Job Search Costs and Incentives*

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Abstract

The costs of searching for a job vacancy are typically associated with friction that deters or delays employment of potentially productive individuals. We demonstrate that in a labor market with moral hazard where effort is non-contractible, job search costs play a positive role, whose effect may outweigh the negative implications. As workers are provided incentives to exert effort by the threat of losing their job and having to search for a new vacancy, a reduction in job search costs leads to fewer employees willing to exert effort. The overall lower productivity will make more individuals and firms opting to stay out of the labor market, resulting in lower employment and decreased welfare. Eventually, a reduction of jobs search costs below a certain level results in collapse of the labor market.

Keywords: job search, moral hazard, labor market, unemployment insurance

JEL codes: D83, J64, J65

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1 Introduction

Mechanisms that target reduction of out-of-pocket expenses (or increase of disposable income) of job seekers but have no effect on the job matching technology are popular in many countries and appear in various forms. Among them, tax deductible expenses related to job hunting (US) and unemployment benefit programs with provisions that an individual maintains the status of "job seeker" such as Jobseeker's Allowance (UK), Newstart Allowance (Australia), Employment Insurance (Canada), and the Unemployment Benefit (New Zealand), to name a few. Such mechanisms are typically seen as means to reduce frictions and to provide better incentives for participation in the job market (Pries and Rogerson, 2009).

We demonstrate that, contrary to the common belief, policies that target reduction of job search costs (or improvement of jobseekers' utility) may have welfare damaging effect and, moreover, may eventually lead to a collapse of the labor market. Our model is applicable to labor markets with long-term wage contracts where an employee's performance is observed after a substantial period of time, as in public administration jobs, academic and medical jobs, and many types of professional employment.

Consider the situation where an employer wants to fill a qualified job position. It is not observable at the stage of job interviews whether a potential employee meets the requirements for this position (or, put differently, whether a potential employee would be willing to exert enough effort to cope with assigned tasks). Furthermore, an employee's productivity becomes observable only after a certain period of time. Thus, in the initial period of employment, an employee can potentially work hard to demonstrate her abilities and to obtain tenure, or, alternatively, she can shirk and, when her real productivity becomes known, leave the job and search for a new vacancy at another firm.

In the described situation, job search costs play a crucial role. The more expensive it is to search for a new job, the less motivation an employee has to 'cheat' in the initial period of employment and move on to another employer. Therefore, a decrease in the job search costs could be welfare damaging, since fewer employees would be willing to exert effort and to continue being employed by the same firm, and more individuals would be searching for a job. This, in turn, reduces firms' benefits of opening a vacancy. Eventually, when these benefits drop below the cost of maintaining a vacancy, firms refrain from offering vacancies, and the labor market collapses.

Our paper contributes to the literature concerned with the relationship between unemployment and incentives. A substantial part of the literature focuses on adverse effects of unemployment benefits on job search effort (Holmlund, 1998; Pissarides, 2000; Fredriksson and Holmlund, 2006). Unemployment benefits provide an income insurance for risk-averse workers on the one hand, but reduce incentives for job search (thus leading to higher unemployment rates) on the other hand.[1] A solution for the incentive problem that the existing literature largely supports is conditioning unemployment benefits on active job search, in other words, restricting the benefits to individuals who seek employment, and only for a limited time after losing the previous job (e.g., Fredriksson and Holmlund, 2006). In comparison, in our model unemployment benefits may be welfare damaging even when only job seekers are targeted. An increase in job seekers' utility undermines incentives for workers to exert *on-the-job effort* and makes individuals more eager to quit one job and seek another.

Our paper is also closely related to the efficiency wage literature. Shapiro and Stiglitz (1984) suggested *involuntarily* unemployment as an incentive device. In their model, firms strategically reduce the number of vacancies, so that some workers remain involuntarily unemployed, so the threat of being laid off motivates employed workers to exert effort. That main insight of Shapiro and Stiglitz (1984) is that "Imperfect monitoring [of workers' on-the-job effort] necessitates unemployment." In contrast, in our model involuntary unemployment is not a necessity. In fact, all unemployment is *voluntary*, as any unemployed worker can always secure a position with certainty. Workers' incentives in our model are linked to broader factor, *job search costs*. As, in principle, one can consider the utility loss of being unemployed as a constituent of the job search cost, we address a more general question than Shapiro and Stiglitz (1984), and we go further by exploring policy implications with regard to job search costs, the issue that has not been raised in previous research.

The rest of the paper is organized as follows. Section 2 describes the basic model. In Section 3 we analyze the equilibrium in a benchmark model with no moral hazard and in Section 4 we analyze the equilibrium in the full model and compare the results to

[1] Under certain assumptions an increase in unemployment benefits can mitigate, rather than aggravate, the incentive problem, by promoting flow into (and creation of) high-productivity jobs (Acemoglu and Shimer, 2000) or through increasing the equilibrium performance-based component of the wage contracts (Demougin and Helm, 2011).

those of the previous section. Section 5 concludes.

2 Preliminaries

We consider a discrete-time labor market populated by a unit mass of heterogeneous individuals and a large set of homogeneous firms that create job positions. Individuals and firms are risk neutral, infinitely lived and maximize their total lifetime utility with discount factor $\delta \in (0, 1)$.

Each individual is characterized by her cost of effort $c \in \mathbb{R}_+$, which is private information. At the beginning of every period, each individual can be in one of two states, employed or unemployed.[2] Each unemployed individual decides whether to participate in the labor market or to stay out. An individual who stays out (called *inactive*) receives unemployment income $u_0 \geq 0$ in that period. Participation in the labor market is costly. An individual who searches for a job incurs a matching fee $s > 0$. In what follows, we will refer to s as the *search cost*. The matching technology is given by matching function $m(x, y) = \min\{x, y\}$, where x and y represent the masses of participating individuals and firms, respectively. Thus, the probability that a job seeker finds a match is given by $\min\{y/x, 1\}$.[3]

At the beginning of every period, each firm has a single job position that can be either filled or vacant. A firm that has a vacancy and is actively searching to fill it incurs a fee s_F in each period, until the vacancy is filled or withdrawn. To make a distinction from the individuals' job search cost, we shall refer to s_F as the *advertising cost*. The matching technology stipulates that the probability to fill a vacancy is $\min\{x/y, 1\}$. As usual in the search literature, since maintaining a vacancy is costly, the total mass of job positions that firms create will be endogenously determined in the model.

After an individual has been matched with a firm, she becomes an employee. In every period of employment she is paid a constant wage w that divides the expected surplus from the job match between the individual and the firm in a fixed proportion. The

[2]Here *unemployed* has its literal meaning of not being employed. This term does not make a distinction between jobless individuals who are looking for a job and who are not.

[3]Our results extend to more general matching functions (see Footnote 6 below), and we restrict the analysis to a simple one to save on unnecessary notation. Note that a matching function determines another type of costs associated with finding a job: the foregone income due to matching failure. This type of costs alone (i.e., exogenous cost $s = 0$) does not suffice for our results to hold.

share of the employee is β.[4] At the end of the period, with exogenous probability $1-\alpha$ the employee quits the job and returns to the market.

Let us now introduce a moral hazard aspect to our story. In every period an employee decides either to exert effort or to shirk. High effort results in high revenue π for the firm, $\pi > u_0$; low effort results in low revenue for the firm, normalized to zero. We assume that the wage is a binding contract, so the firm has to pay the same wage irrespective of productivity. However, the firm can motivate its employee to exert high effort by deciding whether to keep her on the job or to fire her on the basis of her past performance. The history of an employee's performance that preceded employment in the current firm is not observable and cannot be conditioned upon.[5] An employee that lost her job becomes unemployed and, in the next period, makes a decision whether to participate in the labor market or to stay out, and so on.

We focus on Bayesian Nash equilibria in steady state only. In addition, we make the following assumptions on the distribution of individuals' types (costs of high effort). Denote by F the cumulative distribution function of individuals' types. Assume that F is differentiable, and denote by f its density. Further, assume that F first order stochastically dominates the uniform distribution on domain $[0, \alpha\delta\beta(\pi - u_0)]$. Roughly speaking, by this assumption we guarantee that the mass of individuals with relatively high cost of effort (those who prefer to shirk when employed) is substantial enough, in other words, this is not a small minority that firms can ignore in equilibrium.

3 The Benchmark Model

As a benchmark we consider the model with no moral hazard. Specifically, we assume that a firm can decide, conditional on the recent performance of its employee, whether to pay the wage and keep the employee on the job or to fire the employee *without pay.*

3.1 Labor Demand. Denote by x and y the masses of searching individuals and firms, respectively, and by X and Y the masses of active individuals (that are searching

[4]The bargaining approach to wage determination is very common in the search literature (see, e.g., Diamond (1982), Mortensen (1982), and Pissarides (2000) for justification and discussions.)

[5]An employee's history with other firms need not be completely unobservable, though some degree of non-transparency is essential for our results.

or producing) and active firms (that have a filled job or a vacancy), respectively. Let J and V be a firm's value of a filled job and a vacancy, respectively. Let μ_F be the probability to fill a vacancy in a given period, $\mu_F = \min\{x/y, 1\}$. Then

$$V = -s_F + \mu_F J + (1 - \mu_F)\delta V.$$

Assume that firms create vacancies so long as $V > 0$ and withdraw them if $V \leq 0$. If $J \leq s_F$, then $V \leq 0$ for all μ_F, hence there will be no labor demand, $Y = 0$. However, if $J > s_F$, then in steady state $V = 0$ must hold, hence μ_F must satisfy

$$-s_F + \mu_F J = 0. \tag{1}$$

In particular, it means that $\mu_F \equiv \min\{x/y, 1\} = s_F/J < 1$. Hence $x/y < 1$, that is, the mass of job searching individuals is less than the mass of vacancies, so every individual finds a job immediately with certainty.[6]

Let us now derive the mass of active firms, Y. Denote by γ the fraction of individuals that are employed at the beginning of each period. Then

$$\mu_F = \frac{x}{y} = \frac{X - \gamma X}{Y - \gamma X}. \tag{2}$$

Combining (1) and (2) yields

$$Y = X\left(\gamma + (1-\gamma)\frac{J}{s_F}\right). \tag{3}$$

3.2 Labor Supply. In the benchmark model there is no moral hazard, so all employees exert high effort.[7] Hence firms will never dismiss workers. The fraction of individuals who lose their jobs and return to the job market is given by exogenous parameter $1 - \alpha$. The total surplus created by a filled job position is therefore equal to

$$S = \pi - u_0 + \alpha\delta(\pi - u_0) + \ldots = \frac{\pi - u_0}{1 - \alpha\delta}.$$

[6]For more general matching functions (e.g., Cobb-Douglas functions), the proportion of matched job seekers will be less than 1. However, this proportion does not depend on s and does not affect the qualitative results.

[7]Individuals with type $c > w$ will not exert high effort. But these individuals experience negative utility from labor, thus staying out of the labor market in equilibrium.

Similarly, a firm's gross value of filling a vacancy is equal to

$$J = \frac{\pi - w}{1 - \alpha\delta}.$$

We assumed $J = (1-\beta)S$, hence the wage is given by[8]

$$w = u_0 + \beta(\pi - u_0). \tag{4}$$

Let us now determine the equilibrium behavior of an individual with cost of effort c.

Lemma 1. *An individual of type $c \in \mathbb{R}_+$ participates in the job market if and only if*

$$c < \beta(\pi - v_0) - (1 - \alpha\delta)s.$$

Proof. Since we are considering equilibria in steady state only, it is sufficient to compare the lifetime utility of the individual who is *always active* and the one who is *always inactive*. The utility of an inactive individual of type c is

$$U_0 = u_0 + \delta U_0 = \frac{u_0}{1-\delta}. \tag{5}$$

Now consider an active individual of type c. Denote by $U_H(c)$ her lifetime utility starting from a period where she is unemployed (H stands for "high effort" for consistency with notations in further sections). Note that in the period where she is employed, her lifetime utility is simply $U_H(c) + s$, as in a steady state the only difference between being employed and unemployed is the job search cost (as we have established above that individuals find a job immediately with probability one). Then

$$\begin{aligned} U_H(c) &= -s + (w - c) + \delta\left[\alpha(U_H(c) + s) + (1-\alpha)U_H(c)\right] \\ &= \frac{w - c - (1-\alpha\delta)s}{1-\delta}. \end{aligned} \tag{6}$$

Consequently, an individual of type c will participate in the labor market if and only if[9] $U_H(c) > U_0$, or

$$c < w - u_0 - (1 - \alpha\delta)s,$$

[8] An employee's idiosyncratic cost c is unobservable to public and thus cannot be taken into account in wage determination.

[9] The tie is a zero probability event and thus can be ignored.

that, together with (4), yields the result. ■

Intuitively, an individual will participate in the labor market if her cost of effort is small relative to the expected wage, net of the unemployment income and expected costs of job search. Denote by $\bar{c}(s)$ the critical type who is indifferent between participating or not,

$$\bar{c}(s) = \beta(\pi - u_0) - (1 - \alpha\delta)s.$$

3.3 Steady State. We are now in position to find the masses of active individuals and active firms, X and Y, in steady state.

First, by Lemma 1, only individuals of type $c < \bar{c}(s)$ will be active, hence

$$X = F(\bar{c}(s)).$$

Next, a firm's value of a filled job is given by

$$J = (1 - \beta)S = \frac{(1 - \beta)(\pi - u_0)}{1 - \alpha\delta}.$$

Finally, after every period fraction α of active individuals remain employed, thus $\gamma = \alpha$. Consequently, by (3),

$$Y = F(\bar{c}(s)) \left(\alpha + (1 - \alpha)\frac{(1 - \beta)(\pi - u_0)}{s_F(1 - \alpha\delta)} \right).$$

Note that if the individuals' search cost is high enough, $s \geq \beta(\pi - u_0)/(1 - \alpha\delta)$, then no individuals participate and the labor market collapses (since in that case $\bar{c}(s) \leq 0$ and $F(\bar{c}(s)) = 0$, so we have $X = 0$). Similarly, if the firms' advertising cost is high enough, $s_F \geq J = (1 - \beta)(\pi - u_0)/(1 - \alpha\delta)$, no firms are willing to open vacancies, so we have $Y = 0$ and the labor market collapses. For the rest of the paper we assume that $s_F < (1 - \beta)(\pi - u_0)/(1 - \alpha\delta)$.

3.4 Comparative Statics. Let us analyze the relationship between individual's search cost on the welfare. As this model search cost s represents a pure waste, it is very intuitive that a reduction of s leads to welfare improvement.

Indeed, consider a reduction of individual search cost from s to s'. Then the mass of the individuals who search for jobs weakly increases, as $s > s'$ entails $\bar{c}(s) < \bar{c}(s')$, and consequently $F(\bar{c}(s)) \leq F(\bar{c}(s'))$. Any individual who is participating under s' is strictly better off relative to s, as her utility has gone up due to the lower search cost. Any individual who is inactive under s' is indifferent between s and s', as her utility remains unchanged, $u_0/(1-\delta)$. Hence, the consumer surplus strictly increases as s goes down.

Next, firms with filled job positions make profit $(1-\beta)(\pi - u_0)$ in a single period. Under s' the mass of firms engaged in production is larger, and so is the total producers' surplus.

The above is summarized in the following statement.

Proposition 1. *In the model with no moral hazard, a reduction of individuals' search cost is welfare improving.*

4 The Model with Moral Hazard

We now consider the model *with* moral hazard. In this model the wage must be paid to an employee irrespective of her performance, but the firm can motivate its employee to exert high effort by deciding to keep her on the job or not after having observed the performance.

4.1 Interaction of a Firm and an Employee. Let us begin with describing the optimal employment strategy for firms.

Lemma 2. *A firm's optimal strategy is to lay off its employee if and only if the last-period performance is low, irrespective of the previous history of her performance in that firm.*

Proof. The described strategy maximizes the difference between the payoff of one who always exerts high effort and the payoff of one who shirks in a single period, thus maximizing the set of types of individuals who would choose to exert high effort in all periods. ■

Let us derive an employee's equilibrium effort decision. By Lemma 2, under the firm's optimal strategy, the employee's dismissal at the end of any period is based only on that period's performance, thus the preceding history is irrelevant for her effort decision. That is, the employee's effort decision is stationary.

The next result demonstrates that an employee exerts high effort if and only if her type (cost of effort) is below some threshold level which is increasing in s. That is, as search cost s increases, more individuals are willing to exert effort. The intuition behind the result is that higher search cost makes the strategy of shirking and searching for a new job in every period less attractive as compared to the strategy of exerting high effort and staying on the job with some probability.

Lemma 3. *An employee of type $c \in \mathbb{R}_+$ exerts high effort if and only if*

$$c < \alpha\delta s.$$

Proof. Let us compare the lifetime utilities $U_H(c)$ and U_L of an active individual who exerts, respectively, high and low effort whenever employed. The former is given by (6) and the latter is given by

$$U_L = -s + w + \delta U_L = \frac{w - s}{1 - \delta}, \tag{7}$$

since the individual is being laid off after one period of employment and hence re-enters the labor market and pays search cost s in every period. Note that U_L is independent of c, as this person never bears the cost of high effort. Thus, an employee of type c will exert high effort if and only if $U_H(c) > U_L$,[10] or

$$\frac{w - c - (1 - \alpha\delta)s}{1 - \delta} > \frac{w - s}{1 - \delta},$$

which is equivalent to $c < \alpha\delta s$. ■

4.2 Labor Supply. Let us now analyze the equilibrium participation decision of individuals. Denote by $c^*(s)$ the threshold individual type who is indifferent between exerting high or low effort,

$$c^*(s) = \alpha\delta s.$$

[10] As in the proof of Lemma 1, the tie is a zero probability event and thus can be ignored.

Lemma 4. *Let w be a steady-state equilibrium wage and denote*

$$\bar{w}(c) = \begin{cases} u_0 + s - (c^*(s) - c), & \text{if } c < c^*(s), \\ u_0 + s, & \text{if } c \geq c^*(s). \end{cases}$$

An individual of type c will participate in the labor market if w exceeds threshold wage $\bar{w}(c)$, she will be indifferent if $w = \bar{w}(c)$, and she will stay out otherwise.

Function $\bar{w}(c)$ represents the inverse labor supply curve. In other words, for a given wage $w < u_0 + s$, individuals of types below $c = \bar{w}^{-1}(w)$ will participate. At $w = u_0 + s$, the labor supply is discontinuous and jumps up, and for $w > u_0 + s$ it includes *all* types, since the individuals who shirk (with $c \geq c^*(s)$) are now willing to participate too, and their utility does not depend on their cost of effort.

Proof. Let us compare the lifetime utility of an individual from always participating and always staying out. The utility of always staying out, U_0, is given by (5). For an individual with $c < c^*(s)$, the utility of always participating, $U_H(c)$, is given by (6). This individual participates if $U_H(c) > U_0$, or

$$w > u_0 + c + (1 - \alpha\delta)s = u_0 + s - (c^*(s) - c).$$

For an individual with $c \geq c^*(s)$, the utility of always participating, U_L, is given by (7). This individual participates if $U_L > U_0$, or $w > u_0 + s$. ■

Putting together Lemma 3 and Lemma 4, we obtain the following result.

Corollary 1. *Let w be a steady-state equilibrium wage. Then:*

(a) *if $w < u_0 + s$, then every individual of type $c < c^*(s) + w - u_0 - s$ participates with probability one and exerts high effort; every other individual stays out.*[11]

(b) *if $w > u_0 + s$, then all individuals participate with probability one, and only individuals of type $c < c^*(s)$ exert high effort;*

(c) *if $w = u_0 + s$, then every individual of type $c < c^*(s)$ participates with probability one and exerts high effort; every other individual is indifferent between participating or not, and in the event of participating she exerts low effort.*

[11] We ignore a measure zero of individuals who are indifferent.

4.3 Equilibrium. We are interested in equilibria *with positive participation* where there are active participants of the labor market, $X, Y > 0$. Note that there always exists an equilibrium with zero participation, since no labor market activity ($X = Y = 0$) is a steady state.

Define

$$\underline{s} = \frac{\beta(\pi - \alpha\delta u_0)s_F}{(1-\beta)\pi + \alpha\delta s_F} \quad \text{and} \quad \bar{s} = \frac{\beta(\pi - u_0)}{1-\alpha\delta}.$$

We can now describe the equilibrium.

Theorem 1.

(A) *There exists an equilibrium with positive participation ($X, Y > 0$) if and only if $\underline{s} < s < \bar{s}$.*

(B) *The equilibrium with positive participation is unique. If $s \geq \beta(\pi - u_0)$, then it coincides with that in the benchmark model. If $s \leq \beta(\pi - u_0)$,*[12] *then it is characterized by:*

(i) *the equilibrium wage is $w = u_0 + s$;*

(ii) *every individual of type $c < \alpha\delta s$ participates with probability one and exerts high effort; every individual of type $c \geq \alpha\delta s$ participates with probability λ^* and exerts low effort, where*

$$\lambda^* = \frac{(1-\alpha)F(\alpha\delta s)}{(1-\alpha\delta)(1-F(\alpha\delta s))} \cdot \frac{\beta(\pi - u_0) - s}{\beta u_0 + s}. \tag{8}$$

The proof is deferred to the Appendix.

It is worthwhile to note a few features of the equilibrium described in Part B. First, if the job search cost is sufficiently high, $s \geq \beta(\pi - u_0)$, then all individuals who exert low effort when being employed prefer to stay out of the labor market. That is, all individuals who participate are willing to exert high effort, and the equilibrium coincides with that in the benchmark model.

Second, if $s < \beta(\pi - u_0)$, then both groups of individuals, those who exert high effort and those who shirk, are present on the market, $\lambda^* > 0$. Full separation (only high effort workers participate, case (a) in Corollary 1) is impossible, because in that case

[12] For $s = \beta(\pi - u_0)$ both statements are true.

the expected productivity is high, which drives the wage up according to the wage determination rule, thus providing incentives for "shirkers" to participate as well. Full pooling (all individuals participate, case (b) in Corollary 1) is, in general, possible if the productivity of jobs is sufficiently high or if the mass of individuals with low cost of effort is sufficiently large, but we excluded that possibility by our constraints on F.

Finally, in the case of $s < \beta(\pi - u_0)$ the equilibrium wage w is equal to $u_0 + s$, so it is increasing in search cost s. This is because the wage must be kept low enough to prevent individuals who shirk on jobs from entering the market in their entire mass. If s goes down, then the strategy of shirking and switching jobs in every period becomes more attractive, so to counterbalance this effect the wage must go down as well.

4.4 Comparative Statics. Now we demonstrate that, in sharp contrast to the benchmark model, a reduction of individuals' search cost in the model with moral hazard is welfare damaging for $s < \beta(\pi - u_0)$ and eventually leads to collapse of the labor market.

The intuition behind this result is as follows. As we noted before, a reduction of s to s' leads to higher incentives for individuals who shirk at job to participate. Thus, in equilibrium, wage goes down to counterbalance that effect. But all individuals who exert high effort pay the search cost rarely, while receiving the wage in every period. Thus their utility goes down, so some (who would have worked with high effort otherwise) leave the market.

As a result, under lower search cost there are fewer workers who exert high effort and contribute to welfare. The labor market shrinks, total production goes down, and this effect dominates the benefit of having lower search costs. Eventually, as s continues to go down, the expected benefit for firms from opening a vacancy becomes lower than the cost of maintaining the vacancy, thus labor demand drops to zero and the market collapses.

Proposition 2. *In the model with moral hazard, individual's search cost $s^* = \beta(\pi - u_0)$ maximizes the welfare. Any reduction of the search cost below s^* is welfare damaging, moreover, a reduction of the search cost below $\underline{s}$ leads to a collapse of the labor market.*

This proposition is straightforward by Lemma 5 below and Theorem 1, where we use the result in Part B that for $s \geq \beta(\pi - u_0)$ the equilibrium in the model with moral hazard coincides with that in the benchmark model.

Lemma 5. *For all* $s \in (\underline{s}, \beta(\pi - u_0)]$ *the welfare in the model with moral hazard is equal to*

$$W(s) = \int_0^{c^*(s)} \frac{\alpha s - c}{1-\delta} dF(c) + \frac{\alpha(\pi - u_0 - s)}{1 - \alpha\delta} F(c^*(s)) \tag{9}$$

and it is strictly increasing in s.

For all $s \in (0, \bar{s})$ *the welfare in the benchmark model is equal to*

$$\overline{W}(s) = \int_0^{\bar{c}(s)} \frac{[\beta(\pi - u_0) - s] + \alpha s - c}{1-\delta} dF(c) + \frac{\alpha(1-\beta)(\pi - u_0)}{1 - \alpha\delta} F(\bar{c}(s)) \tag{10}$$

and it is strictly decreasing in s.

The proof is deferred to the Appnedix.

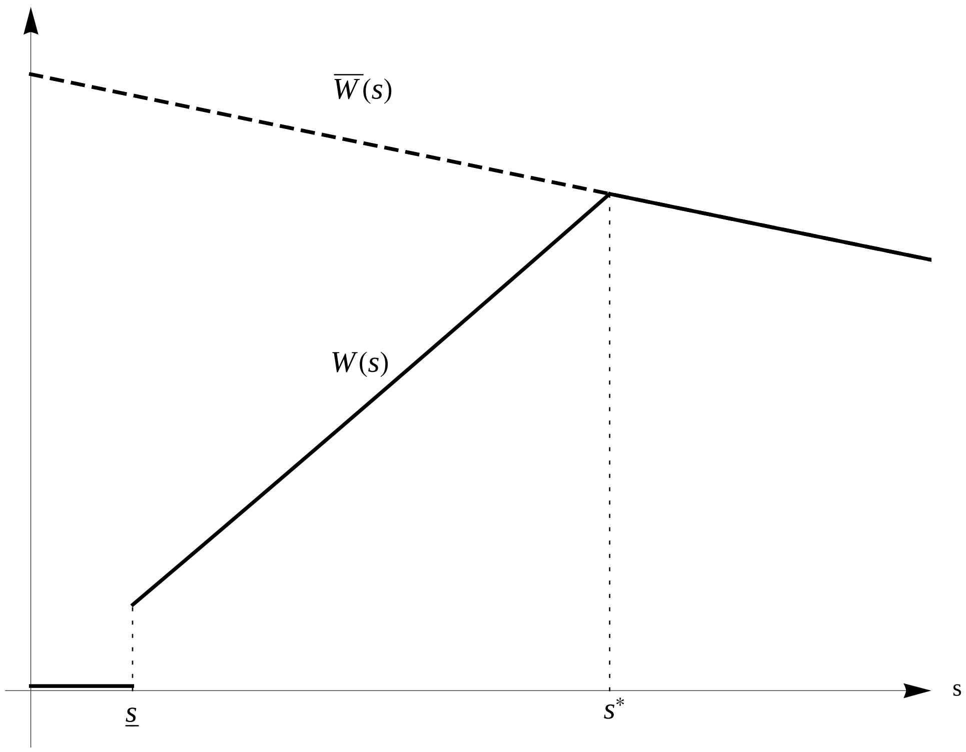

Fig. 1: Comparison of the total welfare in the two models

The difference in the welfare between the two models can be clearly seen by comparing (9) and (10) and is illustrated by Figure 1, where $W(s)$ is plotted as solid line and

$\overline{W}(s)$ as dashed line.[13] The dominant factor that determines the welfare is the mass of individuals who participate in the labor market and exert high effort. Recall that the threshold types for participation and high effort are different in the two models, $c^*(s) < \bar{c}(s)$ for all $s < s^* \equiv \beta(\pi - v_0)$. The gap between $c^*(s)$ and $\bar{c}(s)$ (and consequently, between the quantities of individuals who contribute to production) is at maximum when $s = 0$ and decreases as s grows, up to the point $s = s^*$, where $c^*(s) = \bar{c}(s)$ and the equilibria in the two models become the same. The gap between the two welfare values essentially follows the same pattern, with the difference that for $s \leq \underline{s}$ another factor kicks in: the benefits of production are so low that firms are not willing to open vacancies. So for $s \leq \underline{s}$ we have $W(s) = 0$, as the labor market does not exist. At the other end of the scale, for $s > s^*$, the benefits from "shirking and switching jobs" are so low that every employee is willing to exert high effort. So the two models produce identical equilibria and identical welfare, $W(s) = \overline{W}(s)$. As the search cost goes up above s^*, it provides no additional incentives to exert effort, thus being a pure waste and hence reducing the welfare.

5 Conclusion

In this paper we consider the role of job search costs as an incentive mechanism in the presence of moral hazard. Without moral hazard, or when job search costs are unnaturally high, a policy aimed at reducing unemployment and increasing productivity through a reduction in job search costs is likely to be successful. However, our results illustrate that in the presence of moral hazard and when the existing search costs are not very high, such policies may backfire by removing workers' incentives to exert effort on the job, leading to lower productivity, lower wages, and higher unemployment rates.

Policies that affect job search costs include tax deductibility for search expenses (Lunn, 1973; Garrison and Cummings, 2010) and tight eligibility requirements on unemployment benefits (Grubb, 2001). The introduction of the UK Jobseeker's Allowance in 1996, for example, was to some extent aimed at increasing search intensity among the unemployed and, consequently, the flow into employment (Rayner et al., 2000). However, conclusive evidence for the existence of such desired effects is lacking (Manning,

[13] The plot is done for the values of parameters $\alpha = \delta = 0.9$, $\beta = 1/2$, $\pi = 10$, $u_0 = s_F = 1$ and F uniform on $[0, \alpha\delta\beta(\pi - u_0)]$.

2009).

On the other hand, while unemployment benefits increase unemployment, they were found to increase average productivity levels (Blanchard, 2004). In our model, unemployment benefits have two contrasting effects. The direct effect is in reducing the incentives to participate in the job market for the individuals who exert low effort, so that the average productivity of employed workers increases, but the total output is unaffected. The indirect effect of unemployment benefits is through the reduction in job search costs, which according to our analysis, removes the incentives to exert effort for some proportion of the workers, thus resulting in lower total output.

This interpretation contrasts with existing explanations that attribute the increase in productivity to the fact that unemployment benefits enable workers to decline current job offers and continue searching for more productive jobs (e.g., Diamond, 1981; Acemoglu and Shimer, 2000; Marimon and Zilibotti, 1999). This line of argumentation leads to two possible extensions to the paper. We incorporate any costs associated with a lengthy search to the aggregate search costs and do not model explicitly frictional unemployment in the market as such. Disentangling the different effects could lead to a more complete assessment of different policies that influence job search costs. Another interesting extension would be to include heterogeneous jobs and determine the effect of job search costs on the composition of jobs offered by firms and accepted by workers.

Appendix

A.1 Proof of Theorem 1. **Part (B)**. We will prove that if there exists an equilibrium with positive participation, then it is unique and satisfies the conditions stated in Part B.

Denote by p the probability that a newly hired worker has type $c < c^*(s)$ and thus will exert high effort when employed. Then, surplus S produced by a filled job vacancy is given by

$$S = p\frac{\pi - u_0}{1 - \alpha\delta} + (1 - p)(-u_0), \tag{11}$$

where $(\pi - u_0)/(1 - \alpha\delta)$ is the surplus from an employee who always exerts high effort (as S in Section 3) and $(-u_0)$ is the surplus from an employee who shirks in the first period and loses the job at the end of that period.

Similarly, the value J of a filled job vacancy for a firm is given by

$$J = p\frac{\pi - w}{1-\alpha\delta} + (1-p)(-w) = S - p(\lambda)\frac{w-u_0}{1-\alpha\delta} - (1-p)(w-u_0),$$

where w is the equilibrium wage. Recall that wage determination rule requires

$$J = (1-\beta)S. \tag{12}$$

As J is strictly decreasing in w and $J = S$ for $w = u_0$, for any given p there exists a unique w that solves (12).

Suppose that $s > \beta(\pi - u_0)$. By the wage determination rule, the wage cannot exceed its feasible maximum $u_0 + \beta(\pi - u_0)$, hence $w < u_0 + s$. This corresponds to case (a) in Corollary 1, where all individuals who participate exert high effort, $p = 1$. Then we have $S = (\pi - u_0)/(1-\alpha\delta)$ and $J = (\pi - w)/(1-\alpha\delta)$. Solving (12) for w yields $w = u_0 + \beta(\pi - u_0)$. Note that this is the same equilibrium as in the benchmark model.

Next, suppose that $s < \beta(\pi - u_0)$. Corollary 1 implies the following labor market composition. The total mass of active individuals with type $c < c^*(s)$ is $F(c^*(s))$, of which only fraction $1-\alpha$ lose their jobs and return to the labor market. Hence the mass of individuals with type $c < c^*(s)$ on the labor market constitutes $(1-\alpha)F(c^*(s))$. Next, the total mass of individuals with type $c \geq c^*(s)$ is $1 - F(c^*(s))$, of which some fraction $\lambda \in [0,1]$ are active. Hence the mass of individuals with type $c \geq c^*(s)$ on the labor market constitutes $\lambda(1 - F(c^*(s)))$. Consequently, the probability that a newly hired worker has type $c < c^*(s)$ and thus will exert high effort is given by

$$p = p(\lambda) = \frac{(1-\alpha)F(c^*(s))}{(1-\alpha)F(c^*(s)) + \lambda(1-F(c^*(s)))} = \left(1 + \lambda\frac{1-F(c^*(s))}{(1-\alpha)F(c^*(s))}\right)^{-1} \tag{13}$$

Consider case (c) in Corollary 1 that stipulates $w = u_0 + s$, so condition (i) holds. Then there is a unique value of λ that solves (12) and it is equal to λ^* that can be easily verified. Thus we have proved that the equilibrium must satisfy condition (ii). Yet we need to verify that $\lambda^* \in [0,1]$. We have assumed that $s \leq \beta(\pi - u_0)$, thus $\lambda^* \geq 0$. Also we have assumed that F first order stochastically dominates the uniform distribution on $[0, \alpha\delta\beta(\pi - u_0)]$, i.e.,

$$F(c^*(s)) \leq \frac{c^*(s)}{\alpha\delta\beta(\pi - u_0)} = \frac{\alpha\delta s}{\alpha\delta\beta(\pi - u_0)} = \frac{s}{\beta(\pi - v_0)} \tag{14}$$

for all $s \in [0, \beta(\pi - u_0]$. Hence we have $F(c^*(s))\beta(\pi - u_0) \leq s$ for all $s \in [0, \beta(\pi - u_0)]$. Consequently,

$$\lambda^* = \frac{(1-\alpha)F(\alpha\delta s)}{(1-\alpha\delta)(1-F(\alpha\delta s))} \cdot \frac{\beta(\pi - u_0) - s}{\beta u_0 + s} \leq \frac{(1-\alpha)s}{\beta(1-\alpha\delta) + s} \leq 1.$$

Next, let us show that cases (a) and (b) in Corollary 1 cannot occur in equilibrium. It was shown above that case (a) entails $s > \beta(\pi - u_0)$, a contradiction. It remains to consider case (b) that stipulates $w > u_0 + s$ and $\lambda = 1$. Then we have

$$p = p(1) = \frac{(1-\alpha)F(c^*(s))}{1 - \alpha F(c^*(s))}.$$

Equation (12) can be rewritten as

$$p\frac{w - u_0}{1 - \alpha\delta} + (1-p)(w - u_0) = \beta\left(p\frac{\pi - u_0}{1 - \alpha\delta} + (1-p)(-u_0)\right).$$

Solving for $(w - u_0)$ we obtain

$$\begin{aligned} w - u_0 &= \frac{p\beta(\pi - u_0)}{1 - \alpha\delta(1-p)} - \frac{(1-\alpha\delta)(1-p)u_0}{1 - \alpha\delta(1-p)} \\ &\leq p\frac{\beta(\pi - u_0)}{1 - \alpha\delta(1-p)} = \frac{(1-\alpha)F(c^*(s))}{1 - \alpha F(c^*(s))} \cdot \frac{\beta(\pi - u_0)}{1 - \alpha\delta(1-p)} \\ &\leq \frac{(1-\alpha)s}{(1 - \alpha F(c^*(s)))(1 - \alpha\delta(1-p))} \\ &\leq s, \end{aligned}$$

where the third line is by (14) and the last line is due to:

$$1 - \alpha\delta(1-p) = 1 - \alpha\delta\frac{1 - F(c^*(s))}{1 - \alpha F(c^*(s))} = \frac{1 - \alpha(\delta + (1-\delta)F(c^*(s)))}{1 - \alpha F(c^*(s))} \geq \frac{1-\alpha}{1 - \alpha F(c^*(s))}.$$

But we have assumed $w > u_0 + s$, a contradiction.

Part (A). First, we show that $X = 0$ for $s \geq \bar{s}$. For $s > \beta(\pi - u_0)$, the equilibrium (if it exists) is the same as in the benchmark model, and by Lemma 1, an individual of type c participates in the labor market if and only if $c < \bar{c}(s)$. But for $s \geq \bar{s}$, $\bar{c}(s) = \beta(\pi - v_0) - (1-\alpha\delta)s \leq 0$, hence there is no participation, $X = 0$.

Second, we show that $Y = 0$ for $s \leq \underline{s}$. By (3), in equilibrium $Y > 0$ if and only if $s_F < J$, where

$$J = (1-\beta)S = (1-\beta)\left(p\frac{\pi - u_0}{1-\alpha\delta} - (1-p)u_0\right)$$

Substituting the value of λ^* into (13), after some manipulations, yields

$$p = p(\lambda^*) = \frac{(1-\alpha\delta)(\beta u_0 + s)}{\beta(\pi - \alpha\delta u_0) - \alpha\delta s}.$$

Next, substituting $p(\lambda^*)$ into the expression for J, after some manipulations, yields

$$J = \frac{(1-\beta)\pi s}{\beta(\pi - \alpha\delta u_0) - \alpha\delta s}. \tag{15}$$

At last, solving inequality $s_F < J$ for s yields

$$s > \frac{\beta(\pi - \alpha\delta u_0)s_F}{(1-\beta)\pi + \alpha\delta s_F} \equiv \underline{s}.$$ ■

A.2 Proof of Lemma 5. Let us calculate the welfare in the benchmark model first. In every period an individual of type $c < \bar{c}(s) \equiv \beta(\pi - v_0) - (1-\alpha\delta)s$ obtains $w - c$. Also, with probability $1-\alpha$ she is unemployed at the beginning of the period, so she pays search cost s. Thus the lifetime utility of an individual of type $c < \bar{c}(s)$ is equal to

$$\frac{w - c - (1-\alpha)s}{1-\delta} = \frac{u_0 + \beta(\pi - u_0) - c - (1-\alpha)s}{1-\delta},$$

where we used that in equilibrium the wage satisfies $w = u_0 + \beta(\pi - u_0)$. The lifetime utility of an individual of type $c \geq \bar{c}(s)$ is the unemployment income, $u_0/(1-\delta)$. Hence, the consumer's surplus (net of the unemployment income) is equal to

$$\overline{CS}(s) = \int_0^{\bar{c}(s)} \frac{\beta(\pi - u_0) - (1-\alpha)s - c}{1-\delta} dF(c).$$

Next, at the beginning of the period, the mass of firms who have a filled position is $\alpha F(\bar{c}(s))$. The lifetime utility of any such firm is $(\pi - w)/(1-\alpha\delta)$. Any firm that has an unfilled vacancy or inactive has zero lifetime utility. Hence the producers' surplus is equal to

$$\overline{PS}(s) = \alpha F(\bar{c}(s))\frac{\pi - w}{1-\alpha\delta} = \alpha F(\bar{c}(s))\frac{\pi - (u_0 + \beta(\pi - u_0))}{1-\alpha\delta}$$
$$= \alpha F(\bar{c}(s))\frac{(1-\beta)(\pi - u_0)}{1-\alpha\delta}.$$

Summing up $\overline{CS}(s)$ and $\overline{PS}(s)$ gives the expression for welfare $\overline{W}(s)$. As $\bar{c}(s)$ is strictly decreasing in s, it is easy to verify that $\overline{CS}(s)$ is strictly decreasing and $\overline{PS}(s)$ is decreasing. Hence $\overline{W}(s)$ is strictly decreasing.

Let us now calculate the welfare in the model with moral hazard. In every period an individual of type $c < c^*(s) \equiv \alpha\delta s$ obtains $w - c$ and also pays search cost s with probability $1-\alpha$ that she has become unemployed at the end of the previous period. Thus the lifetime utility of an individual of type $c < c^*(s) \equiv \alpha\delta s$ is equal to

$$\frac{w - c - (1-\alpha)s}{1-\delta} = \frac{(u_0 + s) - c - (1-\alpha)s}{1-\delta} = \frac{u_0 + \alpha s - c}{1-\delta},$$

where we used that in equilibrium the wage satisfies $w = u_0 + s$. The lifetime utility of an individual of type $c \geq c^*(s)$ is the unemployment income, $u_0/(1-\delta)$. Hence, the consumer's surplus (net of the unemployment income) is equal to

$$CS(s) = \int_0^{c^*(s)} \frac{\alpha s - c}{1-\delta} dF(c).$$

Next, similarly to in the benchmark model, at the beginning of the period, the mass of firms who have a filled position is $\alpha F(c^*(s))$. The lifetime utility of any such firm is $(\pi - w)/(1-\alpha\delta)$. Any firm that has an unfilled vacancy or inactive has zero lifetime utility. Hence the producers' surplus is equal to

$$PS(s) = \alpha F(c^*(s))\frac{\pi - w}{1-\alpha\delta} = \alpha F(c^*(s))\frac{\pi - (u_0 + s)}{1-\alpha\delta}.$$

Summing up $CS(s)$ and $PS(s)$ gives the expression for welfare $W(s)$. Taking the derivative of $W(s)$ (where we have used $dc^*(s)/ds = \alpha\delta$) yields

$$\begin{aligned}
\frac{d}{ds}W(s) &= \frac{\alpha}{1-\delta}F(c^*(s)) + \frac{\alpha^2\delta}{1-\alpha\delta}f(c^*(s))(\pi - u_0 - s) - \frac{\alpha}{1-\alpha\delta}F(c^*(s)) \\
&= \frac{\alpha^2\delta}{1-\alpha\delta}f(c^*(s))(\pi - u_0 - s) + \alpha F(c^*(s))\left(\frac{1}{1-\delta} - \frac{1}{1-\alpha\delta}\right) > 0,
\end{aligned}$$

since by assumption $s \leq \beta(\pi - u_0) < \pi - u_0$ and $\frac{1}{1-\delta} - \frac{1}{1-\alpha\delta} > 0$. ■

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