enters if it can hire a worker. Each small firm hires only one worker and has no assets.[10] All firms can raise an infinite amount of capital from outside investors[11] as long as they offer the return of the risk-free technology in expectation.[12] Hence, no firm has an incentive to borrow to invest in the risk-free technology. Investors have correct beliefs on the risk of ideas and their claims are senior to wage claims. The nominal value of their claim on a small firm, D^S, must thus satisfy the participation constraint of investors, $D^S \geq [(1 + r)I]/\hat{\alpha}$, where $\hat{\alpha}$ is the belief about the probability that a realised idea succeeds.

Workers differ in the probability of having an idea, ϕ, which is uniformly distributed on the support [0,1]. Parameter ϕ captures worker creativity. Workers know their type ϕ but firms do not. The workers' information advantage may originate from the fact that they are aware of their contributions to previous projects that are not easily documented. Differences in innate ability have been shown to play an important role in explaining workers' productivity and cannot be easily communicated as all workers have an incentive to claim to be highly creative (Lazear, 1986, 2001). For the sake of simplicity, we assume that the the expected payoff of the idea is the same for all workers and is common knowledge.

1.2. *Timing*

Firms and workers live for two periods.

[8] Also note that large firms typically have many divisions. Hence, before the idea occurs, it is unknown which division output a successful realisation of the idea may affect and therefore impossible to make compensation contingent on output.

[9] Note that A^L can also be interpreted as the value of concurrent projects. Future cash flows generated by these projects allow the repayment of external financiers even if the idea defaults. Since the firm can issue risk-free debt, it has incentives that are identical to the ones created by the use of internal funds.

[10] We make the assumptions about capital endowment of the large and the small firms for the sake of simplicity. As will be clear in Section 3, the implications of the model hold if the large firm is partially outside financed, or conversely, if small firms have some internal funds.

[11] An infinitely elastic supply of capital implies that the sector we are looking at is small with respect to the overall economy. This assumption is common in small open economy models and general equilibrium models analysing specific sectors of the economy like ours.

[12] Note that in our model, ideas either fail or succeed once their are funded. Hence, as there are only two states of the world, debt and equity are equivalent.

1.2.1. *First period*

Job offers. At $t = 0$, firms offer wages.

Occupational choice. At $t = 1$, workers choose to work in the large firm or any of the small firms in order to maximise their expected utility.

Idea. At $t = 2$, each worker has an idea with probability ϕ. Workers communicate their idea, if they have one, to the employer.

Investment. At $t = 3$, the firms choose whether to immediately fund the idea a worker may have suggested, to reject it right away, or to first investigate it. An investigation results in a signal about the success probability of the idea. Firms decide which technology to invest in, potentially after observing the signal. If needed, firms raise external funds.

Output and payoffs. At $t = 4$, the output is realised. Outside investors are paid out and workers receive their compensation, provided that the firm does not default. Otherwise, the firm cannot pay outside investors and workers. After receiving their compensation (or nothing), workers can borrow and consume.

1.2.2. *Second period*

At $t = 5$, all workers and assets are employed in the traditional technology. Workers receive a wage; for simplicity we assume this to be $\underline{w}$ for all of them. They pay back their loans, if any, and consume.

1.3. *Definition of Equilibrium*

The equilibrium is defined as follows:

- Workers maximise their expected utility by making consumption and borrowing decisions and by accepting the offer of the large or any of the small firms. Workers take wages as given. They have rational beliefs about the probability of realising an idea in the large or in a small firm.
- The large and small firms offer wages that maximise their expected profits. They take other firms' wages as given and have correct beliefs on the effect of their offers on the expected creativity of the workers that they attract.
- The large and small firms choose whether to investigate an idea to maximise their expected profits. Firms cannot commit *ex ante* to realise a worker's idea with a certain probability.
- The capital market supplies any amount of capital provided that the expected return equals the return of the risk-free technology. Investors do not observe whether a firm investigates an idea[13] but have correct expectations about firms' decisions.
- The labour market clears. In particular, the mass of workers employed by the large firm (small firms) is such that all the workers who prefer to work in the large firm (small firms) do so in equilibrium.

In what follows, we focus on an equilibrium in which the sets of workers employed in the large firm and in small firms are non-empty. We determine conditions on the parameters under which this is true.

[13] Firms would always declare to their investors that they have done so but this is not credible.

2. Results

We describe first firms' investment decisions ($t = 3$), then workers' occupational choice ($t = 1$), and finally firms' wage offers ($t = 0$).

2.1. *Investigating and Financing Ideas*

In our model, firms investigate an idea only if their funding decisions can be negatively affected by the signal. This is because we assume ideas to have positive net present value *ex ante*. Thus, ideas are always funded after a positive signal and the only reason why firms investigate ideas is that they have an incentive not to fund the idea after a negative signal. Otherwise, the information provided by the signal would be neglected, which is equivalent to saying that firms would not investigate an idea at all.[14] Using Bayesian updating, after a negative signal, the probability of a successful completion of the idea is $\alpha(1-p)/[\alpha(1-p)+(1-\alpha)] < \alpha$.

First, consider the large firm's incentives to investigate the idea. The large firm rejects the idea after a negative signal if the expected payoff from realising the idea is lower than the expected payoff from from investing in the risk-free technology. Formally, this implies:

$$\frac{\alpha(1-p)}{\alpha(1-p)+(1-\alpha)}\lambda Y - \left[1 - \frac{\alpha(1-p)}{\alpha(1-p)+(1-\alpha)}\right] w_1^L - I(1+r) < \underline{w} - w_1^L. \qquad (1)$$

The expected payoff from realising the idea (left-hand side) takes into account that the firm obtains a share of the output λY if the idea succeeds but it cannot invest in the risk-free technology and is committed to pay the wage w_1^L. Similarly, the payoff from investing in the risk-free technology (right-hand side) considers that the worker can produce $\underline{w}$ and must be paid w_1^L. Thus, the large firm rejects the idea after a negative signal provided that the investigation leads to a sufficiently informative signal (p large).

The wage w_1^L is chosen optimally by the large firm and is determined in Subsection 2.3. As argued before, the worker has an incentive to communicate her idea only if $w_1^L < (1-\lambda)Y$. Hence, after simplifying, we can substitute $(1-\lambda)Y$ for w_1^L and give a sufficient condition under which the large firm investigates ideas before deciding whether to fund them:

$$\frac{\alpha(1-p)}{\alpha(1-p)+(1-\alpha)} < \frac{\underline{w} + I(1+r)}{Y}. \qquad (2)$$

In other words, a sufficient condition for the large firm to have an incentive to investigate the idea instead of funding it immediately is that after a negative signal, the idea is a project with negative net present value. This is the case if $p > 1 - (1-\alpha)[\underline{w} + I(1+r)]/\{\alpha[Y - \underline{w} - I(1+r)]\}$. Henceforth, we assume that

[14] This also implies that our assumption that ideas bound to fail never generate a positive signal is without loss of generality because both types of firms have the same incentive to fund the idea after a positive signal. If one were to assume that a positive signal could involve some probability of failure, results would not change qualitatively: the upside of realising the idea remains similar for the two types of firms and the downside is different as in the current version of the model.

(2) is satisfied.[15] If the sufficient condition is satisfied, investigating the idea is efficient. However, the large firm may reject ideas even if they have positive net present value because condition (1) is less restrictive than condition (2).

We now consider small firms' incentives to investigate ideas before funding them. A small firm's payoff of a successful idea is $\max\{\lambda Y - D^S, 0\}$ because the firm appropriates its share of the cash flows from the idea after reimbursing external financiers and because the firm is protected by limited liability. The firm's payoff is nil if the idea fails. The payoff of investing in the traditional technology is also not positive, as the firm cannot pay a wage below $\underline{w}$. If $\lambda Y - D^S > 0$, small firms would fund ideas even after a bad signal. Hence, they would choose to fund ideas without previously investigating them. In equilibrium, since investors have correct expectations on the idea's probability of success: $D^S = (1 + r)I/\alpha$. Thus, small firms do not investigate ideas because under our assumptions $\lambda Y - (1 + r)I/\alpha > 0$.

Clearly, assuming that small firms have no capital at stake is a drastic simplification, but the implications are more general than what it may appear. First, even if small firms had some capital, they would still have less at stake than the large firm.[16] Therefore, they would have stronger incentives to fund risky projects (ideas). In particular, small firms would fund ideas after a negative signal if their capital stake is sufficiently small. Second, these incentives do not depend on the form of financing unless the firm issues pure equity, which is rarely the case for small innovative firms (Kaplan and Stromberg, 2003). Usually, these firms are founded by penniless entrepreneurs. Outside investors do get equity stakes in the firm, while the entrepreneur gets an equity stake for contributing his human capital but does not contribute any financial capital. Hence, the description of small firms' incentives to realise ideas can capture such a situation as well. Finally, one may wonder to what extent monitoring by venture capitalists may substitute the internal investigation of the idea. Gompers and Lerner (2000) find that start-ups funded by large firms generally have higher returns compared to start-ups funded in small independent firms backed by venture capitalists. This suggests that even venture capitalists may not be able to observe a signal as precise as the one within the firm.

The following Lemma summarises the different strategies of the large and the small firms.

LEMMA 1. *Small firms always fund workers' ideas without prior investigation. In contrast, if inequality* (2) *is satisfied, the large firm always investigates ideas and funds them only after a good signal.*

Lemma 1 implies that the large firm is more choosy in the decision to realise an idea and that the small firms accept more ideas but also that more of the ideas that small firms fund fail. These differences in firms' willingness to realise new ideas depend on what companies have at stake. The effect is similar to the one highlighted by Jensen and

[15] Note that inequality (2) makes redundant the assumption that a worker's idea can be realised only within the firm. Rather, this arises as an equilibrium outcome. If the large firm does not realise a worker's idea after investigating it, the expected payoff of the idea is negative *ex post*. Hence, any idea that has been previously rejected by the large firm would not find any financiers.

[16] Similarly, if the large firm is partially outside financed, condition (2) becomes more restrictive. However, as long as the large firm has more at stake than small firms, it is more inclined to observe the signal.

Meckling (1976) who have shown that less capitalised firms have stronger incentives to choose riskier projects. Our result is even more closely related to Sah and Stiglitz (1988) who argue that when considering new projects, organisations require a minimum consensus level (equivalent to a thorough investigation), which depends on what the organisation has at stake.

While here the large firm's reluctance to realise ideas depends on the capital invested and the opportunity cost of not employing the worker in the risk-free technology, other (similar) mechanisms could lead to the same behaviour. For instance, the large firm may be less likely to fund an idea because the commercialisation of the innovation would cannibalise existing revenues from other projects. Condition (2) shows that the large firm may have an incentive to realise *ex ante* positive net present value ideas with a probability that is strictly less than 1 even if there are no negative externalities on concurrent projects.

Thus, 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. Hence, they adopt more centralised and hierarchical structures, which are a way to submit new ideas to a thorough investigation (Child, 1973).

2.2. *Occupational Choice*

Here, we determine how workers with different levels of creativity sort between the large and small firms. We solve for the equilibrium strategies assuming that small firms offer a wage $\underline{w}$ and the large firm offers $w_1^L \geq \underline{w}$. We show in Subsection 2.3 that these are indeed the firms' equilibrium strategies.

At $t = 1$, workers choose between the large and any of the small firms by comparing the expected utility from these two options. The utilities depend on the expected compensation in different states of nature, their probabilities and the worker's probability of having an idea. Table 1 summarises the probabilities of different states of nature for a worker with creativity ϕ and the corresponding first-period compensation paid by the large and small firms. Compensation depends on the states of nature as follows: the worker may be employed in the traditional technology because she had no idea or because her idea was rejected ($j = trad$); the worker may have an idea that turns out to fail ($j = fail$) or an idea that succeeds ($j = suc$).

Table 1

Payoffs and Probability of Different States of Nature in Large and Small Firms

	Idea realised, succ.	Idea realised, fail.	Idea rejected	No idea
Probability in large firm	$\phi\alpha p$	0	$\phi\alpha(1-p)$	$1-\phi$
Probability in small firm	$\phi\alpha$	$\phi(1-\alpha)$	0	$1-\phi$
Payoff in large firm	$(1-\lambda)Y$	–	w_1^L	w_1^L
Payoff in small firm	$(1-\lambda)Y$	0	–	$\underline{w}$

At $t = 4$, after the output is realised, workers take consumption and borrowing decisions in order to maximise their intertemporal utility: $u(c_1) + u(c_2)/(1 + r)$, where c_t is consumption at time t and $u(.)$ is the per-period utility function. We define the indirect utility functions (U_j^f) for different levels of compensation in the large *versus* small firms (f) below as a function of first and second period income:

$$\begin{aligned} U_{suc}^L &= U_{suc}^S \equiv U_{suc} \equiv U^*[(1-\lambda)Y, \underline{w}] \\ U_{trad}^L &\equiv U^*(w_1^L, \underline{w}) \\ U_{trad}^S &\equiv U^*(\underline{w}, \underline{w}) \\ U_{fail}^S &\equiv U^*(0, \underline{w}). \end{aligned}$$

Note that the worker has the same payoff from realising a successful idea in the large or in a small firm.[17] Given the possible income profiles and the assumption that the intertemporal discount rate is equal to the risk-free interest rate, workers borrow only if they are employed in a small firm, their idea is realised and it fails. For this reason, only U_{fail}^S is weakly increasing in B, the maximum amount that may be borrowed at $t = 4$. All other indirect utilities are not affected by B. Since intertemporal utility maximisation implies that workers want to consume the same amount in both periods of their life, they wish to borrow $\underline{w}/2$ if their idea is realised in a small firm and fails. Therefore, the borrowing constraint is binding in equilibrium only if $B < \underline{w}/2$. In what follows, we assume that this is the case.

Table 1 makes clear that occupational choice is affected by the following trade-off. On the one hand, the large firm never defaults and in equilibrium always pays a wage that is higher than the one offered by small firms. On the other hand, since the large firm's investigation produces valuable but noisy information about ideas' prospects, the probability of realising a successful idea is larger in a small firm. The condition stated in Proposition 1 requires that this last effect is strong enough to make the most creative workers, who expect to lose most from the conservatism of the large firm, prefer small firms. This is particularly likely if p is relatively small or Y is relatively large.

PROPOSITION 1. *If*

$$p < \frac{\alpha U_{suc} + (1-\alpha)U_{fail}^S - U_{trad}^L}{\alpha(U_{suc} - U_{trad}^L)} \text{ at } w_1^L = \underline{w},$$

the level of creativity at which a worker is indifferent between a large and a small firm is:

$$\phi^* = \frac{U_{trad}^L - U_{trad}^S}{\alpha U_{suc} + (1-\alpha)U_{fail}^S - U_{trad}^S - \alpha p(U_{suc} - U_{trad}^L)} \in (0,1). \tag{3}$$

Workers with creativity $\phi \leq \phi^*$ choose the large firm, while workers with creativity $\phi > \phi^*$ choose small firms.

Proposition 1 is reminiscent of results in the literature on entrepreneurial choice; see, for instance Lucas (1978), which has established that the most productive workers

[17] Results would be qualitatively similar if we allowed the worker's bargaining power to differ in the large and small firms or if firm and worker bargained on the surplus that remains after paying external financiers.

choose to become entrepreneurs (i.e., to realise their ideas). In our model, creativity is equivalent to expected productivity. Thus, as highlighted by Lazear (1986, 2001), workers with higher expected productivity choose organisations where compensation is more strongly related to performance.

Proposition 1 also implies that for given wages, higher expected payoffs of ideas make relatively less creative workers inclined to choose small firms because the expected cost of having an idea erroneously rejected by the large firm increases.

COROLLARY 1. *For given wages, ϕ^* decreases in the expected payoff of ideas (αY) and increases in w_1^L.*

Conditions (2) and (3) imply that if

$$p \in \left(1 - \frac{(1-\alpha)[\underline{w} + I(1+r)]}{\alpha[Y - \underline{w} - I(1+r)]}, \frac{\alpha U_{suc} + (1-\alpha)U_{fail}^S - U_{trad}^L}{\alpha(U_{suc} - U_{trad}^L)}\right) \tag{4}$$

at $w_1^L = \underline{w}$ and (4) holds, in equilibrium the large firm (but not small firms) investigates new ideas, and the most creative workers choose to be employed in small firms. The latter statement rests on the fact that we can prove in Proposition 2 that the large firm never raises w_1^L to the point that even the most creative worker prefers the large firm. The interval for p is well defined as long as the firm's private cost from realising the idea (that does not affect the upper limit of the interval), $I(1 + r)$, is large enough. The fact that p must be included in an interval with an upper bound that is strictly smaller than 1 implies that the signal about ideas' future prospects must be sufficiently informative to make the large firm willing to follow the signal but also sufficiently noisy because the most creative workers must find it optimal to forgo the safe income offered by the large firm. In what follows, we explore the model implications under the assumption that (4) holds. In Sections 3 and 4, we provide existing and novel empirical evidence supporting the notion that this equilibrium is empirically relevant.

2.3. *Wage Determination*

Finally, we determine the wages that firms offer workers at $t = 0$. As discussed before, our assumptions on what is verifiable and contractible at $t = 0$ imply that the wage is paid in all states of the world, except when the firm defaults or when a successful idea is realised.[18]

We first determine the wage offered by small firms. Note that small firms default if the idea is unsuccessful. Thus, the wage they offer is paid only if the worker is employed in the traditional technology. Since there is free entry, small firms compete to hire a worker and in equilibrium they cannot offer a wage below $\underline{w}$, because there would

[18] Also, note that alternative compensation policies would not be possible. First, if firms offered a higher wage to workers who have an idea also when this is not realised, any worker could pretend to have an idea to obtain the higher wage. Second, if firms that do not default paid a lower wage to workers whose ideas fail, the commitment to offer a wage larger than $\underline{w}$ would not be credible. In fact, at $t = 3$, firms would find it optimal to make workers without ideas (or with ideas that are not realised) fail, as a failure cannot be clearly defined at $t = 0$ and firms could always drive the productivity of the worker to zero to make it appear as a failure. The large firm would thus not succeed in attracting any workers. Also note that under our assumptions, in the large firm, ideas never fail in equilibrium.

always be another small firm willing to pay an ε more. In addition, small firms cannot offer a wage higher than $\underline{w}$ because they have no own funds. Under the assumption that investors' claims are senior to wage claims,[19] small firms cannot finance wages through external funds and therefore are not able to pay $w_1^S > \underline{w}$. Thus, in equilibrium small firms offer $w^S = \underline{w}$.

We then determine the large firm's wage offer. First, note that Corollary 1 establishes that when w_1^L goes up, ϕ^* increases. Therefore, both the mass and expected creativity of the workers employed in the large firm increase with w_1^L. Wages can thus be used to attract creative workers. In other words, compensation is used as a tool to affect worker sorting, as in Lazear (1986).

At $t = 0$, the large firm maximises:

$$\max_{w_1^L} \mathrm{E}\Pi(w_1^L) = \int_0^{\phi*} [(1-\phi)(\underline{w} - w_1^L) + \phi \mathrm{E}(\pi_1^L)]\mathrm{d}\phi. \tag{5}$$

In (5), the integrand is the large firm's expected payoff from a worker of type ϕ : $\underline{w} - w_1^L$ is the payoff if the worker does not generate an idea and is employed in the traditional technology; $\mathrm{E}(\pi_1^L) \equiv \alpha \mathrm{p}[\lambda Y - (1+r)I] + (1-\alpha \mathrm{p})(\underline{w} - w_1^L)$ is the expected payoff if the worker has an idea that is realised only after a good signal.

Note that Proposition 1 implies that the large firm has to offer $w_1^L > \underline{w}$ to attract a non-empty set of workers. Proposition 2 establishes when this is optimal.

Proposition 2. *If the expected payoff of ideas is sufficiently high, the large firm offers a wage $w_1^L > \underline{w}$. Otherwise, it does not employ any workers and does not fund any ideas. The large firm never finds it optimal to offer w_1^L such that $\phi^* = 1$.*

Proposition 2 implies that if the large firm decides to compete with small firms for creative workers, it must offer higher wages. The trade-off it faces is the following: by offering high wages, it attracts a larger mass of workers and, on average, more talented workers. But a higher wage also implies that the per capita profit of each worker employed in the traditional technology decreases. It is hence optimal for the large firm to compete with small firms if the expected surplus generated by new ideas is sufficiently large. The large firm, however, never finds it optimal to offer a wage so high that it attracts even the most creative worker.

Finally, we derive the mass of ideas funded by the large and the small firms. Small firms fund all the ideas of the workers they employ: $\int_{\phi*}^1 \phi \mathrm{d}\phi = [1 - (\phi*)^2]/2$. The mass of ideas funded in the large firm is: $x \equiv \int_0^{\phi*} \phi \alpha p d\phi = \alpha p (\phi*)^2/2$. Therefore, our simplifying assumption that the large firm has enough funds for all ideas implies $A^L \geq x(I + w_1^L)$.

2.4. *Better Access to Credit*

Access to consumer credit increased dramatically in the second half of the 1980s and during the 1990s. As Guiso *et al.* (2001) and Sullivan (2008) show, it has become easier for US households to borrow through unsecured debt such as credit card debt during

[19] If investor claims were not senior, it would be possible to overpay non-creative workers employed in the risk-free technology at the expense of external financiers. This would undermine the feasibility of external financing.

unemployment spells. Proposition 3 shows that these developments in household access to financial markets are important for both occupational choice and firm profitability. In particular, as the borrowing constraint B relaxes, consumption can be smoothed more easily when an idea fails. As a consequence, the cut-off level of creativity at which workers prefer to be employed in small firms decreases, which implies the next Proposition.

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

An increase in B – through its effect on occupational choice – has other interesting effects which can be summarised as follows:

1 The large firm attracts fewer and less creative workers and realises fewer ideas. Thus, its profits per worker decrease.
2 Small firms also employ on average fewer 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 realised in equilibrium because small firms realise ideas with larger probability. This implies that more ideas fail because small firms do not investigate ideas but also that fewer good ideas are rejected.
4 Small firms take more risk than the large firm. Thus, profit volatility of the affected sectors increases, while the aggregate output decreases.
5 The expected utility of creative workers employed in small firms increases because they can smooth consumption more easily. Also, the utility of workers employed in the large firm can increase because w_1^L may increase.

2.5. *Extensions*

2.5.1. *Organisational change and capital structure*

According to our analysis, competition from small firms impairs the large firm's ability to attract creative workers and may thus make its profitability lower than that of small firms.

The large firm can react to small firms' competition by spinning off units, that is, by creating low-capitalised separate legal entities. This commits the firm not to investigate ideas as managers of spin-offs consider the capital provided by the headquarters as external funds. Hence, they are less conservative about realising the workers' ideas.

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). Interestingly, biotechnological research involves the application of ideas within the organisation, just as in our model.

An effect similar to the one of organisational change can be achieved through changes in capital structure: a large firm can distribute dividends (or buy back equity) and increase leverage. This was common during the 1990s (*The Economist*, 2002). However, when new ideas are realised within the existing firms, their cash flows are combined 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 improves incentives with respect to one project but distorts incentives with respect to other projects. For this reason, we believe that the implications for organisational change are more relevant.

2.5.2. *Ideas in large and small firms*

We have assumed that all ideas are identical and have positive net present value. An extension of our model can explain why large and small firms often fund different types of ideas. Small firms appear to contribute a disproportionate number of break-through innovations that involve low development costs, while large firms specialise in incremental improvements and innovation with high development costs (Arrow, 2000; Baumol, 2004).

While break-through innovations may resemble the positive net present value ideas we have considered so far, incremental innovation with high development costs are likely to generate relatively low payoffs for large investment. In other words, these ideas are likely to have *ex ante* negative net present value.

If they are still unable to commit themselves to a thorough investigation, small firms cannot raise external funds to finance negative net present value ideas. The conservatism of the large firm becomes an advantage because observing the signal may reveal that an idea has good prospects even though the prior is pessimistic.

If all ideas were non-profitable *a priori*, the large firm could attract *all* workers by offering a wage $w_1^L = \underline{w}$. The wage would be equal to the one offered by small firms but the large firm would also give the possibility of realising innovative ideas.[20] The small firms, not being able to raise external funds, would not fund any ideas.

In reality, some ideas are likely to generate large cash flows for small investments. Consistently with the empirical evidence, our model implies that most of these ideas are funded by small firms that attract the most creative workers who, besides having more ideas, may also have more profitable ideas. The least creative workers would be more likely to choose the large firm for implementing their incremental innovations.

3. Existing Empirical Support

We first present evidence consistent with the result that large firms are less inclined to realise risky ideas than small firms and that this affects workers' attitudes towards large *versus* small firms. Second, we summarise what is known about the relationship between income risk and occupational choice.

3.1. *Large Firms vs Small Firms: Screening and Occupational Choice*

There is some directly related empirical evidence that what firms have at stake influences their willingness to realise workers' ideas. Harberg (1963) finds that in contrast to small firms, the industrial laboratories of large companies are only minor sources of inventions. He states that even research-minded companies 'wallowing in large profits

[20] The most creative workers expecting to have an idea with higher probability could even accept a wage discount.

from previous projects' are reluctant to realise new ideas. Rather, they concentrate on improving old products. In large industrial laboratories, the research director spends considerable effort in developing research programmes for the entire team. Each worker is assigned a pre-arranged task and innovative ideas are subject to careful screening, as they could jeopardise the company's profits from previous projects and its assets. Hence, despite good salaries and security, elaborate facilities and technical support, the most creative scientists shy away from industrial laboratories.

Harberg's findings seem to fit well with more recent circumstances. For instance, the *Wall Street Journal* (2002) reports that science and engineering PhDs at General Electric, a large and highly diversified company, felt frustrated because they were spending too much time on routine tasks instead of pursuing broader ideas. Zenger (1994) presents survey evidence that for the same reason, small firms attract superior talent for their 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 realisation of their ideas.

Large companies have reacted differently to the increased competition for talent that seems to have occurred through the 1990s. A few of them, which considered innovation at the core of their business, have decentralised by breaking up units and creating spin-offs. Others maintained their centralised organisation at the risk of attracting less creative workers.

In line with our theory, Rajan and Wulf (2006) find that during the 1990s hierarchies have become flatter and employees have been conferred more freedom to choose what to work on. Just as predicted by our theory, it is mainly companies with less physical assets per employee that employ flatter hierarchies granting workers more freedom to realise their ideas. The authors argue that organisational changes depend upon increasing competition for employees' talent. In the light of our model, 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.[21]

Our model allows us to generate novel predictions on the link between firm organisation and corporate volatility. Rajan and Wulf (2006) find that companies where employees are granted more responsibility have higher volatility of earnings. In our theory, this is a consequence of the organisational change implying the realisation of more ideas. In this respect, our theory can explain the increase in firm level volatility during the 1990s, especially in sectors with more research and development and higher use of external funds (Comin and Philippon, 2006). Consistent with the mechanism of our model, Comin and Philippon also find that small firms have more volatile returns and higher exit rates and that firm level volatility is a good predictor of unemployment risk and wage volatility and dispersion.

[21] Some of the implications of our model on non-hierarchical organisations and innovative activity are similar to Aghion and Tirole (1997). In their paper, flatter hierarchies and employee empowerment increase the initiative of workers and may hence contribute to spur innovation. Beyond Aghion and Tirole (1997), our model implies that

(*i*) more creative workers are more likely to choose flatter organisations, i.e., organisations where they are more likely to realise their ideas;

(*ii*) firms that have less at stake (small firms) have stronger incentives to empower their employees.

3.2. *Income Risk and Occupational Choice*

A number of papers are consistent with the link we establish between income risk and occupational choice. Individual income variability depends mainly on fluctuations in employment status (Guiso *et al.*, 2002). The probability of losing one's job, in turn, is higher at smaller companies (Caves, 1998; Comin and Philippon, 2006). Furthermore, Gruber (1997) provides evidence that unemployment is followed by a drop in consumption, which is larger for individuals with higher after-tax real wages. The empirical evidence also shows that more risk-averse individuals self-select in secure jobs (Fuchs-Schundeln and Schundeln, 2005) and that less risk-averse individuals are more likely to be self-employed (Guiso and Paiella, 2007). Since borrowing constraints make individuals more risk-averse (Gollier 2000), these findings are in line with our argument.

Moreover, occupational choice is known to be influenced by institutional factors that affect downside risk in similar fashion as borrowing constraints do. Fan and White (2003) and Berkowitz and White (2004), for instance, study the effect of US bankruptcy exemptions that reduce downside risk. Bankruptcy exemptions provide partial wealth insurance for risk-averse potential entrepreneurs. Empirically, in states with higher bankruptcy exemptions, small firms and households are more likely to be denied credit and are granted smaller loans at higher interest rates. Nonetheless, the probability of owning a business is higher when exemption levels are higher. This suggests that incentives for risk-taking are equally important as access to start-up capital for entrepreneurial activity, and, more generally, for occupational choice. In the above papers, the channel is bankruptcy exemptions, in our model, it is relaxed borrowing constraints.

4. Empirical Evidence

Overall, the existing empirical evidence suggests that income risk matters for worker sorting. In our model, a relaxation in the borrowing constraint provides insurance against downside risk and affects occupational choice. Borrowing constraints for households have been relaxing in several countries during the second half of the 1980s and the 1990s (Jappelli and Pagano, 1994; Debelle, 2004).[22] There is also anecdotal evidence that workers became more inclined to take risky jobs in small firms during the same period (Cappelli, 1999; Malone 2003). However, the link between borrowing constraints and changes in workers' attitudes over jobs has not been established before. Our empirical analysis explores this link in a systematic way. We also show that a proxy for the upside of risky ideas helps to explain changes in workers' occupational choice.

4.1. *Data and Empirical Strategy*

We use the 'Survey of Consumer Finances (SCF)', a triennial survey about wealth, income and demographic characteristics of US households, conducted by the Board of

[22] Especially in the US during the 1990s, households have been able to increase their indebtedness. The US 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, 2008). In addition, increasing housing prices have allowed households to increase their mortgages, contributing to relaxed liquidity constraints.

Governors of the Federal Reserve System since 1989. The latest edition of SCF we have access to is 2001.[23] SCF is one of the primary data sources for research on entrepreneurship and small businesses; see, for instance, Wolken (1998), Moskowitz and Vissing-Jorgensen (2002).

SCF provides detailed information on employment of household members. In particular, we know the size of the firm that employs an individual and whether an individual runs her own business. There are also several items capturing household access to consumer credit, such as credit card limits and the maximum amount that can be drawn on credit lines. We also have information on whether households were denied credit or were discouraged from borrowing.

Figures 1 and 2 plot the fraction of individuals that work in small firms (defined as firms with fewer than 100 employees) and the maximum amount that can be drawn on the household's credit cards and credit lines. The Figures suggest a picture that is largely consistent with the stylised facts mentioned in the Introduction. Employment in small firms increased substantially from 1989 to 1992. Then it oscillated, possibly driven by different expectations on the business cycles and the expected payoff of new ideas. Such an explanation would be consistent with the fact that employment in small firms appears higher in 1998 – the peak of the high-tech bubble – than in 2001 (after the burst of the bubble) or in 1995 (when expectations about the payoffs of ideas were less inflated). The unused credit limit of the median household also increased in real terms during the sample period, suggesting a relaxation of borrowing constraints.

The information provided by SCF allows us to develop a test of our theory. In our empirical strategy, we use the fact that individuals differ not only in respect to their unobserved creativity (as the model assumes) but also in the ability to obtain consumer credit. According to our theory, other things equal, workers with less tight borrowing constraints should be more likely to be employed in risky jobs. Put differently, we exploit individual heterogeneity in access to credit to test whether borrowing constraints are related to occupational choice. The estimates we report are based on the 1998 SCF. The results are similar for the other survey rounds.

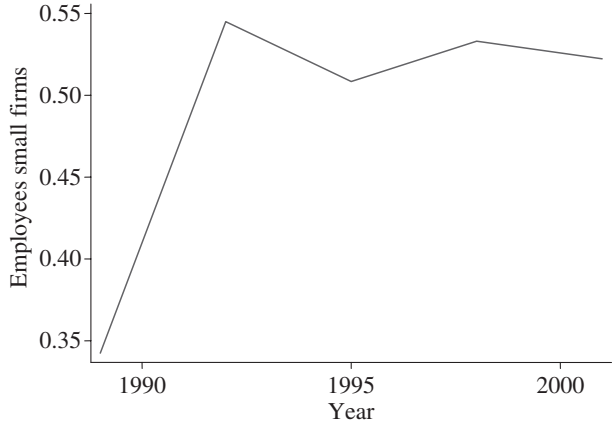

Fig. 1. *Employment in Small Firms*

[23] SCF provides repeated cross-sections but does not allow us to follow the same household over time.

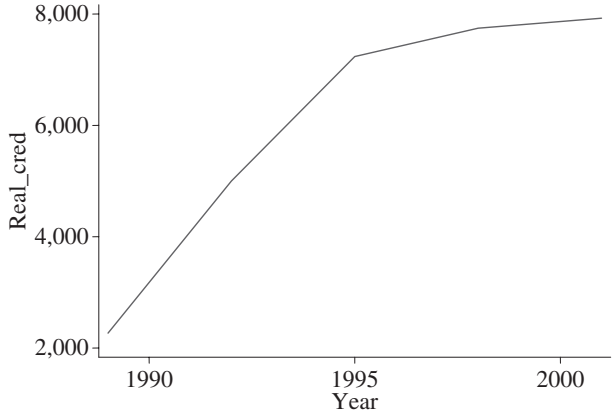

Fig. 2. *Credit Limit*
Notes. This Figure reports the maximum amount that on average a household can draw on credit cards and credit lines in 1992 US Dollars.

Our main proxy for the ease of accessing credit is the unused part of credit card balances and lines of credit, defined as the maximum amount that can be drawn minus any amount that the household already owes. Such variables are often used in corporate finance as an inverse measure of financing constraints; see, for instance, Petersen and Rajan (1997) and Kaplan and Zingales (1997). They are generally considered good proxies for the size of the buffer that the financial system can provide in bad times. However, the actual value of the variable depends on the demand for credit. For this reason, we also use the limits on credit cards and lines of credit (without subtracting the amount that is actually owed) as alternative proxies. To the extent that they are supply-determined, as Sufi (2009) argues, they represent the actual willingness of intermediaries to provide credit.

Table 2 provides descriptive statistics for the main variables. Approximately half of the individuals are either employed in small firms or are self-employed. As expected, the limit on credit cards is significantly smaller than the total amount that can be borrowed on credit cards and credit lines. Slightly less than 20% of the respondents declare that they were credit-constrained or were discouraged from borrowing. Notice that the average net wealth of households in the sample is very high (over 4 million US dollars in 1998). The distribution is, however, highly skewed; the median household has a net wealth of less than 5,000 dollars in 1998 and net wealth (including pension assets and real estate) is less than 100,000 dollars for more than two thirds of the sample. Additionally, one quarter of the sample has negative net wealth.

4.2. *Borrowing Constraints and Occupational Choice*

We estimate the probability that the head of household is employed in a small firm or is self-employed. We consider being self-employed equivalent to working in a small firm because small firms always realise ideas in our model. Table 3 shows that the proxy for access to credit is indeed associated with higher probability of holding a risky occupation. Without sorting, it would be hardly conceivable that borrowing constraints

Table 2*a*

Descriptive Statistics

	1998 sample			All survey rounds		
	No. obs.	Mean	Standard Deviation	No. obs.	Mean	Standard Deviation
Risky occupation	14,910	0.56	0.49	58,644	0.44	0.497
Employed in small firms	14,091	0.53	0.49	52,140	0.37	0.484
Credit limit	14,910	77.76	1,066.90	58,644	70.20	1,160
Credit card limit	14,910	19.10	35.04	58,644	17.74	4,920
Credit constraint	14,910	0.19	0.39	58,644	0.19	0.39
Own income	14,910	62.43	225.31	58,644	73.07	701.38
Spouse income	14,910	9.03	26.36	58,644	9.63	41.85
Household wealth	14,910	4,615.60	23,100	58,644	3,785.91	24,000
Age	14,910	44.90	12.80	58,619	44.97	12.88
Number of dependants	14,910	1.79	1.41	58,644	1.54	1.33
College degree	14,910	0.50	0.50	58,644	0.51	0.50
Expectation of income growth	14,910	0.33	0.47	30,704	0.16	0.37
Income uncertainty	14,910	0.31	0.46	58,644	0.55	0.50
Yearly IPOs	14,910	602	0	58,644	517.63	101.82

Notes. This Table presents mean and standard deviation for the main variables used in the analysis. All survey rounds include the 1989, 1992, 1995, 1998, and 2001 rounds of the Survey of Consumer Finances (SCF). Only heads of household who are employed at the time of the survey are included. *Risky occupation* is a dummy variable that takes value equal to 1 if the head of the household runs his own business or is employed in a firm with fewer than 100 employees and zero otherwise. *Employed in small firms* is a dummy variable that takes value equal to 1 if the head of the household is employed in a firm with fewer than 100 employees and zero otherwise (observations regarding individuals who run their own business are excluded). *Credit limit* is the unused part of the credit limit of all credit lines and credit cards of the household in thousands USD. *Credit card limit* is the unused part of the credit limit of all credit cards of the household in thousand USD. *Credit constraint* is a dummy variable that takes value 1 if the household has been denied credit or did not apply for a loan because anticipated to be denied credit and zero otherwise. *Own income* is the income of the head of the household in thousand USD. *Spouse income* is the income of the spouse in thousand USD. *Household wealth* has been computed as the sum of all financial and real assets of the household net of any liabilities and includes pension assets and is expressed in thousands USD. *Age* is the age of the head of the household. *Number of dependants* is the number of members of the household who are financially dependent. *College degree* is a dummy variable that takes value 1 if the head of the household has a college degree and zero otherwise. *Expectation of income growth* is a dummy variable that takes value 1 if the household expects the income to grow during the following year and equal to zero otherwise. *Income uncertainty* is a variable that takes value 1 if the household declares to save for the bad times and zero otherwise. *Yearly IPOs* is the number of IPOs during the year.

matter for occupational choice in this way. Rather, one would expect the opposite, namely, that workers with safer jobs and more stable flows of income have easier access to credit, as banks consider them safer borrowers.

We control for a number of individual characteristics that may affect occupational choice, like age, number of dependants, whether the individual has a college degree and household income (including individual's and spouse's income) and wealth. The income of the spouse also helps to control for an additional channel through with the availability of insurance may affect occupational choice – the possibility of risk sharing within the household. Finally, we include controls for the sector of activity, the type of task an individual performs on her job and gender.

Individuals who belong to wealthier households are indeed more likely to have risky occupations. Interestingly, workers with lower incomes are more likely to be employed in small firms. This is consistent with the implication of our model that small firms offer

Table 2*b*

Descriptive Statistics

	Risky occupation	Employed in small firms	Credit limit	Credit card limit	Credit constraint	Own income	Spouse income	Household wealth	Age	Number of dependants	College degree	Expectation of income growth	Income uncertainty
Risky occupation	1												
Employed in small firms	0.7502	1											
Credit limit	0.0598	0.0382	1										
Credit card limit	0.0272	0.0121	0.3514	1									
Credit constraint	−0.1168	−0.0539	−0.0367	−0.0375	1								
Own income	−0.025	−0.0354	0.0217	0.0394	−0.0285	1							
Spouse income	0.0037	−0.0075	0.3096	0.8981	−0.0271	0.0059	1						
Household wealth	0.0712	0.0485	0.1344	0.1003	−0.0471	0.1177	0.0886	1					
Age	0.3066	0.2161	0.0602	0.0473	−0.2573	0.0387	0.0117	0.115	1				
Number of dependants	0.0318	0.0161	−0.0064	0.0173	−0.0039	0.0249	0.0326	0.0108	−0.0963	1			
College degree	0.1472	0.0394	0.0516	0.0515	−0.1771	0.0629	0.0469	0.0753	0.1481	0.0075	1		
Expectation of income growth	−0.0248	−0.0056	−0.01	−0.0165	0.1171	−0.0127	−0.0119	−0.014	−0.1397	0.0218	−0.0377	1	
Income uncertainty	0.0367	0.0722	0.0056	−0.0025	0.0732	−0.01	−0.0107	0.0061	−0.0502	−0.0332	−0.077	−0.0331	1

Notes. This Table presents the correlation matrix of the main variables as defined in Panel (*a*). All survey rounds have been used to compute the correlation coefficients.

Table 3

Access to Credit and Occupational Choice

	Risky occupation		Small vs. large firms		Small vs. large firms		Small vs. large firms		Small vs. large firms	
	(1)		(2)		(3)		(4)		(5)	
									All survey rounds	
	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat
Credit limit	0.0001	2.36	0.0001	2.41					0.00003	4.13
Credit card limit					0.0001	3.68				
Credit constraint							−0.0050	−1.94		
Own income	−0.0208	−19.17	−0.0211	−18.85	−0.0211	−18.86	−0.0047	−19.9	−0.0306	−41.55
Spouse income	0.0001	−0.68	−0.0001	−0.61	−0.0001	−0.81	0.00002	0.41	−0.0001	−1.31
Household wealth	0.0013	3.87	0.0002	0.70	0.0000	0.74	0.0000	1.10	0.0000	0.38
Age	0.0074	19.09	0.0069	17.51	0.0067	16.66	0.0017	20.07	0.0059	30.53
Number of dependants	0.0078	2.39	0.0073	2.19	0.0069	2.04	0.00164	2.19	0.0067	3.55
College degree	−0.0279	−2.26	−0.0369	−2.92	−0.0423	−3.31	−0.0069	−2.52	−0.0482	−7.61
Obs.		14,910		14,091		14,091		14,091		52,120
Pseudo R-squared		0.15		0.14		0.14		0.14		0.19

Notes. This Table links the occupation of the head of the household to measures of access to credit and control variables. Specifications (1)–(4) include only observations relating to the 1998 round of the survey. Specification (5) includes the 1989, 1992, 1995, 1998 and 2001 rounds. All variables are defined in Table 1. The following additional dummy variables have been included in the equations but their coefficients are not reported: A dummy that takes value 1 if the head of the household is a female and zero otherwise, six dummies variables concerning the task of the head of the household in his (her) occupation, seven dummies concerning the sector of occupation of the head of the household. Additionally, in specification (5), four year dummies have been included. All equations have been estimated using a probit model and marginal effects and t-statistics are reported. Standard errors are corrected for heteroscedasticity.

lower wages.[24] Older workers are more likely to be employed in small firms, which suggests that workers may move to small firms after having gained experience at a larger company.

An alternative explanation of our results is that less financially constrained individuals have easier access to start up capital and, for this reason, are more likely to be self-employed.[25] To explore this possibility, we exclude from our regression individuals who are self-employed. Thus, we can focus on the effect of access to credit on the choice between employment in large and small firms (Table 3, regression 2). The choice between large and small firms cannot be driven by access to start-up capital as we here look at employees, not entrepreneurs. Yet, if borrowing constraints affect occupational choice, as we argue, the more constrained workers should prefer a safer income profile. The data support this; individuals with larger unused credit limits are less likely to work in large firms. Since financial intermediaries should be more willing to lend to individuals with safer and highly verifiable salaries, such as large firms' employees, if anything, our estimates may underestimate the actual effect of borrowing constraints on occupational choice. Interestingly and in accordance to our conjecture that access to start capital should not affect the choice between small and large firms, wealth does not enter significantly in the regression.

We also consider alternative proxies for access to credit (Table 3, regressions 3 and 4): First, we consider only the credit card limit, which is more likely to be supply-determined, as credit card companies often mail free credit cards. Also, we use a dummy that takes value one if the household has been denied credit or has been discouraged from applying for a loan, in a way similar to Guiso *et al.* (1996) who analyse the effect of borrowing constraints on the decision to buy equity. In both cases, the estimates suggest that individuals with easier access to credit are more likely to be employed in small firms. Similar estimates obtain when we use the maximum amount that can be drawn on the households credit cards and credit lines (results omitted). Also, the results are similar for different rounds of the survey. Table 3 (regression 6) shows the estimates obtained when pooling all survey rounds.

There are alternative mechanisms that could explain our results. One possibility is that individuals employed in small firms expect faster income growth. This would lead to reverse causality. According to the life cycle theory (Modigliani, 1986), it would be optimal for them to apply for credit lines and higher credit card balances in order to anticipate consumption. We can investigate this alternative mechanism. The survey reports whether households expect their income to grow in the following year. In Table 4 (regression 1), we include a dummy variable that takes value one if households answers yes, and zero otherwise. Individuals working in small firms expect higher income growth but this leaves the coefficient of the credit limit unchanged. Hence, this alternative mechanism can be discarded.

[24] This result is in line with a large literature showing that large firms usually pay higher wages (Oi and Idson, 1999). One of the leading hypotheses is that the organisation of the workplace and the selection of employees with unobservable characteristics are responsible for the positive relation between wages and employer size. Our empirical results are fully in line with this and the theory builds on related ideas.

[25] Hurst and Lusardi (2004) find that availability of initial capital, proxied by an individual's initial wealth, does *not* affect the decision to become an entrepreneur and rationalise this by the small amount of capital necessary to start a new business.

Another possibility is that individuals who work in small firms actively seek to obtain higher credit limits because their income is more volatile. The survey asks whether people 'save for bad times'. Household with higher income uncertainty may be more likely to save for the bad times and, at the same time, to attempt to increase their credit limits. The dummy variable *income uncertainty* takes value 1 if they answered yes, and zero otherwise. The estimates show that this variable is not statistically significant. Most importantly, the coefficient of our variable of interest is not affected in a qualitative way. In an alternative specification that we omit here, we proxy for income uncertainty by including a dummy variable equal to one if the household reports not to be able to give a good estimate of the following year income. Also in this case, the proxy for income uncertainty is not statistically significant and the coefficient of our variable of interest is not affected.

Another concern could be that our sample includes very wealthy individuals, who are unlikely to ever be financially constrained, because they can use their wealth to smooth consumption. If our results were driven by the richest individuals, we should be concerned that our proxies for access to credit capture some omitted factor. Hence, in Table 4 (regression 3), we estimate the parameters excluding all individuals with more than 50,000 dollars wealth.[26] In accordance to our theory, the credit limit has a larger effect on the probability of being employed in a small firm. Interestingly, the coefficient of the spouse income becomes positive and almost statistically significant. This suggests that there may be insurance within the family besides insurance through financial markets for poorer households. Hence, besides the relaxation of borrowing constraints, also the increasing proportion of two-earner households may have a role in explaining why job security has become less important.

Overall, we believe that our estimates, together with the fact that different proxies for access to credit yield qualitatively similar results, suggest that the credit limit affects occupational choice. To mitigate remaining concerns about endogeneity problems, we construct a more direct test of the mechanism of our model.

Our theoretical mechanism applies mainly to jobs where creativity is important. Individuals in management or R&D gain more from realising their ideas than others. Therefore, we run our regression for two different subsamples: workers with managerial or research-related jobs and workers with manual jobs. Access to credit should increase the probability of working in a small firm only in the first subsample. The estimates in Table 4 (regressions 4 and 5) suggest that this is indeed the case. The effect of borrowing constraints is more than double for managers and scientists with less than 1,000 dollars wealth (estimates not reported), in other words, for the individuals who are more likely to value the ability to borrow to smooth consumption over time.

Finally, we use the time-series dimension of SCF to investigate whether after controlling for wages, individuals become more prone to work in small firms when the expected payoff of the ideas is larger. Both increases in α or Y should increase the probability of employment in small firms (provided that (4) is still satisfied). In particular, individuals with relatively less access to credit should choose to be employed in small firms.

[26]This is quite a small number if one considers that it includes real estate and pension assets, which an individual may not want to liquidate following a temporary income shock.

Table 4

Robustness Analysis

	Small vs. large firms		Small vs. large firms		Small vs. large firms		Small vs. large firms		Small vs. large firms		Small vs. large firms	
	(1)		(2)		(3)		(4)		(5)		(6)	
					Wealth<50000		Managers and scientists		Manual workers		All survey rounds	
	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat
Credit limit	0.00001	2.34	0.00001	2.41	0.0005	2.64	0.00002	3.88	−0.0001	−1.6	0.000001	1.83
Credit limit × Yearly IPOs											0.000001	2.67
Own income	−0.0210	−18.77	−0.0211	−18.83	−0.0023	−7.96	−0.0422	−13.31	−9.96	−7.03	−0.0002	−4.16
Spouse income	−0.0001	−0.79	−0.0001	−0.6	0.0006	1.58	−0.0001	−0.46	0.0001	1	−0.0005	−0.7
Household wealth	0.0002	0.63	0.0002	0.68	−0.0046	−7.77	−0.00002	−0.09	0.0024	5.17	0.0008	2.49
Age	0.0072	18.01	0.0069	17.51	0.0049	10.06	0.01	15.53	0.0022	2.84	0.0073	33.26
Number of dependants	0.0079	2.36	0.0074	2.19	0.0039	1	0.01408	2.77	−0.0008	−0.14	0.0102	4.57
College degree	−0.0369	−2.92	−0.0370	−2.93	−0.0294	−1.97					−0.0152	−2.08
Expectation of income growth	0.0692	5.37										
Income uncertainty			0.0065	0.66								
Number of IPOs during the previous year											0.0001	6.71
Obs.		14,091		14,091		9,199		6,691		4,232		52,120
Pseudo R-squared		0.14		0.14		0.13		0.16		0.23		0.20

Notes. This Table links the occupation of the head of the household to measures of access to credit and control variables. Specifications (1)–(5) include only observations relative to the 1998 round of the survey. Specification (6) includes survey rounds 1989-2001. Specification (4) includes only observations relative to heads of the household who have managerial or research related jobs (managers and scientists). Specification (5) includes only observations relative to heads of the household who are employed as armed force, manual workers, drivers or farmers (manual workers). All variables are defined in Table 1. The following additional dummy variables have been included in the equations but their coefficients are not reported: a dummy that takes value 1 if the head of the household is a female and zero otherwise, six dummies variables concerning the task of the head of the household in his (her) occupation, seven dummies concerning the sector of occupation of the head of the household. All equations but (6) have been estimated using a probit model and marginal effects and t-statistics are reported. Equation (6) has been estimated by ordinary least squares to be able to interpret the interaction term directly. Standard errors are corrected for heteroscedasticity.

We conjecture that the expected payoff of ideas is positively related to the yearly number of initial public offers (IPOs). Arguably, years with a large number of IPOs are preceded by a lot of news on the good performance of entrepreneurial companies. This may lead individuals to revise upward their expectation on the upside of their ideas. Using the yearly number of IPOs from Loughran and Ritter (2004), we run a regression similar to the previous ones but we now use all survey rounds. We also include the yearly number of IPOs and an interaction term between the unused credit limit and the yearly number of IPOs.

The estimates presented in Table 4 (regression 6) show that an increase in the yearly number of IPOs increases the probability of any individual being employed in a small firm. This alone is also consistent with the fact that labour demand from small firms is particularly strong in those years. However, the positive and significant sign of the interaction variable suggests that in years in which the payoff of ideas is expected to be higher, more individuals with relatively less access to credit are employed in small firms. In the absence of our theory, this is more difficult to explain. The alternative hypothesis based on labour demand of small firms could explain why more individuals work in small firms during those years, but could not explain why sorting of workers changes over time.

The estimated effect is not only statistically but also economically significant: an increase in the number of IPOs from 344 to 566, respectively the median and the highest number of IPOs in our sample period, increase by 2.5 percentage points the probability that an individual with a credit limit of 7,000 dollars (the median credit limit in the sample) is employed in a small firm.

5. Conclusions

In our theory, financial market development eases household access to credit. When their borrowing constraints relax, workers change their attitude towards jobs and wage security in large firms. Rather, they seek riskier jobs in small firms that allow them to realise their own ideas. As the upside of ideas is particularly important for talented workers, large firms lose while small firms gain in competing for talented workers. Thus, the article shows that the availability of finance affects corporations not only through financial markets but also through the labour market.

Our theory has a number of implications. First, financial development and technological progress have dark sides: they may create excessive volatility and affect average firm profits negatively. Small firms may recklessly fund new ideas and steal the most creative workers from large firms. Although large firms' conservatism may be optimal, they may adopt policies to commit themselves to investigating ideas less thoroughly by creating spin-offs and increasing leverage to attract creative workers.

Second, it should be noted that excessive risk-taking can also be optimal. For instance, if workers exert effort *ex ante* to generate profitable ideas, firms would want to commit themselves to realise ideas with high probability to increase incentives for workers. Whether excessive risk-taking is beneficial for the overall economy is ultimately an empirical issue beyond the scope of this article.

Third, the relative competitiveness of large *versus* small firms may change along the business cycle. During booms, individuals find it easier to borrow and an increasing number of creative workers choose small firms. In contracting phases of the business cycle, household access to credit becomes more difficult because real estate prices decrease or because households are too indebted. Then, a stable income becomes more important. This effect is reinforced because during recessions the *ex ante* expected payoff of ideas may be lower. Also, it becomes more difficult to find new jobs, and as a consequence, income losses after firm defaults are larger. Hence, jobs in large firms become what they used to be before the boom: safe havens for workers.

If one interprets employment in small firms as entrepreneurial activity, then, the model also predicts that entrepreneurial activity is procyclical. This is similar to Rampini (2004). The reason however is very different: in Rampini's model, during recessions, potential entrepreneurs have difficulties to fund risky projects because of agency problems. In our model, workers sort themselves differently into small or large firms when the expected payoff from ideas changes. This, in turn, affects how many ideas are realised in large and small firms, respectively. In this way, we can also explain why an improvement in the expected payoffs of ideas is followed by an increase in firm defaults without relying on irrational or overoptimistic expectations.

Finally, the logic of our model can be applied in other contexts. Lenient bankruptcy laws, unemployment insurance and the ease in finding new jobs affect workers' payoffs after firm default in a way very similar to the ease of borrowing constraints. The mechanism highlighted in our model suggests that these factors should spur risk taking in the labour market and, ultimately, innovation.

Appendix

A.1. *Proof of Proposition 1*

In Proposition 1, the creativity level of the worker who is indifferent between working in the large or in a small firm, ϕ^*, is determined by equating the expected utility from working in the large and in a small firm:

$$\phi^*\alpha U_{suc} + \phi^*(1-\alpha)U^S_{fail} + (1-\phi^*)U^S_{trad} = \phi^*\alpha p U_{suc} + (1-\phi^*\alpha p)U^L_{trad}.$$

This can be rewritten as:

$$\phi^*[\alpha U_{suc} + (1-\alpha)U^S_{fail} - U^S_{trad} + \alpha p(U^L_{trad} - U_{suc})] = U^L_{trad} - U^S_{trad}, \tag{6}$$

from which the equation in Proposition 1 follows.

Note that under our assumptions $U^L_{trad} - U^S_{trad} \geq 0$ and $U^L_{trad} - U^L_{suc} \leq 0$. Hence, $\phi^* \in (0,1)$ and there exists an equilibrium in which a non-empty set of workers is employed both in the large and the small firms if $\alpha U_{suc} + (1-\alpha)U^S_{fail} - U^S_{trad} + \alpha p(U^L_{trad} - U_{suc}) > 0$. This implies:

$$p < \frac{\alpha U_{suc} + (1-\alpha)U^S_{fail} - U^L_{trad}}{\alpha(U_{suc} - U^L_{trad})}. \tag{7}$$

Inequality (7) requires that the benefits from working in a small firm exceed the costs for the most creative worker ($\phi = 1$). If (7) is satisfied, the left hand side of (6) increases in ϕ

faster than the right-hand side. 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 $\phi > \phi^*$.

Inequality (7) depends on the endogenous variable w_1^L. In Corollary 2, however, we prove that the large firms never finds it optimal to raise w_1^L to the point that even the most creative worker prefers to be employed in the large firm if at $w_1^L = \underline{w}$ some workers prefer the small firms. Hence, a sufficient condition for an equilibrium with a non-empty set of workers employed in small firms to exist is that inequality (7) is satisfied at $w_1^L = \underline{w}$.

Finally, note that $\phi^* \in (0,1)$ implies $w_1^L > \underline{w}$. The set of workers in the large firm is non-empty only if the utility from working in the large firm exceeds the utility in the small firm for the least creative worker ($\phi = 0$), which implies $U_{trad}^L - U_{trad}^S > 0$ and thus $w_1^L > \underline{w}$.

A.2. Proof of Corollary 1

Corollary 1 simply follows from the fact that if $p < \dfrac{\alpha U_{suc} + (1-\alpha)U_{fail}^S - U_{trad}^L}{\alpha(U_{suc} - U_{trad}^L)}$, then:

$$\frac{\mathrm{d}\phi^*}{\mathrm{d}\alpha} = -\phi^* \frac{U_{suc} - U_{fail}^S - p(U_{suc} - U_{trad}^L)}{[\alpha U_{suc} + (1-\alpha)U_{fail}^S - U_{trad}^S - \alpha p(U_{suc} - U_{trad}^L)]} < 0$$

because inequality (7) implies

$$p\alpha(U_{suc} - U_{trad}^L) < \alpha U_{suc} + (1-\alpha)U_{fail}^S - U_{trad}^L < \alpha(U_{suc} - U_{fail}^S)$$

and

$$U_{trad}^L > U_{trad}^S > U_{fail}^S$$

and

$$\frac{\mathrm{d}\phi^*}{\mathrm{d}Y} = -\phi^* \frac{U'_{suc} - pU'_{suc}}{[\alpha U_{suc} + (1-\alpha)U_{fail}^S - U_{trad}^S - \alpha p(U_{suc} - U_{trad}^L)]} < 0$$

because $U'_{suc} > pU'_{suc}$ (where U' refers to the first derivative of U).
Finally,

$$\frac{\mathrm{d}\phi^*}{\mathrm{d}w_1^L} = \frac{U_{trad}^{LJ}[\alpha U_{suc} + (1-\alpha)U_{fail}^S - U_{trad}^S - \alpha p(U_{suc} - U_{trad}^S)]}{[\alpha U_{suc} + (1-\alpha)U_{fail}^S - U_{trad}^S - \alpha p(U_{suc} - U_{trad}^L)]^2} > 0.$$

if $p < \alpha U_{suc} + (1-\alpha)U_{fail}^S - U_{trad}^L/\alpha(U_{suc} - U_{trad}^L)$ as assumed in Proposition 1.

A.3. *Proof of Proposition 2*

By employing capital in traditional technology, the large firm can always obtain a payoff of zero. The large firm thus chooses to employ a subset of creative workers offering a wage $w_1^L > \underline{w}$ only if the maximum of Equation (5) is larger than zero. The first-order condition of Equation (5) with respect to w_1^L is:

$$[(1-\phi^*)(\underline{w} - w_1^L) + \phi^* \mathrm{E}(\pi_1^L)]\frac{\mathrm{d}\phi^*}{\mathrm{d}w_1^L} + \int_0^{\phi^*} \left[-(1-\phi) + \phi \frac{\mathrm{dE}(\pi_1^L)}{\mathrm{d}w_1^L}\right]\mathrm{d}\phi = 0. \tag{8}$$

Integrating by parts, we obtain:

$$[(1-\phi^*)(\underline{w}-w_1^L)+\phi^*\mathrm{E}(\pi_1^L)]\frac{\mathrm{d}\phi^*}{\mathrm{d}w_1^L}-\phi^*+\frac{\phi^{*2}}{2}+\frac{\phi^{*2}}{2}\frac{\mathrm{dE}(\pi_1^L)}{\mathrm{d}w_1^L}=0. \quad (9)$$

The first term in the above first-order condition represents the effect of an increase of w_1^L on the mass of workers in the large firm, multiplied by the per capita profit of the large firm. This effect is positive for $w_1^L = \underline{w}$ (the lowest admissible wage). The first-order condition can thus be satisfied with equality with levels of w_1^L larger than $\underline{w}$ because $-\phi^* + \phi^{*2}/2 + (\phi^{*2}/2)\mathrm{dE}(\pi_1^L)/\mathrm{d}w_1^L$ is unambiguously negative for $\phi^* > 0$.

Since the large firm's expected profits increase in w_1^L when $\phi^* = 0$, in equilibrium the large firm offers $w_1^L > \underline{w}$ that satisfies the first-order condition with equality, if the expected profits are strictly larger than zero. This is case if the expected payoff from realising an idea is large enough.

By contradiction, assume that the large firm offers w_1^L so high that $\phi^* = 1$. Considering that at $\phi^* = 1, \mathrm{d}\phi^*/\mathrm{d}w_1^L = 0$, (9) becomes $-1 + \frac{1}{2} - \frac{1}{2}(1 - \alpha\mathrm{p}) < 0$. Thus, it would be optimal for the firm to decrease w_1^L. This proves that in equilibrium the large firm never offers a wage that attracts all creative workers.

A.4. Proof of Proposition 3

As pointed out in Subsection 3.1, the borrowing constraint is relevant only for workers in small firms if their idea fails and $B < \underline{w}/2$. Workers would then like to borrow to smooth their consumption, but they encounter a binding borrowing constraint. Hence, when B increases to B', U_{fail}^S increases. This implies that

$$\frac{\mathrm{d}\phi^*}{\mathrm{d}B}=-\frac{\phi^*(1-\alpha)U_{fail}^{S\prime}}{[\alpha U_{suc}+(1-\alpha)U_{fail}^S-U_{trad}^S-\alpha p_1(U_{suc}-U_{trad}^L)]}<0.$$

Hence, ϕ^* decreases, and for given wages, more workers want to be employed in small firms.

The wage small firms pay does not change, as it is pinned down by competition among firms and their lack of capital. By contradiction, assume that after the increase in B, the large firm would increase wages such that the set of workers it employs is larger ($\phi^{*\prime} > \phi^*$). This would imply $w_1^{L\prime} > w_1^L$.

$\phi^{*\prime}$ is the optimal mass of worker to employ in equilibrium if

$$\int_0^{\phi^{*\prime}}\phi\mathrm{E}[\pi_1^L(B',\phi^{*\prime})]+(1-\phi)[\underline{w}-w_1^L(B',\phi^{*\prime})]\mathrm{d}\phi\geq\int_0^{\phi^*}\phi\mathrm{E}[\pi_1^L(B',\phi^*)]+(1-\phi)[\underline{w}-w_1^L(B',\phi^*)]\mathrm{d}\phi.$$

Here, $w_1^L(B',\phi^{*\prime})$ is the wage, and $\pi_1^L(B',\phi^{*\prime})$ the level of expected profits per idea when the possible maximum borrowing is B' and the mass of workers employed in a large firm is $\phi^{*\prime}$.

Similarly, when the borrowing constraint is B, profit maximisation implies

$$\int_0^{\phi^*}\phi\mathrm{E}[\pi_1^L(B,\phi^*)]+(1-\phi)[\underline{w}-w_1^L(B,\phi^*)]\mathrm{d}\phi\geq\int_0^{\phi^{*\prime}}\phi\mathrm{E}[\pi_1^L(B,\phi^{*\prime})]+(1-\phi)[\underline{w}-w_1^L(B,\phi^{*\prime})]\mathrm{d}\phi.$$

At $B < B'$, the firm can employ a given mass of workers at a lower wage as $\mathrm{d}\phi^*/\mathrm{d}B < 0$. This implies that

$$\int_0^{\phi^{*\prime}}\phi\mathrm{E}[\pi_1^L(B,\phi^{*\prime})]+(1-\phi)[\underline{w}-w_1^L(B,\phi^{*\prime})]\mathrm{d}\phi>\int_0^{\phi^{*\prime}}\phi\mathrm{E}[\pi_1^L(B',\phi^{*\prime})]+(1-\phi)[\underline{w}-w_1^L(B',\phi^{*\prime})]\mathrm{d}\phi,$$

which leads to a contradiction.

Hence if $B' > B$, $\phi^{*\prime} < \phi^*$.

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