CFS Working Paper Series

No. 603

Marco Pagano and Luca Picariello

Talent Discovery, Layoff Risk and Unemployment Insurance

Center for Financial Studies | Goethe University | Theodor-W.-Adorno-Platz 3 | 60323 Frankfurt am Main | Germany
Phone +49 69 798 30050 | Fax +49 69 798 30077 | info@ifk-cfs.de | www.ifk-cfs.de

The CFS Working Paper Series

presents ongoing research on selected topics in the fields of money, banking and finance. The papers are circulated to encourage discussion and comment. Any opinions expressed in CFS Working Papers are those of the author(s) and not of the CFS.

The Center for Financial Studies, located in Goethe University Frankfurt's House of Finance, conducts independent and internationally oriented research in important areas of Finance. It serves as a forum for dialogue between academia, policy-making institutions and the financial industry. It offers a platform for top-level fundamental research as well as applied research relevant for the financial sector in Europe. CFS is funded by the non-profit-organization Gesellschaft für Kapitalmarktforschung e.V. (GfK). Established in 1967 and closely affiliated with the University of Frankfurt, it provides a strong link between the financial community and academia. GfK members comprise major players in Germany's financial industry. The funding institutions do not give prior review to CFS publications, nor do they necessarily share the views expressed therein.

Center for Financial Studies | Goethe University | Theodor-W.-Adorno-Platz 3 | 60323 Frankfurt am Main | Germany
Phone +49 69 798 30050 | Fax +49 69 798 30077 | info@ifk-cfs.de | www.ifk-cfs.de

Talent Discovery, Layoff Risk and Unemployment Insurance*

Marco Pagano
University of Naples Federico II, CSEF and EIEF

Luca Picariello
University of Naples Federico II and CSEF

2 October 2018

Abstract

In talent-intensive jobs, workers' quality is revealed by their performance. This enhances productivity and earnings, but also increases layoff risk. Firms cannot insure workers against this risk if they compete fiercely for talent. In this case, the more risk-averse workers will choose less quality-revealing jobs. This lowers expected productivity and salaries. Public unemployment insurance corrects this inefficiency, enhancing employment in talent-sensitive industries, consistently with international evidence. Unemployment insurance dominates legal restrictions on firms' dismissals, which penalize more talent-sensitive firms and thus depress expected productivity. Finally, unemployment insurance fosters education, by encouraging investment in risky human capital that enhances talent discovery.

JEL: D61, D83, I20, J24, J63, J65.

Keywords: talent, learning, layoff risk, unemployment insurance.

---

*We thank Viral Acharya, Fernando Alvarez, Alberto Bennardo, Wouter Dessein, Andrew Ellul, Gaetano Gaballo, Harald Hau, Bengt Holmström, Tullio Jappelli, Eirik Gaard Kristiansen, Ola Kvaløy, Jin Li, Ramon Marimon, Ernst Maug, Trond Olsen, Paola Pagano, Ettore Panetti, Fausto Panunzi, Nicola Pavoni, Alessio Piccolo, Giorgio Primiceri, Jean-Charles Rochet, Fred Schroyen, Annalisa Scognamiglio, Marko Terviö, Alberto Zazzaro, Kuo Zhang, and participants at the CSEF-IGIER Symposium on Economics and Institutions, 2017 Galatina Summer Meetings, 2017 Midwest Economic Theory Conference, 2018 AEA Meetings, 2018 SOLE Meetings. the 2018 EFA Meetings, the 6th Workshop in Macro Banking and Finance, and seminars at Aalto University, Collegio Carlo Alberto, CSEF, Geneva, HEC Montreal and NHH for useful input. We acknowledge financial support from EIEF, ERC (FINLAB project no. 295709) and NHH.

1 Introduction

In the knowledge economy it is increasingly important to discover workers' talent, as a firm's ability to innovate – as by introducing a new app or investment strategy – depends crucially on the quality of its employees' human capital (Kaplan and Rauh, 2013). The hallmark of talent-intensive industries is that their technology does not require merely the efficient performance of routine tasks, but rather such qualities as imagination and intelligence, as well as education and training. In this setting, corporate success often hinges on identifying the most talented workers and assigning them to the tasks they are best at.

If the labor market is competitive, talented workers share in the productivity gains they generate, in the form of high salaries or bonuses. However, *ex ante* talent discovery is a source of risk for workers, if they are not fully aware of their own quality: *ex post*, they may turn out to be worse than they had expected, and if so they may be dismissed and forced to search for a more suitable job. This risk entails considerable welfare losses for workers (Low, Meghir and Pistaferri, 2010): those who are dismissed suffer earnings losses not only while unemployed but also upon reentry (Jacobson, LaLonde and Sullivan, 1993) and typically cut back on consumption (Gruber, 1997; Browning and Crossley, 2001).

In principle, this risk is privately insurable: firms commit to generous severance pay for dismissed employees and so compensate them if they are found to be untalented. But firms can provide such insurance only if the labor market is not fully competitive, i.e. workers are not free to move to another employer once their talent is discovered. If they are, firms cannot provide severance payments to the less talented as this would mean cross-subsidizing them at the expense of the talented, who would react by going over to a competing employer.

Hence, in the presence of *ex-post* competition for talent, workers are left to bear the layoff risk arising from the talent discovery process, absent any public unemployment insurance. We show that in these circumstances, risk-averse workers have an incentive to reduce the risk by choosing to work for firms and in industries whose projects convey little information about employees' quality. These firms and industries naturally feature less efficient allocation of talent than those where employers can learn more about their employees' quality. Accordingly, the absence of layoff risk is accompanied by lower average wages. As a result, industries with talent-sensitive

technologies (where job performance reveals a worker's ability) will find it harder to recruit workers and develop: only the least risk-averse workers – if any – will want to work in such industries.

As Hirshleifer (1971) points out, information revelation brings benefits in terms of productive efficiency, but also entails the cost of forgone opportunities for insurance. In this paper, we show that this lack of insurance can impair the development of talent-sensitive industries and technologies. By the same token, this market failure highlights a hitherto neglected efficiency rationale for public unemployment insurance (UI), whereby it is society – rather than firms – that supports dismissed workers, funding their benefits with payroll taxes on those who retain their jobs. Being buffered against layoff risk, even risk-averse workers will prefer jobs in talent-sensitive industries with their high salaries. The prediction is that such industries should be able to flourish in economies where competition for workers' talent is associated with a generous public safety net against layoff risk – a prediction that appears broadly consistent with international evidence.

Compared with public unemployment insurance (UI), trying to protect workers by limiting firms' power of dismissal is socially inefficient. Employment protection legislation (EPL) effectively forces firms to retain low-quality workers too, inducing firms in the talent-intensive industries to refrain from hiring in the first place, in order to break even. This is because, owing to limited liability, workers can share in the firm's surplus but are protected from the losses that they generate. Thus EPL leads to an inefficiently low level of learning about workers' talent, and results in lower average wages, not just reduced layoff risk. Hence, in our framework EPL is an inferior solution to UI.

We also investigate the impact of talent discovery and layoff risk on workers' accumulation of human capital. Expanding the baseline model to allow for an initial stage of education investment, we find that the introduction of UI spurs such investment by workers, by decreasing the risk of the return to human capital. Insofar as UI encourages employment in talent-sensitive industries, it also increases the total number of workers who acquire education. Hence, UI acts both on the intensive and on the extensive margin of education – a channel that in turn compounds the impact of UI on talent discovery.

The paper is structured as follows. Section 2 frames our contribution within the relevant literature. Section 3 lays out the model's assumptions. Section 4 derives

the evolution of beliefs about employees' talent and firms' resulting optimal layoff rule. Sections 5.1 and 5.2 characterize the equilibria in noncompetitive and competitive labor markets and compare them. Section 6 shows how public UI affects the equilibrium. Section 7 investigates the effects of employment protection legislation, and compares them with those of UI. Section 8 extends the model to a setting in which workers can invest in education before entering the labor market. Section 9 concludes.

2 The Literature

This work lies at the intersection of two strands of research: the literature on learning about workers' quality and that on the insurance offered by private employers and public institutions. What naturally links the two is the simple fact that talent discovery is a source of risk for the worker.

Learning about talent can occur either within the firm (from one's work performance with a given employer) or in the market (from sequential matching with different employers). In our model, learning is within the firm, as in the career concerns models dating back to Fama (1980), Harris and Holmström (1982) and Holmström (1999). But since such learning spills over to other potential employers, competition means that firms cannot insure workers against talent uncertainty. In our setting, the non-insurability of human capital risk leads not only to inefficient risk-sharing within firms but also to low average productivity: talent discovery is efficient only if workers can be insured against the implied risk, and this cannot take place in a competitive labor market. Workers will shield themselves against this risk by slowing down talent discovery: in Acharya, Pagano and Volpin (2016) they do so by churning across jobs; in our setting, by choosing talent insensitive jobs. In contrast, in search models of the labor market such as Jovanovic (1979) workers' mobility enables learning about workers' quality, by promoting the efficient matching of employees and firms.

In our setting, workers bear the cost of talent discovery in the form of layoff risk. In reality, firms too bear costs in such a learning process, since hiring novices means forgoing senior employees with proven track records. Terviö (2009), in a search model with uncertain worker quality, shows that this implicit screening cost deters efficient talent discovery: rather than test promising novices, firms pay inefficiently high salaries to mediocre incumbent workers. Thus, in Terviö's model too, labor

market competition leads to inefficiently little talent discovery, but owing to screening costs and not, as in our framework, to uninsurable layoff risk.

Far from being inessential, this feature of our model is at the root of its main prediction: that public UI enables efficient talent discovery even with labor market competition. Interestingly, substitutability between firm-level insurance provision and public UI is documented empirically by Ellul, Pagano and Schivardi (2018).

Our paper contributes to the literature on the costs and benefits of UI, showing that it enhances productive efficiency. The literature has recognized that UI stabilizes workers' consumption (Gruber, 1997) and avoids mortgage defaults (Hsu, Matsa and Meltzer, 2018), but has also stressed the disincentive to job search and the resulting increase in the duration of unemployment spells (Moffitt and Nicholson, 1982; Meyer, 1990, and Katz and Meyer, 1990).[1] But other papers show that UI also allows workers to search longer and so to find better matches, thus raising aggregate productivity (Diamond, 1981; Acemoglu, 1997; Marimon and Zilibotti, 1999; Choi and Fernández-Blanco, 2018). Indeed, Nekoei and Weber (2017) document empirically that UI improves the quality of the firms where the jobless eventually find work and raises their wages. In these papers UI raises productivity by subsidizing talent discovery in the marketplace; in our setting, it subsidizes talent discovery within the firm.

The only search-theoretic model of UI with risk-averse workers is Acemoglu and Shimer (1999, 2000). In their general equilibrium setting, if firms choose a labor-intensive technology, they create many vacancies and can fill them offering low wages: risk-averse workers accept low wages because they have good chances of filling a vacancy and avoiding unemployment. If instead firms choose a capital-intensive technology, they create few vacancies, and even if they offer high wages, few workers will apply for fear that the job will be taken by a competing applicant. This creates vacancy risk for firms, deterring them from opting for such technology. UI changes this by encouraging even risk-averse workers to take the unemployment risk associated with a capital-intensive technology.

Hence, also in Acemoglu and Shimer UI implies higher and productivity of employed workers, as well as higher unemployment risk, as in our model. But our model

[1] Moffit and Nicholson (1982) find that a 26-week extension of the benefit duration lengthens the average period of unemployment by about 2.5 weeks. Meyer (1990) shows that the probability of getting a new job declines as the level of benefits rises and increases just before the entitlement period expires.

differs in two important respects: first, unemployment risk arises from the danger of being dismissed, not from the risk of the job being filled by a competing applicant; and second, the productivity-enhancing effect of UI stems from better talent discovery, not the selection of a more capital-intensive technology. This translates into different predictions about the effects of UI: according to our model, UI reallocates employment towards talent-intensive industries, while according to Acemoglu and Shimer it induces all firms to adopt more capital-intensive technologies.

3 The Model

We study a two-period model with Bayesian learning about workers' talent. The economy is populated by competitive firms owned by risk-neutral shareholders and a continuum of measure N of workers. Each worker can operate at most one project. Each project lasts for two periods and must be operated by the same worker in both. If the worker leaves the firm at the end of the first period, the project is terminated prematurely.

Firms belong to one of two industries, $j = \{1, 2\}$, with technologies featuring specific sensitivity to employees' talent $\lambda_j \in [0\,,\,1]$, as is explained below in greater detail. Each industry j has a continuum of homogeneous projects of measure $G_j > N$. As a result, in each industry there is at least one project per worker: workers – not projects – are the scarce factor of production. The model can be easily generalized to any number of industries.

Workers are risk-averse: their instantaneous utility $u(c_t)$ is increasing and concave in their time-t consumption c_t. Their lifetime utility is $U = u(c_1) + \beta u(c_2)$, where β is their discount factor. They also have no initial wealth, cannot borrow and have no access to insurance markets, for instance due to moral hazard problems. Moreover, workers are assumed not to save because they are impatient: their discount factor β is smaller than the market interest factor, which is assumed to be 1. Hence, they do not insure themselves by saving against shocks to the value of their human capital due to changes in their reputation. These assumptions allow us to focus on the firm as the only source of insurance against these shocks.

3.1 Worker Types and Productivity

Workers differ in talent: worker i's quality is $q_i = \{G, B\}$ ("good" or "bad") and is initially unknown to all, including workers themselves. The common prior belief about workers' quality is $Pr(q = G) = p \in [0\,,\,1]$. The revenue produced by a worker in each period is observable by all firms, so that Bayesian posterior beliefs about a worker's quality are also common. This assumption is without loss of generality, provided that previous work experience (as opposed to performance) is common knowledge.[2]

Workers have reservation wage $w_0 > 0$ per period. In each of its two periods, a project produces revenue y_t. The revenue y_t can take either a high value $\overline{y} > w_0$ or a low value $\overline{y} - c$, which does not cover the worker's reservation wage w_0, and thus yields a negative surplus: $\overline{y} - c - w_0 < 0$. Revenue depends on the combination of technological risk and the worker's talent, as illustrated by Figure 1. With probability $1 - \lambda$, the payoff depends only on technological risk: revenue is $\bar{y}$ with probability p and $\bar{y} - c$ with probability $1 - p$. Alternatively, with probability λ the project's revenue reflects the worker's talent: if good, revenue is $\bar{y}$; if bad, $\bar{y} - c$.

Hence, λ can be seen as the project's sensitivity to the worker's talent: the higher λ, the less the "noise" in the project's payoff, and the sharper its "signal" about the talent of the project's executor.[3] For example, in the extreme case where $\lambda = 1$, the project always succeeds if run by a good worker and fails otherwise, so the project outcome is perfectly informative about the worker's talent. In the polar opposite case $\lambda = 0$, the project succeeds with the unconditional probability p, and its revenue is therefore totally uninformative.

Notice that λ does not affect a project's unconditional probability of success or,

[2]Intuitively, suppose that workers' first-period performance is observed only by their current employer, but that those leaving their firm after the first period can be told apart from the others. In this case, potential employers would infer that such employees had been dismissed and therefore that they had performed poorly, since it is optimal to fire only such employees. Employees who performed well would have no incentive to resign, as otherwise they would be mistaken for bad workers. Hence, other employers' belief about the low quality of workers leaving their firm is rational.

[3]Here we take talent sensitivity λ to be determined by technology. But it can also be affected by the firm's organizational structure: the performance of a small firm depends more on the individual performance of its employees than that of a large-scale firm; similarly, a production process performed in small teams is more informative about individuals' talent than one performed by large teams.

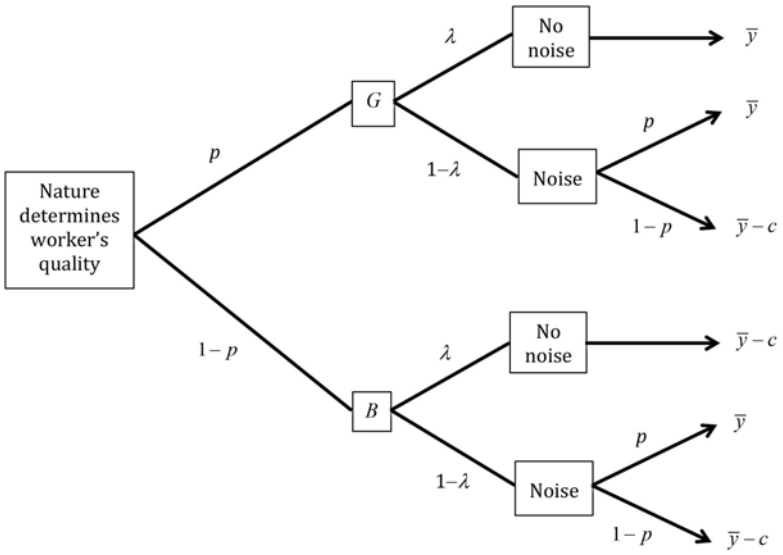

Figure 1: Project payoffs

therefore, its expected revenue, $\bar{y} - (1-p)c$, or its variance $p(1-p)c^2$. As we shall see, in this model a project's sensitivity to talent, λ, increases expected return and risk only by sharpening the firm's learning and thus heightening its propensity to liquidate bad-performing projects ahead of time: the relationship between λ and payoff moments is driven by the firm's behavioral response, not by technology.

To make the problem interesting, we impose the following parameter restrictions:

$$\bar{y} - (1-p)c \geq w_0 > \bar{y} - c > 0. \tag{1}$$

The left-hand-side inequality implies that it is initially efficient to hire any worker, since the unconditional expected revenue is positive. The right-hand-side inequality implies that the productivity of bad workers is low enough so that the employer does not wish to retain them. Condition (1) can be rewritten as

$$p \geq 1 - \frac{\bar{y} - w_0}{c} > 0, \tag{2}$$

so that in what follows we restrict our attention to the interval $p \in \left[1 - \frac{\bar{y}-w_0}{c}, 1\right]$.

3.2 Labor Contracts

Firms are assumed to compete for workers at their initial hiring. After the first production period, workers can be dismissed or retained, based on their previous performance. Regarding workers' mobility, we consider two labor market regimes: non-competitive, in which workers cannot resign and seek new jobs, owing to loyalty or market frictions (search costs, say, or regulation); and competitive, in which workers are free to resign and switch to a new employer. In other terms, in the first regime workers commit to stay with their initial employer, in the second they do not. Firms, instead, are assumed to be able to commit to long-term contingent contracts: when hiring, they offer wage contracts for both production periods, $\{w_t\}_{t=1}^2$, conditional on retaining the employee in the second period. In other words, workers' performance in each period is not only observable but also verifiable.[4] However, since in the competitive labor market regime workers can resign after the first production cycle, they renegotiate their second-period salary w_2, based on their past performance. Hence, in this regime, the salaries $\{w_t\}_{t=1}^2$ paid to retained workers are the same as those that would be generated by a sequence of spot contracts.

The wage that the firm pays in the first period depends on its prior belief $\theta_0 = p$ about the worker's quality; that in the second period depends on the revenue y_1 generated in the first period, hence on the firm's posterior belief, $\theta_1 = \Pr(q = G|y_1)$. Hence, the second-period wage is effectively a function of the belief, $w_2(\theta_1)$. Wages can never be negative, as employees are protected by limited liability.

Once a worker is hired and assigned to a project, she generates revenue y_1. Based on this initial payoff, the firm decides whether to keep the worker running the project or not: if the expected "continuation revenue", denoted by y_2, falls short of the worker's reservation wage w_0, then the firm will want to liquidate the project and dismiss the worker. When a project is liquidated, the firm is better off dismissing the employee and producing nothing rather than paying the reservation wage w_0 for being idle.

Recalling that the firm's revenue at time t equals y_t, its profit equals $y_t - w_t$. The

[4] Failing this, firms would not be able to offer any insurance, even in the non-competitive regime: see footnote 6 below.

firm chooses its wage offer $\{w_t\}_{t=1}^2$ so as to maximize its expected profits:

$$\mathbb{E}_0(y_1 - w_1) + \begin{cases} \mathbb{E}_0(y_2 - w_2) & \text{if the worker is retained,} \\ 0 & \text{otherwise,} \end{cases} \tag{3}$$

and workers maximize expected utility as of the beginning of the game:

$$\mathbb{E}_0 \left[u(w_1) + \beta u(w_2) \right]. \tag{4}$$

3.3 Time Line

The time line has four stages (see Figure 2).

At $t = 0$, firms compete for workers, offering contracts that pay wages $\{w_t\}_{t=1}^2$, and workers choose which firm to work for.

At $t = 1$, each worker initiates a project within the firm, produces revenue y_1, and earns wage w_1.

At $t = 2$, beliefs on each employee's quality are updated, and firms accordingly decide whether to retain or dismiss workers. If the labor market features ex-post competition, the wages w_2 are renegotiated to retain workers.

At $t = 3$, the employees kept on continue to operate the project, produce revenue y_2 and receive wage w_2; otherwise, the project is liquidated and employees earn the reservation wage w_0 absent any insurance, severance pay if pledged by the firm, or else a public unemployment insurance benefit.

4 Profits, Beliefs and Layoffs

The expected revenue of projects at $t = 1$ is the same for all firms, irrespective of λ:

$$\mathbb{E}_0(y_1) = \bar{y} - (1 - p)c. \tag{5}$$

However, the actual value of the revenue y_1 will generally differ depending on the employee operating the project. Based on its realization, the belief about the quality of the employee is updated from the prior $\theta_0 = p$ to the posterior θ_1, which can take

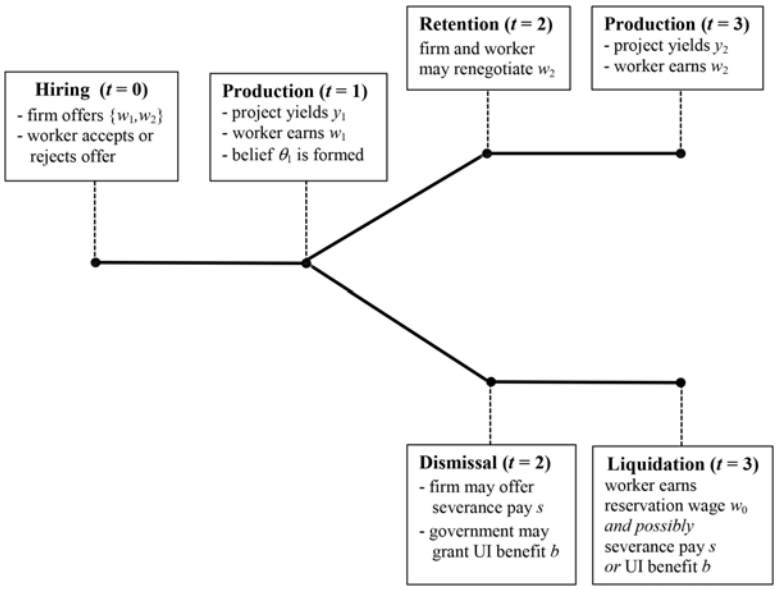

Figure 2: Time line

one of two values: $\Pr(q = G|y_1 = \bar{y}) \equiv \theta_H$ for workers that generated a profit at $t = 1$ or $\Pr(q = G|y_1 = \bar{y} - c) \equiv \theta_L$ for those that produced a loss.

This Bayesian updating depends on the informativeness λ of the firm's technology:

$$\theta_H = \lambda + (1 - \lambda)p \geq p \tag{6}$$

and

$$\theta_L = (1 - \lambda)p \leq p. \tag{7}$$

Hence, the expected second-period revenue of the project upon good performance, $y_{2H} \equiv \mathbb{E}_1(y_2|y_1 = \bar{y})$ is

$$y_{2H} = \bar{y} - (1 - \theta_H(\lambda))\, c, \tag{8}$$

while the corresponding expression upon bad performance, $y_{2L} \equiv \mathbb{E}_1(y_2|y_1 = \bar{y} - c)$, is

$$y_{2L} = \bar{y} - (1 - \theta_L(\lambda))\, c. \tag{9}$$

These two expressions bracket the average first-period revenue: $y_{2H} \geq \mathbb{E}_0(y_1) \geq y_{2L}$, $\forall\lambda$. The revenue from the project is expected to increase upon good performance and decrease upon bad.

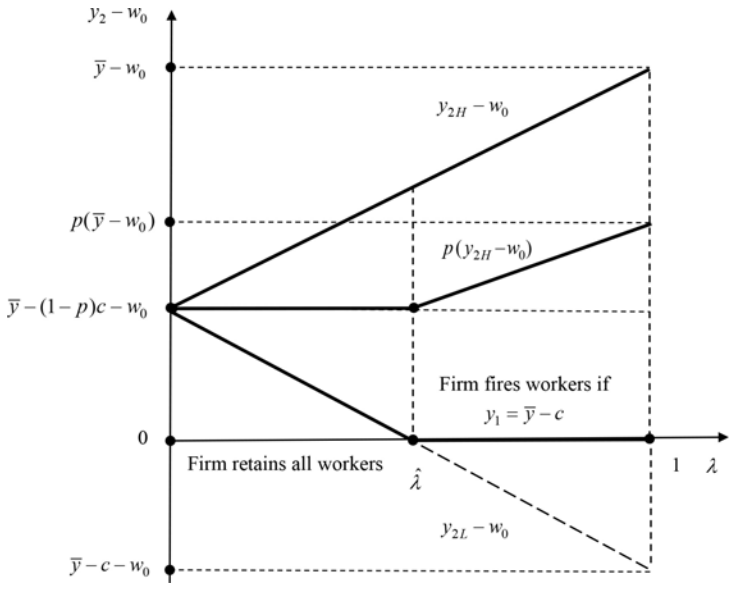

Figure 3: Informativeness of technology and dismissal policy

Based on the updated beliefs, firms will choose different optimal dismissal policies depending on the informativeness of their technology, λ:

Lemma 1 *If the revenue is $y_1 = \bar{y}$, the worker is retained and the project is continued, irrespective of the firm's talent-sensitivity λ. If $y_1 = \bar{y} - c$, the worker is dismissed only by firms with talent-sensitivity $\lambda \geq \widehat{\lambda} = \frac{\bar{y}-(1-p)c-w_0}{pc}$, and the project is liquidated.*

This lemma, proved in the Appendix (like all subsequent results), is illustrated by Figure 3. The informativeness of the firm's technology, λ, ranges form 0 to 1. Above the threshold value $\widehat{\lambda}$, it is optimal for the firm to dismiss low-performing workers. This raises the firm's productive efficiency, namely, its ex-ante expected surplus $\mathbb{E}_0(y_2) - w_0$, because, when λ is greater than $\widehat{\lambda}$ the firm's screening ability is good enough to determine the liquidation of unpromising projects, and the continuation only of those that are likely to be profitable, and thus to pay a higher average wage. Such a dismissal policy is tantamount to an "up-or-out" mechanism, by which employees that prove successful at $t = 1$ receive a wage increase and the others are dismissed. And in fact "up-or-out" contracts are common in talent-sensitive industries, such as academia, professional services and high-tech.

However, this gain in productive efficiency comes at the cost of unemployment

risk, as workers who happen to perform poorly at $t = 1$ are dismissed. This can be seen in Figure 2, where the $y_{2L} - w_0$ line flattens to the right of $\lambda = \widehat{\lambda}$: by dismissing low-performing workers and terminating their projects, highly talent-sensitive firms generate zero surplus, instead of a negative expected surplus.This raises these firms' unconditional expected surplus at $t = 2$, as shown by the $p\left[y_{2H}(\lambda) - w_0\right]$ upward-sloping line in the figure:

$$p\left[y_{2H}(\lambda) - w_0\right] + (1-p)\max\left\{y_{2L}(\lambda) - w_0, 0\right\} = \begin{cases} \mathbb{E}_0(y_1) - w_0 & \text{if } \lambda < \widehat{\lambda}, \\ p\left(y_{2H} - w_0\right) > \mathbb{E}_0(y_1) - w_0 & \text{if } \lambda \geq \widehat{\lambda}, \end{cases} \tag{10}$$

where $\mathbb{E}_0(y_1)$, y_{2H} and y_{2L} are given by expressions (5), (8) and (9), respectively.

5 Labor Market Equilibrium

Let us now turn to the equilibrium of the labor market. First we consider the benchmark case of the noncompetitive regime, where workers cannot be poached by other firms at $t = 2$, after projects have generated their first payoff. Next we study a regime in which such poaching is possible, so that there is competition for workers also at $t = 2$. Finally, we contrast the allocation of risk and workers across firms in these two regimes.

5.1 The Benchmark: Noncompetitive Labor Market

We start with a labor market regime without ex-post competition for workers, owing – for instance – to prohibitive switching costs or regulatory constraints that prevent workers from resigning. In this regime, when firms bid for workers' services at $t = 0$, they commit to pay their workforce a lifetime wage equal to the revenue they are expected to generate during their career. This is immediate in firms with $\lambda < \widehat{\lambda}$, where workers are expected to produce revenue $\mathbb{E}_0(y_1)$ in each period, and earn lifetime wage $w_1 + w_2 = 2\mathbb{E}_0(y_1)$. In these firms there is no need to insure workers, as they are never dismissed.

Instead, in firms with $\lambda \geq \widehat{\lambda}$ workers generate expected revenue $\mathbb{E}_0(y_1) + py_{2H}$, where the second term is the revenue that retained workers are expected to produce. Ex-ante competition leads firms to bid wages up to the point where total expected

profits (3) are zero. Owing to lack of ex-post competition, these firms can transfer this expected revenue to their employees in the form of a riskless income flow. They can do so because they manage to retain high-performing workers without compensating them fully for the expected revenue y_{2H} that they generate; hence they can insure low-performing workers by offering them severance pay funded at the expense of retained ones. Absent such insurance, with probability p the employees of these firms would be retained and earn their expected revenue y_{2H}, and with probability $1-p$ would be dismissed and earn the reservation wage w_0. Thus, their expected income is $py_{2H} + (1-p)w_0$. With perfect insurance, all of the firm's employees earn this sum with certainty, whether retained or not. Specifically, the lifetime wage of retained workers is

$$w_1 + w_2 = \mathbb{E}_0(y_1) + py_{2H} + (1-p)w_0. \tag{11}$$

Dismissed workers earn the same amount, as they receive severance pay $s = p(y_{2H} - w_0)$ supplementing their reservation wage w_0, so that their lifetime income is

$$w_1 + w_0 + s = \mathbb{E}_0(y_1) + py_{2H} + (1-p)w_0. \tag{12}$$

Since retained workers produce expected revenue $\mathbb{E}_0(y_1) + y_{2H}$ in excess of their lifetime wages w_1+w_2 in (11), they pay an insurance premium $(1-p)(y_{2H}-w_0)$, which fund severance pay s to dismissed workers, resulting in a transfer $p(1-p)(y_{2H}-w_0)$ across the two groups. The firm breaks even in providing such insurance, while still optimally using the information about their employees' quality inferred from their first-period performance and terminating projects that made losses in the first period.

Since workers are credit-constrained, firms will not only offer perfect insurance, but also consumption smoothing via an implicit loan contract: as workers are impatient ($\beta < 1$), they prefer a decreasing consumption path. Hence a fully optimal contract requires firms to pay a higher salary at $t = 1$ than at $t = 2$, such that $u'(w_1) = \beta u'(w_2)$, with $w_1 + w_2$ given by expression (11).

Notice that in firms where $\lambda \geq \widehat{\lambda}$ employees earn strictly more than in those where $\lambda < \widehat{\lambda}$, since $\mathbb{E}_0(y_1) + py_{2H} + (1-p)w_0 > 2\mathbb{E}_0(y_1)$. Moreover, since in these firms the expected second-period output $py_{2H}+(1-p)w_0$ is increasing in λ, the employees of the most informative firms receive the highest possible lifetime compensation, without bearing any risk. In this labor market regime the firms with the highest value of

λ – namely, those with the most informative technology and the highest expected productivity – will be able to attract all the employees, and no other firms will be able to operate. This is summarized in the following:

Proposition 1 *If the labor market is noncompetitive at $t = 2$, in equilibrium efficiency in production and risk sharing is attained, as the most talent-sensitive firms employ the entire workforce and fully insure their employees.*

As we shall see in Section 5.2, if the labor market is competitive at $t = 2$, this result does not hold.[5]

5.2 Competitive Labor Market

If the labor market is competitive both at $t = 0$ and at $t = 2$, the workers whose projects are profitable at $t = 1$ can be poached at $t = 2$ by other firms: since they condition on good first-period performance by the worker, competing firms can offer her a wage exceeding the unconditional expectation of her output. Hence, if a firm were to pay its employees their unconditional expected output in each period (hence making zero expected profits), so as to provide them with full insurance, in the second period it would lose all of its best workers to its competitors, and would be left only with overpaid low-quality workers, as in Acharya, Pagano and Volpin (2016).

Hence, competing firms bid the wage *in each period* up to the expected revenue generated by the worker:[6]

$$w_t = \begin{cases} \mathbb{E}_{t-1}(y_t) & \text{if retained,} \\ 0 & \text{if dismissed.} \end{cases} \tag{13}$$

[5]It is worth noticing that for this outcome to obtain in equilibrium, it is necessary not only that workers commit not to resign from their job, but also that firms commit to the payments envisaged in their contracts, conditional on workers' performance. Thus, commitment is required on both sides: otherwise, firms could hold up their employees and earn higher profits by paying less than the agreed wages. Clearly, this would prevent efficient risk-sharing.

[6]Note that, in this labor market regime, the revenue generated by an employee cannot be reallocated across periods via labor contracts. On the one hand, the firm cannot set $w_1 > \mathbb{E}_0(y_1)$ and later recover this implicit loan via a lower wage w_2, because workers may resign after $t = 1$, thus defaulting on the implicit loan. On the other hand, workers will not be willing to accept $w_1 < \mathbb{E}_0(y_1)$ in exchange for a higher w_2, owing to their impatience coupled with their inability to borrow at $t = 1$.

Hence, the expected wage of an employee in a firm with $\lambda < \widehat{\lambda}$ is $\mathbb{E}_{t-1}(y_t) > w_0$ for both periods $t = 1$ and $t = 2$ (as shown by Lemma 1). Recalling equations (8) and (9) for expected productivity, the workers' expected utility is

$$\mathbb{E}_0(U) = u\left(\bar{y} - (1-p)c\right) + \beta\left[pu(y_{2H}) + (1-p)u(y_{2L})\right]. \tag{14}$$

Instead, employees in a firm with $\lambda \geq \widehat{\lambda}$ have unconditional expected utility

$$\mathbb{E}_0(U) = u\left(\bar{y} - (1-p)c\right) + \beta\left[pu(y_{2H}) + (1-p)u(w_0)\right] \tag{15}$$

since in these firms a worker producing $y_1 = \bar{y} - c$ yields a conditional expected revenue $y_{2L} < w_0$ and therefore is dismissed at $t = 2$.

The next question is how workers choose among employment opportunities. The most interesting case is that in which they can choose between "safe" jobs (offered by firms with talent intensity $\lambda_S < \widehat{\lambda}$) and "risky" jobs (in firms with talent intensity $\lambda_R \geq \widehat{\lambda}$). In this case, workers self-select into firms according to their degree of risk aversion ρ, the more risk-averse opting for safe jobs, the less risk-averse for risky ones:

Proposition 2 *Workers prefer offers from firms with $\lambda_S < \widehat{\lambda}$ to those from firms with $\lambda_R \geq \widehat{\lambda}$ if and only if their risk aversion ρ exceeds $\widehat{\rho} \equiv \frac{[1-(1-\lambda_R)p]c-\bar{y}+w_0}{y_{2L}^S-w_0} \geq 0$, which is increasing in λ_R.*

The proof of this proposition relies on the fact that the expected benefit of a safe compared to a risky job increases with degree of risk aversion. Hence, workers with risk aversion below the threshold $\widehat{\rho}$ are willing to forgo job security for the sake of higher expected wages; the opposite applies to more prudent workers. The threshold risk aversion $\widehat{\rho}$ is monotonically increasing from 0 to a peak as the talent-sensitivity λ_R of the risky industry rises from $\widehat{\lambda}$ to 1: intuitively, as the informativeness of technology increases, jobs become more productive and pay higher wages, inducing even more risk-averse workers to accept the implied greater risk of dismissal. This prediction is far from self-evident, because a more informative technology increases both risk and expected return to human capital; however, the implied increase in expected return dominates that in risk, attracting more workers to the talent-sensitive industry.

If instead all the available jobs are either safe or risky, workers' choices polarize:

Proposition 3 *(i) If all firms have $\lambda < \widehat{\lambda}$, risk-averse workers choose to work for those with the lowest λ.*

(ii) If all firms have $\lambda \geq \widehat{\lambda}$, all workers choose to work for those with the highest λ, irrespective of their risk attitudes.

The intuition for part (i) is that firms with talent-intensity below $\widehat{\lambda}$ effectively offer wage lotteries that are mean-preserving spreads of those offered by firms with $\lambda = 0$, whose technology is totally insensitive to talent. Since all the wage lotteries at $t = 2$ have the same unconditional expected payoff but a variance that increases in λ, at $t = 0$ risk-averse workers prefer the least informative firm (i.e. choose the lowest-risk lottery as per Rothschild and Stiglitz, 1970). If instead only firms with high talent-sensitivity are present, workers cannot insure themselves against dismissal by picking a safer but less lucrative job. Absent the possibility of limiting downside risk, workers will want to maximize upside opportunity, and thus to work for the most informative firm on the market, recalling that the expected wage is linearly increasing in λ.

Taken together, the last two propositions enable us to address the more general case in which the talent-sensitivity λ of the firms potentially active is distributed over a continuum that includes $\widehat{\lambda}$. In this more general case, the model predicts that relatively risk-averse employees (those with $\rho \geq \widehat{\rho}$) will only accept offers from firms featuring the lowest level of talent-sensitivity; conversely, employees with risk-aversion $\rho < \widehat{\rho}$ will work only for the most talent-sensitive firms.

5.3 Inefficiency of Labor Market Competition

Section 5.2 shows that labor market competition at $t = 2$ prevents firms from insuring their employees against layoff risk and so induces risk-averse workers to choose less talent-sensitive jobs. By contrast, in the non-competitive labor market posited in Section 5.1, where workers cannot resign $t = 2$, firms offer severance payments that implement efficient risk-sharing, so that all workers are willing to be employed in the most talent-sensitive firms.

This means that labor market competition destroys opportunities for risk-sharing and produces a less efficient allocation of the workforce. The model predicts that when workers are sufficiently risk-averse (that is, at least some are characterized by

risk aversion larger than $\widehat{\rho}$), labor market competition results in fewer workers choosing talent-sensitive firms. At the limit, no such firm will be viable. Thus, the economy will feature less talent discovery, less layoff risk (hence, a lower unemployment rate), and lower productivity (and consequently, lower wages) than if firms were able to offer severance pay.

If instead all workers have low risk aversion ($\rho < \widehat{\rho}$), they will choose jobs in highly talent-sensitive firms (those with $\lambda > \widehat{\lambda}$) even in a competitive labor market, but this production efficiency comes at the cost of less efficient risk-sharing. In principle, in this kind of economy layoff risk is insurable, as it is idiosyncratic; yet firms cannot insure it, since they cannot cross-subsidize dismissed workers via severance payments financed by lower wage payments to retained, high-quality workers.

This suggests that, in a competitive labor market, public intervention can improve efficiency by offering the risk-sharing that firms cannot. The next two sections consider two alternative government interventions in this economy and explore the extent to which they can increase efficiency.

6 Public Unemployment Insurance

The government can intervene by introducing a public UI scheme to protect dismissed employees of talent-intensive industries. We assume the scheme is run on a balanced budget: the unemployment benefits b paid to dismissed workers are funded by taxing the income of employees of the same firms at rate $\tau \in [0\,,\,1]$. We further assume no deadweight costs: the taxes levied require no collection costs and impose no distortion of labor supply decisions.[7] We discuss the implications of relaxing the latter assumption below.

The introduction of UI affects optimal strategies of both the firms and workers:

Lemma 2 *With a public UI system, the employees of firms with* $\lambda_R \geq \lambda^* = \frac{\bar{y}-(1-p)c-(w_0+b^*)}{pc} < \widehat{\lambda}$ *pay payroll taxes at the rate* $\tau^* = (1-p)(1-w_0/y_{2H}^R)$ *and receive unemployment benefits* $b^* = p(y_{2H}^R - w_0)$*: they are fully insured against layoff risk.*

[7] Thus, it is irrelevant whether the taxes that fund the system are lump-sum or payroll-based.

Intuitively, the UI system has two effects. First, the availability of the unemployment benefit increases workers' outside option: when bargaining with firms, their outside option is now $w_0 + b$, not just the reservation wage w_0. As this increases retention costs, firms become more demanding in their dismissal policy than in the absence of UI: not only firms with talent sensitivity $\lambda \geq \widehat{\lambda}$, but also those with $\lambda \in [\lambda^*, \widehat{\lambda})$ will dismiss workers upon bad performance at $t = 1$. Second, UI eliminates layoff risk by insuring workers against it.

Hence, UI implies that workers in risky firms have the same income whether employed or not. This affects the choice between risky and safe jobs:

Proposition 4 *If offered contracts by firms with different talent sensitivity such that $\lambda_S < \widehat{\lambda} < \lambda_R$, given public UI workers will accept the offer from the most talent-sensitive firm, regardless of their risk aversion.*

A key difference between firms' provision of severance pay and public UI is that the latter is universal in coverage. As was seen in Section 5.1, if a firm pledges severance pay in a competitive labor market regime, it will lose its best workers to competitors and be left with a pool of overpaid employees. Hence no firm can commit to insure dismissed workers via severance pay. By contrast, public UI effectively forces all firms to fund unemployment benefits via the payroll tax. Hence, when the government provides workers with insurance against layoff risk, labor market competition is no longer an issue.

As already mentioned, public UI raises workers' outside option and thus makes hiring more expensive. As a consequence, firms' optimal dismissal policies will become stricter than in the absence of UI: layoff risk will exist also in firms with talent-sensitivity $\lambda \in [\lambda^*, \widehat{\lambda})$, not just in those with $\lambda \geq \widehat{\lambda}$. This will make these firms unattractive to workers: in the presence of UI, their wage offers become dominated by those of other firms. This is because firms with $\lambda \in [\lambda^*, \widehat{\lambda})$ would be more productive on average if they did not dismiss low-performing workers: this is not the optimal technological choice for them, and they adopt it only because of UI. As a result, the wages that they can offer are not competitive with those of firms whose talent-sensitivity is outside the interval $[\lambda^*, \widehat{\lambda})$. However, this does not contradict the statement that UI enhances talent discovery: faced with the choice between a firm with $\lambda \in [\lambda^*, \widehat{\lambda})$ and one with $\lambda \geq \widehat{\lambda}$, risk-averse workers who would choose the less talent-sensitive job without UI, will take the more talent-revealing job in the pres-

ence of UI. And for workers choosing between a firm with $\lambda \in [\lambda^*, \widehat{\lambda})$ and one with $\lambda < \lambda^*$, the introduction of UI will not make a difference: as just argued, the latter outcompete the former in the presence of UI, but would do so even in the presence of UI, as for $\lambda < \widehat{\lambda}$ workers always opt for the firm with the least talent-sensitive technology (by Proposition 3).

To sum up, public UI will induce all workers – irrespective of risk aversion – to accept jobs from the most talent-sensitive firms at $t = 0$, since these can offer the highest possible salaries. This implies that the economy achieves efficient production, in addition to efficient risk sharing. This is clearly an extreme prediction, following from the assumption that the government designs UI to provide complete coverage against layoff risk: it is straightforward to show that if coverage is less than complete, the most risk-averse workers may still prefer a talent-insensitive firm. In fact, incomplete coverage of layoff risk may be an optimal feature of UI if there are deadweight costs in the redistribution from the employed to the unemployed, in the form either of costly tax enforcement or of labor supply distortions. Cross-country differences in such costs may indeed explain why in practice public UI systems feature different income replacement rates.

Hence, the empirical prediction is that the fraction of employees working in talent-sensitive firms is positively correlated with the coverage of layoff risk offered by unemployment benefits. Figure 4 presents some stylized facts regarding this prediction, by plotting sectoral employment shares against a measure of the generosity of UI, using yearly data for 17 OECD countries in 1995-2013. Employment shares are the ratios of employees in three different sectors to total employment (excluding self-employed workers): (i) information and communication in the top panel; (ii) professional, scientific and technological services in the middle panel; (iii) manufacturing in the bottom one. We take the first two sectors to be more talent-sensitive than the third, being more knowledge-intensive technologies, and accordingly we expect them to employ a higher fraction of workers in jurisdictions and periods where UI is more generous. The measure of UI generosity is the income replacement rate, i.e. the ratio of unemployment benefits a worker receives in the first two years of unemployment to the worker's last gross wage. This variable captures both the level and the duration of unemployment benefits, and varies both across countries and over time.[8]

[8]The data are based on Aleksynska and Schindler (2011), as extended by Ellul, Pagano and Schivardi (2018) from 2005 to 2013. The replacement rate averages 0.35 for the whole sample, but

All three panels plot the residuals of employment share regressions that include country fixed effects (to partial out unobserved heterogeneity due to time-invariant differences in countries' industrial specialization) and year effects (to absorb common trends that may arise from global changes in technology or product variety). The regression lines and their confidence intervals show that the fraction of employees is positively and significantly correlated with the income replacement rate in the two top panels, while it is negatively and significantly correlated with it in the bottom panel, that refers to manufacturing. To get an idea of the economic significance of the estimates, consider that increasing the replacement rate from its average in the Czech Republic (0.06, the lowest in the sample) to that of Portugal (0.65, the highest) is associated with an increase of 0.8 percentage points in the fraction of employees in professional, scientific and technological services and a decrease of 2.6 percentage points in the fraction in manufacturing, compared with overall sample means of 12 and 18 percent, respectively for the two sectors.

These stylized facts appear to be consistent with the model's prediction. Note that we do not seek to determine the direction of causality between UI generosity – the amount and duration of benefits – and industrial structure. In principle, causality might run in either direction. In one sense, more generous UI should make employees more inclined to work in talent-sensitive industries and so enable them to attract a larger fraction of the workforce. In the other, if most employees work in talent-sensitive industries – because they have low risk aversion, say, or are highly educated – there will be a strong constituency for generous UI system; and the opposite will hold if most people work in industries with low talent-sensitivity. Both lines of argument are consistent with our model.

Notice that in the model as laid out so far, workers are the only agents who respond to the introduction of public UI and can generate a reallocation of employment by accepting job offers from riskier firms. However, one might also envisage a variant of the model in which firms themselves may, at a cost, increase the talent-sensitivity of their production technology, by investing in R&D. In this case, the introduction of UI may prompt an increase in such investment. To see this, consider an economy where initially all firms have talent-sensitivity $\lambda_S < \widehat{\lambda}$ and all workers risk-aversion

with significant international differences. In France, the Netherlands, Norway, Portugal and Spain, it averages over 0.40; in the Czech Republic, Greece, Israel and the U.K., it is under 0.20. In some countries replacement rates vary significantly over time: this is the case of Denmark, Italy, Norway and Portugal.

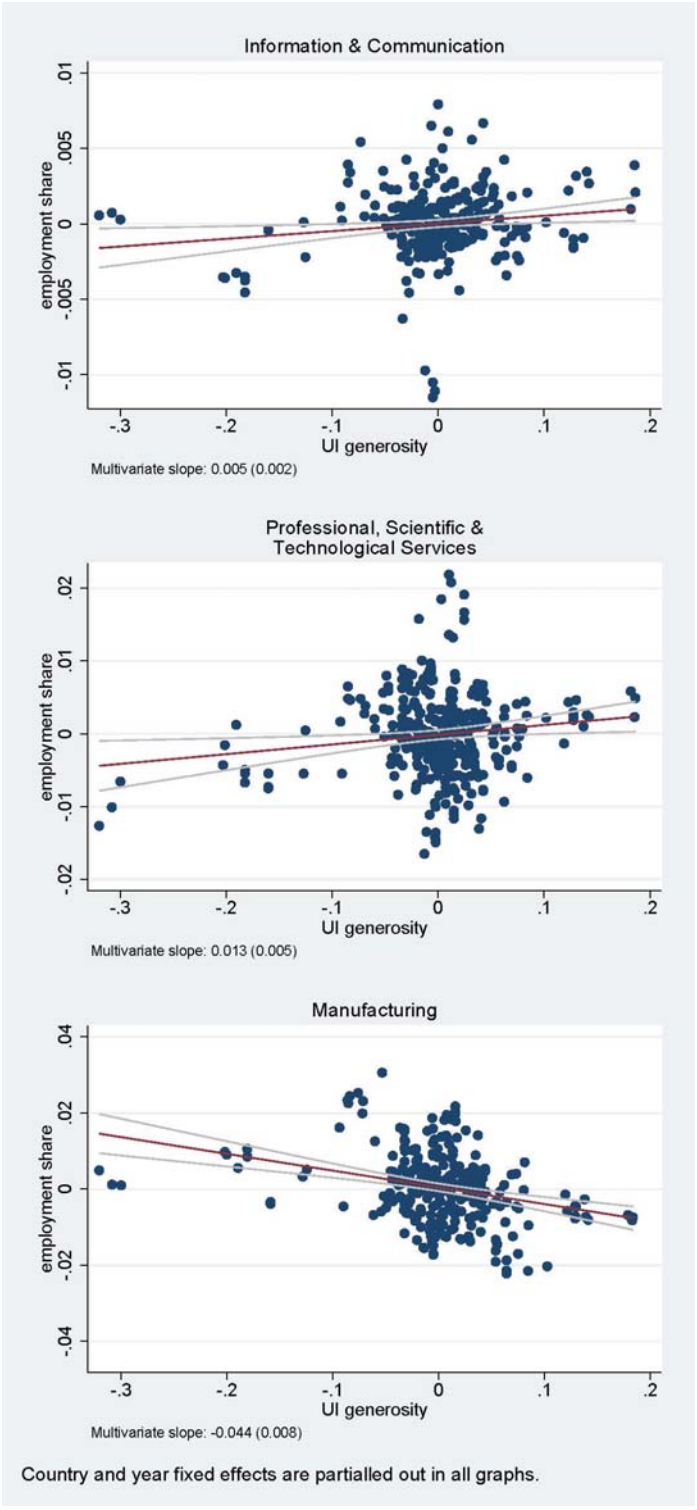

Figure 4: Sectoral employment share and unemployment insurance, OECD countries

$\rho \geq \widehat{\rho}$. In this case, even if firms could increase their talent-sensitivity to $\lambda_R \geq \widehat{\lambda}$ by investing in R&D, none would have an incentive to do so, because it would no longer be able to hire workers. However, if a UI system offering perfect insurance is instituted in this economy, firms get an incentive to invest in R&D and convert to a talent-sensitive technology, provided the cost of R&D is not prohibitively high: in fact, firms electing not to invest in R&D could no longer attract workers and thus would shut down.

Evidence on this point is provided by Ellul, Wang and Zhang (2016), who find that firms in states with more generous UI tend to feature greater risk-taking behavior along various dimensions, including R&D investment. They regress the ratio of R&D investment to total assets on the replacement rate in the state where the company is headquartered, and on lagged company level controls (total assets, leverage, ROA, market-to-book ratio, asset tangibility and sales growth), and find that the coefficient of the replacement rate is positive and significant. While their R&D evidence comes from a subsample of firms where they observed data on managerial compensation, a comprehensive sample of 139,210 firm-year observations between 1992 and 2013, drawn from Compustat yields the same result.[9]

7 Employment Protection Laws

An alternative public insurance that is often thought to reduce employment risk is to restrict the freedom to dismiss, via "employment protection legislation" (EPL). Such restriction can take various forms: (i) prohibition of dismissals, (ii) requirement of "just cause" for dismissals, or (iii) requirement of a pre-set payment to dismissed workers. The last of these effectively amounts to universal mandatory severance pay, and as such functions similarly to public UI. We therefore focus on EPL that restricts dismissals – indeed, for clarity, we take the case of an outright ban on dismissals.

Our main result is that, in a competitive labor market, dismissal restrictions have radically different effects from UI:

Lemma 3 *If EPL forbids layoffs, firms with* $\lambda_R \geq \widehat{\lambda}$ *are not viable.*

[9] We are most grateful to Kuo Zhang for kindly re-estimating the R&D regressions on this larger sample.

If firms are forced to keep workers on despite bad performance at $t = 1$, the more talent-sensitive will refrain from hiring them at $t = 0$, expecting not to break even otherwise. This result hinges on two key assumptions of the model: labor market competition and workers' limited liability. Competition implies that workers appropriate all the surplus that they generate, when this is positive, while limited liability shields them from the losses that they generate at $t = 2$, as the firm is forced to retain them regardless of performance at $t = 1$. As a result, talent-sensitive firms will not break even in expectation: only firms with $\lambda_S < \widehat{\lambda}$ will be active in the market.

This result plays an important role in the effects of EPL, by comparison both with no government intervention and with public UI:

Proposition 5 *(i) When labor markets are competitive and EPL forbids dismissals, production is (weakly) less efficient than with no government intervention.*

(ii) Compared with public UI, EPL implies less efficient production, and (weakly) less insurance against layoff risk.

This proposition points out that EPL weakly decreases welfare by eliminating the more talent-sensitive firms, whose jobs may appeal to the less risk-averse workers. Hence, EPL drives expected revenue and wages below the no-intervention level: the elimination of layoff risk is achieved at the cost of lower production efficiency. This is consistent with the finding of Bartelsman et al. (2016) that, in countries with restrictive EPL, risky industries contributing to aggregate productivity growth are smaller relatively less productive.

The comparison with public UI drawn in the second statement of the proposition is even starker, because with UI all workers prefer jobs in firms with high talent sensitivity and productivity, while with EPL all must take jobs in firms with low talent sensitivity and productivity. Nor does this efficiency loss imply better insurance of workers, as UI eliminates all layoff risk while with EPL workers remain exposed to wage risk in firms with low talent sensitivity.

8 Education

So far we have had workers choose only which job to accept. Actually, however, career choices are preceded by educational ones. Insofar as education affects job performance, it is a factor in both expected wages and layoff risk. In this section we show that UI encourages workers' investment in education by lowering human capital risk, and via this channel it further enhances workers' expected productivity (compared to the baseline model of no educational choice).

In this model, it is natural to posit that education reduces noise ("errors") in production and thus heightens the dependence of payoffs on the intrinsic quality of workers – that is, it raises the parameter λ for any given technology of the firm. In other words, the talent-sensitivity parameter is now dictated not only by technology but also by workers' educational level.

To capture this idea with the smallest possible change to our setting, we suppose that the economy consists of identical (safe) firms with $\lambda < \widehat{\lambda}$, and that education allows workers to increase the informativeness of the revenue they generate at $t = 1$ to some $\lambda' > \widehat{\lambda}$. For simplicity, we assume initially that education is costless (later we relax this assumption). Then, by Proposition 3 only workers with sufficiently low risk aversion ($\rho < \widehat{\rho}$) will become educated: the highly risk-averse ($\rho \geq \widehat{\rho}$) would be damaged if they increased the informativeness of the revenue they generate. By getting educated, the workers with low risk aversion increase both the mean and the variance of their compensation, exposing themselves to layoff risk. The others avoid such risk by not getting educated.

Now, assume that UI is introduced in this economy. Based on Proposition 4, being insured against layoff risk, now workers with high risk aversion ($\rho \geq \widehat{\rho}$) too become educated, increasing their expected compensation to the level of the less risk-averse. Hence, the introduction of UI enhances investment in human capital, and via this channel too increases the expected productivity of firms and the expected income of workers, at the same time as it raises the unemployment rate.

In the setting considered here, workers' educational choice is binary; that is, UI increases the number of people who acquire education (the extensive margin) but not the amount of education that they acquire (the intensive margin). A simple way of capturing the effect on the intensive margin too is to consider a variant in which in addition to cost-free basic education, workers can invest more in their human capital

at a cost ψ. This investment increases the informativeness of their performance further, to $\lambda'' > \lambda'$.

As a benchmark, consider the educational choice of risk-neutral workers: they will acquire costly education if and only if the cost ψ does not exceed the threshold value $\overline{\psi} \equiv p(1-p)(\lambda'' - \lambda')c$, a gauge of the implied increase in expected earnings (or the incremental return to education).[10] Risk-averse workers, by contrast, may not wish to invest in costly education even if $\psi \leq \overline{\psi}$, because – unlike risk-neutral workers – they must consider not only the expected net benefit, but also the incremental layoff risk associated with higher education. Since, however, with UI these workers too effectively behave as if they were risk-neutral, its introduction induces all to invest in costly education. More precisely:

Proposition 6 *If $\psi \leq \overline{\psi}$, in the absence of UI workers with risk-aversion $\rho < \widehat{\rho}$ acquire costly education if and only if $\rho \leq \rho_E \equiv \frac{\overline{\psi} - \psi}{(1-p)\psi} > 0$. In the presence of UI, all workers invest in education regardless of their risk aversion.*

Hence, if $\psi \leq \overline{\psi}$, educational choices in the absence of UI differ among three groups of workers, defined by their degree of risk aversion:

- those with $\rho \geq \widehat{\rho}$ acquire no education;
- those with $\rho \in [\rho_E, \widehat{\rho})$ acquire only cost-free education;
- those with $\rho \in [0, \rho_E)$ acquire both cost-free and costly education.

Instead, given UI, all three types of worker acquire both types of education. Hence, UI affects not only the extensive margin, inducing workers with high risk-aversion ($\rho \geq \widehat{\rho}$) to become educated (and indeed to invest even in costly education), but also, the intensive margin, encouraging workers with low risk-aversion ($\rho \in [\rho_E, \widehat{\rho})$) to acquire costly education as well, which they would not have done in the absence of UI.

[10] The value of $\overline{\psi}$ is derived from the incentive constraint for a risk-neutral worker to invest in costly education:

$$p[\overline{y} - (1 - \theta_H(\lambda''))c] - \psi \geq p[\overline{y} - (1 - \theta_H(\lambda'))c]$$

This inequality implies that a risk-neutral worker will invest in further education for any $\psi \leq p(1-p)(\lambda'' - \lambda')c \equiv \overline{\psi}$.

9 Conclusions

In human capital-intensive industries (such as high-tech, professional services and health), talent discovery is crucial. It is essential to efficient matching of workers to tasks, which translates into increased production and higher wages. At the same time, talent discovery entails risks for workers who are uncertain about their own skills, insofar as after some work experience they may prove to be less talented than expected, and thus possibly subject to dismissal.

In a non-competitive labor market, firms can insure their employees against the consequent human capital risk with severance pay. A competitive labor market, however, prevents such insurance, as it can only be provided at the expense of more talented workers: the cross-subsidy to poorly performing employees would induce the more talented to switch to a competitor, leaving their initial employer with only overpaid, untalented employees. Absent insurance, risk-averse workers will select themselves into less talent-sensitive occupations, which discover less precise information about their skills and thus generate less or no layoff risk.

The core implication of our model for policy is that in competitive labor markets, public unemployment insurance (UI) will encourage workers to seek employment in the more talent-sensitive industries, irrespective of their risk aversion, as they prefer to test their skills in jobs that reveal better information about their talent. This allows for more efficient job-talent matches, hence higher average wages and steeper career profiles. The resulting increase in job loss (and consequently in the unemployment rate) does not entail any welfare loss thank to the UI safety net. The heightened layoff risk reflects more frequent firings of workers in case of poor performance: unemployment benefits increase workers' reservation wage, so that firms are less likely to break even and will be more demanding in their staff retention standards.

We also show that UI dominates another possible policy intervention, namely employment protection legislation (EPL) restricting firms' power of dismissal. In fact, if the labor market is competitive and workers are protected by limited liability, EPL will prevent highly talent-sensitive firms from breaking even, and so will distort employment toward firms with less talent-sensitive technologies and therefore lower expected productivity. Hence, in order to foster the discovery and efficient allocation of talent, public policy should prefer insurance of employees against unemployment to norms that impede dismissals. Other interesting policy implications are that UI may

encourage firms to enhance the talent sensitivity of their technologies, for instance by investing in R&D, and workers to acquire education, regardless of their degree of risk-aversion. Hence, simple though it is, our model nevertheless generates a substantial set of empirical predictions, most of which have yet to be tested empirically.

Admittedly, these strong results would be attenuated or modified in a richer model that allowed for the possible efficiency costs of UI. For instance, if labor supply decisions were modelled as resulting from a trade-off between leisure and consumption, the payroll taxes required to fund unemployment benefits would distort labor supply.

Moreover, our model rules out the workers' self-insurance via financial markets, as by borrowing when dismissed, in order to focus on firms and on the social security system as the sole sources of insurance against human capital risk. This assumption is not unrealistic, as workers are often credit-constrained (Jacobson, LaLonde and Sullivan, 1993). Clearly, self-insurance via precautionary saving would reduce the social welfare gain produced by an UI system.

Finally, our analysis abstracts from the general equilibrium effects of the allocation of workers among industries, such as the effect on the relative prices of goods produced by industries of differing talent sensitivity; this approach is appropriate to a small open economy where the relative prices of tradeables are dictated by the international market. For instance, the model predicts that on the introduction of UI all workers will switch to the most talent-sensitive industries. If, instead, the relative price of these industries' output were determined endogenously, in the domestic economy, it would decline as their output increased, limiting the extent of labor reallocation. Nevertheless, the result that more labor would be employed in the talent-sensitive industries would still hold qualitatively.

Appendix: Proofs

Proof of Lemma 1

Proof. Since $\theta_H \geq p$, by condition (2) we have $1 - \theta_H < \frac{\bar{y}-w_0}{c}$. Therefore, if at $t = 1$ the project yields a positive surplus, the employee is retained and the project continued. If instead the project delivers a loss at $t = 1$, the belief that the worker is good is updated to $\theta_L \leq p$. We need to distinguish two possible cases for the conditional expected revenue:

1) $1 - \theta_L < \frac{\bar{y}-w_0}{c}$: the worker is retained for any realization of y_1, being expected to produce a positive surplus;

2) $1 - \theta_L \geq \frac{\bar{y}-w_0}{c}$: the worker is dismissed, being expected to generate a loss for any wage of w_0 or greater.

Whether a firm conforms to case 1 or case 2 depends on the talent-sensitivity of its production technology λ. By continuity of θ_L, $\exists\ \widehat{\lambda}\ :\ \bar{y} - (1 - \theta_L)c = w_0$ given by

$$\widehat{\lambda} \equiv \frac{\bar{y} - (1-p)c - w_0}{pc}. \tag{16}$$

If the project's informativeness is $\widehat{\lambda}$, the firm is indifferent between dismissing and retaining a worker who failed in the previous period, as in expectation it will always break even . If $\lambda < \widehat{\lambda}$, the firm optimally keeps all its employees (case 1). If $\lambda \geq \widehat{\lambda}$, instead, the firm dismisses workers who generate a loss at $t = 1$ and retains those who generate a positive surplus (case 2), as the former would not enable it to break even. ■

Proof of Proposition 1

Proof. We prove this proposition in two steps:

1) if all firms offer contracts with severance pay, workers choose to work for firms with $\lambda \geq \widehat{\lambda}$.

2) given 1), workers choose to work for the most talent-sensitive firm in the market.

1) Any firm with $\lambda < \widehat{\lambda}$ pays all workers a lifetime wage that does not depend on their performance, so that their expected utility is:

$$w_1 + w_2 = 2[\bar{y} - (1-p)c]. \tag{17}$$

Instead, firms with $\lambda \geqslant \widehat{\lambda}$ offer a lifetime wage:

$$w_1 + w_2 = [\bar{y} - (1-p)c] + [p(\bar{y} - (1-\theta_H)c) + (1-p)w_0]\,. \tag{18}$$

Since lifetime utility is increasing in the lifetime wage $w_1 + w_2$, and $\bar{y} - (1-p)c < p[\bar{y} - (1-\theta_H)c] + (1-p)w_0$ for any $\lambda \geq \widehat{\lambda}$, it follows that (18) exceeds (17), so that any worker prefers to work for firms with $\lambda \geqslant \widehat{\lambda}$.

2) To see that workers prefer the firm with the highest λ among those with $\lambda \geqslant \widehat{\lambda}$, note that (18) is increasing in λ, since:

$$\frac{\partial(w_1 + w_2)}{\partial \lambda} = pc \cdot \frac{\partial \theta_H}{\partial \lambda} = p(1-p)c > 0.$$

Hence, they will pick the most talent-sensitive firm in the market. ■

Proof of Proposition 2

Proof. Let ΔU_S denote the expected benefit from choosing the safe rather than the risky job, so that

$$\Delta U_S = \beta \left\{ pu[\bar{y} - (1-\theta_H^S)c] + (1-p)u[\bar{y} - (1-\theta_L^S)c] - \left\{ pu[\bar{y} - (1-\theta_H^R)c] + (1-p)u(w_0) \right\} \right\}. \tag{19}$$

To simplify notation, let us define:

$$y_{2H}^S \equiv \bar{y} - (1-\theta_H^S)c, \qquad y_{2L}^S \equiv \bar{y} - (1-\theta_L^S)c, \qquad y_{2H}^R \equiv \bar{y} - (1-\theta_H^R)c, \tag{20}$$

which allows us to rewrite (19) as follows:

$$\Delta U_S = \beta \left\{ (1-p) \left[u(y_{2L}^S) - u(w_0) \right] - p[u(y_{2H}^R) - u(y_{2H}^S)] \right\}. \tag{21}$$

Consider any two expected revenues x_1 and x_2 such that $x_1 \in (w_0,\, y_{2H}^S)$ and $x_2 \in (y_{2H}^S\,,\, y_{2H}^R)$. By the mean value theorem, we can write (21) as

$$\Delta U_S = \beta \left[(1-p)u'(x_1)(y_{2L}^S - w_0) - pu'(x_2)(y_{2H}^R - y_{2H}^S)\right], \tag{22}$$

where by the concavity of the utility function $u'(x_1) > u'(x_2)$ since $y_{2L}^S < y_{2H}^S < y_{2H}^R$. Substituting (20) into equation (22) yields

$$\Delta U_S = \beta \left\{(1-p)[u'(x_1)y_{2L}^S - u'(x_2)(\lambda_R - \lambda_S)pc]\right\}. \tag{23}$$

By adding and subtracting $(1-p)u'(x_2)(y_{2L}^S - w_0)$ on the right-hand side of (23), dividing and multiplying it by $u'(x_2)$ and simplifying, we obtain:

$$\Delta U_S = \beta \left\{(1-p)u'(x_2)\left[\rho(y_{2L}^S - w_0) + \bar{y} - c + (1-\lambda_R)pc - w_0\right]\right\}, \tag{24}$$

where $\rho \equiv \frac{u'(x_1)-u'(x_2)}{u'(x_2)}$ is a measure of the worker's risk aversion: for fixed values of x_1 and x_2, the greater the curvature of the utility function, the larger the numerator and the smaller the denominator. By the continuity of ΔU_S in ρ, there exists a critical risk aversion level:

$$\widehat{\rho} \equiv \frac{[1-(1-\lambda_R)p]\,c - \bar{y} + w_0}{y_{2L}^S - w_0} \geq 0 \tag{25}$$

such that for any $\rho \geq \widehat{\rho}$, workers will prefer the safe job, and for any $\rho < \widehat{\rho}$ they will prefer the risky one. Clearly, the threshold risk aversion $\widehat{\rho}$ is increasing in λ_R: indeed, it equals 0 for $\lambda_R = \widehat{\lambda}$ and $(c-\bar{y})/y_{2L}^S > 0$ for $\lambda_R = 1$. ■

Proof of Proposition 3

Proof. (i) In firms with $\lambda < \widehat{\lambda}$, the unconditional expected wage at $t=2$ equals the worker's expected productivity:

$$\mathbb{E}_0(y_2) = p\left[\bar{y} - (1-\theta_H)c\right] + (1-p)\left[\bar{y} - (1-\theta_L)c\right]. \tag{26}$$

Upon substituting for θ_H and θ_L, this expression becomes

$$\begin{aligned}\mathbb{E}_0(y_2) &= p\left[\bar{y} - (1-p)(1-\lambda)c\right] + (1-p)\left\{\bar{y} - [1-(1-\lambda)p]\,c\right\} \\ &= \bar{y} - (1-p)c = \mathbb{E}_0(y_1)\ \forall \lambda < \widehat{\lambda},\end{aligned}$$

which is independent of λ. However, the unconditional variance of the wage is increasing in λ:

$$\sigma^2 = p\left\{y_{2H} - [\bar{y} - (1-p)c]\right\}^2 + (1-p)\left\{y_{2L} - [\bar{y} - (1-p)c]\right\}^2 = p(1-p)\lambda^2 c^2.$$

hence, the wage paid by firms with informativeness $\lambda < \widehat{\lambda}$ is a mean-preserving spread of the distribution of the wage that would be paid by a firm with $\lambda = 0$, which does not update its beliefs. Thus, a risk-averse worker will always choose the least informative project available.

(ii) In firms with $\lambda \geq \widehat{\lambda}$, a worker who produces $y_1 = \bar{y} - c$ at $t = 2$ is dismissed and gets zero utility. If instead $y_1 = \bar{y}$ at $t = 2$, the worker's wage is increasing in λ (as is shown in the proof of Proposition 1). Thus, all workers prefer to work for the firm featuring the highest λ. ■

Proof of Lemma 2

Proof. First, we derive the new condition that defines the firms that lay off underperforming workers at $t = 1$ under UI. As in the proof of Lemma 1, we distinguish two possible cases for the conditional expected revenue:

1) $1-\theta_L < \frac{\bar{y}-w_0-b}{c}$: the worker is retained for any realization of y_1, being expected to produce a positive surplus;

2) $1-\theta_L \geq \frac{\bar{y}-w_0-b}{c}$: the worker is dismissed, being expected to generate a loss for any wage of $w_0 + b$ or greater.

Whether a firm conforms to case 1 or case 2 depends on the talent-sensitivity of its production technology λ. By continuity of θ_L, $\exists\ \lambda^* \ :\ \bar{y} - (1-\theta_L)c = w_0 + b$ given by

$$\lambda^* = \frac{\bar{y} - (1-p)c - (w_0 + b)}{pc}. \tag{27}$$

The government chooses the optimal tax rate τ and transfer to unemployed workers b in order to maximize the social welfare function subject to the binding budget constraint and the non-negativity constraint for the tax rate τ.:

$$\underset{\{\tau\,,b\}}{max}\beta\left\{pu[y_{2H}^R(1-\tau)] + (1-p)u(w_0+b)\right\},$$

subject to

$$py_{2H}^{R}\tau = (1-p)b, \quad \text{for } \tau \in [0\,,\,1],$$

which is equivalent to:

$$\max_{\tau} \; \beta \left\{ pu[y_{2H}^{R}(1-\tau)] + (1-p)u\left(w_0 + \frac{py_{2H}^{R}\tau}{1-p}\right)\right\}.$$

Working out the first-order condition for an interior solution to this problem gives the optimal level of τ:

$$\tau^{*} = (1-p)\left(1 - \frac{w_0}{y_{2H}^{R}}\right). \tag{28}$$

Substituting τ^{*} into the budget constraint yields the optimal UI benefit:

$$b^{*} = p(y_{2H}^{R} - w_0), \tag{29}$$

so that employees in firms with $\lambda_R \geq \lambda^{*}$ obtain full insurance. Replacing the unemployment benefit b with its optimal value b^{*} in (29) yields the value of λ^{*}. Since $b^{*} > 0$, it is immediate that $\lambda^{*} < \widehat{\lambda}$. ■

Proof of Proposition 4

Proof. Given public UI, workers employed by firms featuring $\lambda_R \geq \widehat{\lambda}$ have a riskless income, so that their utility is:

$$u\left(\bar{y} - (1-p)c\right) + \beta u(py_{2H}^{R} + (1-p)w_0), \tag{30}$$

whereas a worker employed by a firm featuring $\lambda_S \in [0\,,\widehat{\lambda})$ has unconditional expected utility

$$u\left(\bar{y} - (1-p)c\right) + \beta\left[pu(y_{2H}^{S}) + (1-p)u(y_{2L}^{S})\right]. \tag{31}$$

For a risk-neutral worker, utility (30) exceeds (31), because $py_{2H}^{R} + (1-p)w_0 > py_{2H}^{S} + (1-p)y_{2L}^{S} = \overline{y} - (1-p)c$. A fortiori, this shall apply to a risk-averse worker, since by Jensen's inequality $pu(y_{2H}^{S}) + (1-p)u(y_{2L}^{S}) < u\left(py_{2H}^{S} + (1-p)y_{2L}^{S}\right) = u\left(\overline{y} - (1-p)c\right)$. This holds for every $\lambda_R \geq \widehat{\lambda} > \lambda_S$. Hence, given public UI, any worker would choose the more talent-sensitive job over the less informative one. ■

Proof of Lemma 3

Proof. If firms cannot fire workers in a competitive labor market, those featuring talent-sensitivity $\lambda < \widehat{\lambda}$ earn zero unconditional expected profit. On the other hand, if workers are not dismissed after a bad outcome at $t = 1$, the unconditional expected profit for a firm with $\lambda \geq \widehat{\lambda}$ is:

$$\mathbb{E}_0(\pi) = (1-p)[\bar{y} - (1-\theta_L^R)c] \leq 0. \tag{32}$$

Note that firms with $\lambda \geq \widehat{\lambda}$ will not want to keep under-performing employees idle, as this would generate an expected loss equal to their reservation wage:

$$\mathbb{E}_0(\pi) = -w_0 < 0. \tag{33}$$

Hence, if highly talent-intensive firms do not fire workers after a bad outcome at $t = 1$, they make losses. Anticipating this at $t = 0$, in an EPL regime such firms have no incentive to hire workers, and will be inactive. This is an equilibrium, since there are no profitable deviations from a situation in which all such firms are inactive: if any one of them were to start production and enter the labor market, the others would have an incentive to poach the employees tested by this firm: any other firm with $\lambda \geq \widehat{\lambda}$ has an incentive to free ride on the others, so that in equilibrium none would be active at $t = 0$. ■

Proof of Proposition 5

Proof. (i) By Proposition 2, in a competitive labor market without government intervention, workers with risk-aversion $\rho < \widehat{\rho}$ choose to work for firms with $\lambda \geq \widehat{\lambda}$. By Lemma 3, when EPL is in place, these jobs are no longer available, so that expected revenue and wages in the economy are lower than in the absence of EPL. If instead all workers have risk-aversion $\rho \geq \widehat{\rho}$, then they will all work for firms with $\lambda < \widehat{\lambda}$ that feature no layoff risk, so that the introduction of EPL is inconsequential.

(ii) By Proposition 4, in a competitive labor market with public UI, all workers choose the most talent-sensitive (highest-λ) job available, which generates the highest feasible production while maintaining efficient risk-sharing. By Lemma 3, when EPL is in place only jobs in firms with $\lambda_S < \widehat{\lambda}$ are available, so that the expected revenue

and wages in the economy are strictly lower than with public UI. Moreover, with EPL all workers will have to take jobs in firms with $\lambda_S < \widehat{\lambda}$, which feature wage risk (unless $\lambda_S = 0$), whereas in the presence of UI they would have chosen jobs in firms with $\lambda_R \geq \widehat{\lambda}$, yet would bear no layoff risk. Hence, EPL also implies less efficient risk sharing than UI. ■

9.1 Proof of Proposition 6

Proof. Let ΔU_E denote the benefit for a risk-averse worker with $\rho < \widehat{\rho}$ from investing in costly education. Let $y_{2H}(\lambda'')$ and $y_{2H}(\lambda')$ denote the expected revenue generated by workers respectively with and without costly education, conditional on observing $y_1 = \overline{y}$. Since $\lambda'' > \lambda'$, $y_{2H}(\lambda'') > y_{2H}(\lambda')$. We assume that $\psi < \overline{\psi}$, so that at least the risk-neutral workers invest in costly education. This condition implies $\psi < y_{2H}(\lambda'') - y_{2H}(\lambda') = (1-p)(\lambda'' - \lambda')c$. The net utility gain from costly education is

$$\begin{aligned}\Delta U_E &= \beta \left[pu\left(y_{2H}(\lambda'') - \psi\right) + (1-p)u(w_0 - \psi) - pu\left(y_{2H}(\lambda')\right) - (1-p)u(w_0)\right]. \\ &= \beta \left\{ p\left[u\left(y_{2H}(\lambda'') - \psi\right) - u\left(y_{2H}(\lambda')\right)\right] - (1-p)[u(w_0) - u(w_0 - \psi)]\right\}. \quad (34)\end{aligned}$$

Consider any two expected revenues x_1 and x_2 such that $x_1 \in (w_0 - \psi, w_0)$ and $x_2 \in (y_{2H}(\lambda'), y_{2H}(\lambda'') - \psi)$. By the mean value theorem, we can write (34) as

$$\Delta U_E = \beta \left\{ p[(1-p)(\lambda'' - \lambda')c - \psi]u'(x_2) - (1-p)u'(x_1)\psi \right\}.$$

where, by the concavity of the utility function, $u'(x_1) > u'(x_2)$ since $w_0 < y_{2H}(\lambda') < y_{2H}(\lambda'') - \psi$. Hence, $\Delta U_E \geq 0$ if and only if

$$(1-p)u'(x_1)\psi \leq u'(x_2)p\left[(1-p)(\lambda'' - \lambda')c - \psi\right]. \quad (35)$$

By adding and subtracting $(1-p)u'(x_2)\psi$ on its left-hand side, (35) can be rewritten as

$$\rho \leq \rho_E \equiv \frac{p(1-p)(\lambda'' - \lambda')c - \psi}{(1-p)\psi} = \frac{\overline{\psi} - \psi}{(1-p)\psi},$$

where $\rho \equiv \frac{u'(x_1) - u'(x_2)}{u'(x_2)}$ is a measure of the worker's risk aversion, as it denotes the slope of marginal utility: workers whose risk aversion is below the threshold ρ_E will invest in costly education, those with risk aversion above ρ_E will not. The threshold risk aversion ρ^E is decreasing in the cost ψ of additional education. It is immediate

that costly education implies a net benefit $\Delta U_E > 0$ in the presence of public UI, since in this case effectively all workers behave as risk-neutral. ■

References

[1] Acemoglu, Daron (1997), "Training and Innovation in an Imperfect Labour Market," *Review of Economic Studies* 64(3), 445-464.

[2] Acemoglu, Daron, and Robert Shimer (1999), "Efficient Unemployment Insurance," *Journal of Political Economy* 107(5), 893-928.

[3] Acemoglu, Daron, and Robert Shimer (2000), "Productivity Gains from Unemployment Insurance," *European Economic Review* 44 (June), 1195-1224.

[4] Acharya, Viral, Marco Pagano, and Paolo Volpin (2016), "Seeking Alpha: Excess Risk-Taking and Competition for Managerial Talent," *Review of Financial Studies* 29(10), 2565-2599.

[5] Agrawal, Ashwini and David Matsa (2013), "Labor Unemployment Risk and Corporate Financing Decisions," *Journal of Financial Economics* 108(2), 449-470

[6] Aleksynska, Mariya, and Martin Schindler (2011), "Labor Market Regulations in Low-, Middle- and High-Income Countries: A New Panel Database," IMF working paper No. 11/154.

[7] Bartelsman, Eric J., Pieter A. Gautier and Joris De Wind (2016), "Employment Protection, Technology Choice and Worker Allocation," *International Economic Review* 57(3), 787-825.

[8] Browning, Martin, and Thomas F. Crossley (2001), "The Life-Cycle Model of Consumption and Saving," *Journal of Economic Perspectives* 15(3), 3-22.

[9] Choi, Sekyu, and Javier Fernández-Blanco (2018), "Worker Turnover and Unemployment Insurance," *International Economic Review*, forthcoming.

[10] Diamond, Peter (1981), "Mobility Costs, Frictional Unemployment, and Efficiency," *Journal of Political Economy* 89(4), 798-812.

[11] Ellul, Andrew, Marco Pagano and Fabiano Schivardi (2018), "Employment and Wage Insurance within Firms: Worldwide Evidence," *Review of Financial Studies* 31(4), 1298-1340.

[12] Ellul, Andrew, Cong Wang, and Kuo Zhang (2016), "Labor Unemployment Risk and CEO Incentive Compensation," CEPR Discussion Paper No. 11634.

[13] Fama, Eugene (1980), "Agency Problems and the Theory of the Firm," *Journal of Political Economy* 88(2), 288-307.

[14] Gruber, Jonathan (1997), "The Consumption Smoothing Benefits of Unemployment Insurance," *American Economic Review* 87(1), 192-205.

[15] Harris, Milton, and Bengt Holmström (1982) "A Theory of Wage Dynamics," *Review of Economic Studies* 49(3), 315-333.

[16] Holmström, Bengt (1999), "Managerial Incentive Problems: a Dynamic Perspective," *Review of Economic Studies* (special issue) 66(1), 169-182.

[17] Hirshleifer, Jack, (1971), "The Private and Social Value of Information and the Reward to Inventive Activity," *American Economic Review* 61(4), 561-574.

[18] Hsu, Joanne, David Matsa, and Brian Meltzer (2018), "Unemployment Insurance as a Housing Market Stabilizer," *American Economic Review* 108(1), 49–81.

[19] Jacobson, Louis S., Robert J. LaLonde and Daniel G. Sullivan (1993), "Earnings Losses of Displaced Workers," *American Economic Review* 83(4), 685-709.

[20] Kaplan, Steven N., and Joshua Rauh (2013) "It's the Market: The Broad Based Rise in the Return to Top Talent," *Journal of Economic Perspectives* 27(3), 35-56.

[21] Katz, Lawrence F., and Bruce D. Meyer (1990), "The Impact of the Potential Duration of Unemployment Benefits on the Duration of Unemployment," *Journal of Public Economics* 41, 45-72.

[22] Low, Hamish, Costas Meghir and Luigi Pistaferri (2010), "Wage Risk and Employment Risk over the Life Cycle," *American Economic Review* 100(4), 1432-67.

[23] Marimon, Ramon, and Fabrizio Zilibotti (1999), "Unemployment vs. Mismatch of Talent: Reconsidering Unemployment Benefits," *Economic Journal* 109, 266-291.

[24] Meyer, Bruce D. (1990), "Unemployment Insurance and Unemployment Spells," *Econometrica* 58(4), 757-782.

[25] Moffitt, Robert, and Walter Nicholson (1982), "The Effect of Unemployment Insurance on Unemployment: The Case of Federal Supplemental Benefits," *Review of Economics and Statistics* 64(1), 1-11.

[26] Nekoei, Arash, and Andrea Weber (2017), "Does Extending Unemployment Benefits Improve Job Quality?," *American Economic Review* 107(2), 527-61.

[27] Rothschild, Michael and Joseph Stiglitz (1970), "Increasing risk: I. A definition," *Journal of Economic Theory* 2(3), 225-243.

[28] Terviö, Marko (2009), "Superstars and Mediocrities: Market Failure in the Discovery of Talent," *Review of Economic Studies* 76(2), 829-850.

CENTER FOR FINANCIAL STUDIES

CFS Working Paper Series

Recent Issues

All CFS Working Papers are available at *www.ifk-cfs.de*.

No.	Authors	Title
602	Andrew Ellul, Marco Pagano, and Annalisa Scognamiglio	*Career Risk and Market Discipline in Asset Management*
601	Klaus Adam, Michael Woodford,	*Leaning Against Housing Prices As Robustly Optimal Monetary Policy*
600	Klaus Adam, Dmitry Matveev, Stefan Nagel	*Do Survey Expectations of Stock Returns Reect Risk-Adjustments?*
599	Aleksandar Andonov, Roman Kräussl, and Joshua Rauh	*The Subsidy to Infrastructure as an Asset Class*
598	Roman Kräussl, Zsofia Kräussl, Joshua Pollet, and Kalle Rinne	*The Performance of Marketplace Lenders: Evidence from Lending Club Payment Data*
597	Roman Kräussl, Joshua Pollet, and Denitsa Stefanova	*Signaling or Marketing? The Role of Discount Control Mechanisms in Closed-End Funds*
596	Luiz Félix, Roman Kräussl, and Philip Stork	*Predictable Biases in Macroeconomic Forecasts and Their Impact Across Asset Classes*
595	Renée Adams, Roman Kräussl, Marco Navone, and Patrick Verwijmeren	*Is gender in the eye of the beholder? Identifying cultural attitudes with art auction prices*
594	Amy Whitaker and Roman Kräussl	*Blockchain, Fractional Ownership, and the Future of Creative Work*
593	Petrus Ferreira, Roman Kräussl, Wayne R. Landsman, Maria Nykyforovych, and Peter Pope	*Reliability and Relevance of Fair Values: Private Equity Investments and Investee Fundamentals*