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The impact of hiring subsidies on survival of heterogeneous jobs

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Abstract

While hiring subsidies are expected to stimulate the creation of jobs, the literature highlights that the wage increases that may result from these subsidies could also increase the number of job destructions. In the presence of wage rigidities, this effect is irrelevant. This paper explores the likely mechanism by which hiring subsidies tend to modify job composition with more low productivity jobs entering the market. Given that these jobs on average survive less long, this composition effect increases the job destruction rate. Also, the share of subsidized jobs increases with the subsidy.

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1 Introduction

Hiring subsidies are aimed at reducing unemployment among vulnerable workers, such as the young, the unskilled and the long term unemployed. Several papers estimate their impact on job creations. Some find positive effects (Blundell et al. (2004), Kangasharju (2007), Cahuc et al. (2019), Sjogren & Vikstrom (2015)), others conclude that there are no significant effects such as Boockmann et al. (2012) for older workers or Schunemann et al. (2015) for the long-term unemployed.

The effect of hiring subsidies on separations is less studied although intuitively separations may also be impacted. For instance, job destructions may increase among the non-beneficiaries, through a substitution effect, and/or among former beneficiaries, as employers find themselves encouraged to make new subsidized hires, leaving their aggregate labor demand unchanged, and thus dismissing workers with similar characteristics who cannot or no longer be subsidized (Dahlberg & Forslund (2005)).

Existing theory also highlights a wage effect that would lead to more destructions. Mortensen & Pissarides (2001) indeed show that, by stimulating the inflow of vacancies, hiring subsidies increase the job finding rate among the unemployed. Workers' exit option thus increases, while the employers' exit option remains unchanged by free entry. The surplus of a match is consequently lower and the wage higher. As a result, jobs are more likely to be destroyed in the event of a productivity shock. Calibrated models that estimate the net employment effect of hiring subsidies find conflicting results, depending on the extent of this wage effect in different institutional contexts. Kitao et al. (2011) calibrate Mortensen & Pissarides (1994)'s model with US data. They distinguish between the skilled and unskilled segments of the labour market, but do not allow for substitution effects. In their simulations, the destruction effect dominates the creation effect in both skill groups, even though the wage effect is lower for the unskilled for whom market tightness is initially lower. Cahuc et al. (2019) estimate the impact of a temporary hiring subsidy policy implemented during the 2008 recession in France. They conclude on the absence of any significant effect on market tightness and wages, probably because of the moderate size of the program as it was limited in time, targeted on low wages and restricted to small firms. Making use of a dynamic model calibrated with data from Germany, Brown et al. (2011) argue that hiring subsidies targeted at the long-term unemployed should be preferred to low wage subsidies to create employment because the former entail lower deadweight losses. But the wage effect is absent from their model because the wage is fixed through insider bargaining.

The contribution of this paper is to show that hiring subsidies may increase destructions even in the absence of substitution or wage effects. The net employment effect thus remains ambiguous even in the presence of wage rigidities. This is particularly important in the European context where a minimum wage is often binding for the unskilled and where targeted workers have low weight on centralized bargaining processes. Assuming fixed wages and heterogenous jobs, I show that hiring subsidies reduce job survival by modifying the composition of job vacancies. The key point is that, if at the outset jobs are not ex ante equally productive, for instance because the marginal productivity of labor is decreasing, then hiring subsidies tend to create lower-productivity jobs that survive less long. Empirically, Sjogren & Vikstrom (2015) also find that employment drops once the subsidy expires, likely because of employers' incentive to dismiss workers as soon as they stop benefiting. This result is compatible with the fact that, in some cases, job survival hinges on the subsidy.

2 The model

2.1 Job heterogeneity

There is a continuum of homogeneous workers of size 1 and a set of price-taking prospective employers. Employers face jobs with heterogeneous initial productivity $y \sim H(y)$, $y \in \mathbb{R}_+$. Agents are infinitely lived and discount the future at rate r. The model is developed in continuous time and the lifetime of a job is as follows:

1. At any point in time, prospective employers can draw a job type $y \sim H(y)$ against a lump sum cost κ.
2. If the productivity level y is deemed high enough, a job vacancy is opened.
3. The matching process takes place.
4. A created job produces a flow y of the numeraire and is eligible to a flow subsidy s during a period of length Δ that starts at creation date c. The worker is paid at the prevailing exogenous wage w.
5. A job is subject to idiosyncratic productivity shocks which follow a Poisson process with arrival rate λ. The shock is additive and iid $\varepsilon \sim F(\varepsilon)$, with $\varepsilon \in (-\infty, \varepsilon_u]$. Each new shock replaces the former. When a shock occurs, the employer decides whether or not to destroy the job.

The matching process obeys usual assumptions: the number of pairs formed at any time is given by the function $M(u, v)$, which is increasing in u, the rate of unemployment, and v, the number of vacancies. $\theta = v/u$ denotes labor market tightness. The matching function is such that the filling rate of vacancies $m(\theta) \equiv M/v$ is decreasing in θ and the exit rate out of unemployment $\theta m(\theta) = M/u$ increasing in θ.

2.2 Employers' decisions

Two decisions are made by employers: the opening of a vacancy and the destruction of a job. Let us solve the model backwards.

2.2.1 Job destruction

Consider an employer holding a job with productivity y and random component ε_t, with the subscript t denoting the time elapsed since the job's creation date (job duration). The flow equivalent of the asset value of the job writes

$$\begin{aligned} rJ(y, \varepsilon_t, t) &= y + \varepsilon_t - w + s + \lambda (J_\lambda - J(y, \varepsilon_t, t)) + \dot{J}, \text{ if } t \in [0, \Delta), \\ &= y + \varepsilon_t - w + \lambda (J_\lambda - J(y, \varepsilon_t, t)), \text{ otherwise,} \end{aligned}$$

with $\dot{J} \equiv dJ/dt$. The flow profit is equal to the prevailing productivity $y + \varepsilon_t$ minus the wage, the hiring subsidy s being granted as of the creation date for a period of length Δ. This temporary subsidy makes the environment non-stationary before the expiration date ($t = \Delta$) and stationary after it. As a result, $\dot{J} = 0$ for all $t \in [\Delta, +\infty)$. J_λ stands for the asset value conditional on the occurrence of a productivity shock[1]:

$$J_\lambda \equiv E_\varepsilon \max \{J(y, \varepsilon, t), 0\} = \int_{\tilde{\varepsilon}(t)}^{\varepsilon_u} J(y, \varepsilon, t)\, dF(\varepsilon) > 0,$$

[1] I make the simplifying assumption that job destruction only takes place at the moment a shock hits.

where $\tilde{\varepsilon}(t)$ is such that the employer is indifferent between holding and destroying the job: $J(y, \tilde{\varepsilon}, t) = 0$. The job is thus destroyed if and only if the shock that occurs ε_t falls short of the reservation value $\tilde{\varepsilon}(t)$. Let $\phi(t)$ denote the hazard rate among jobs of duration t and initial productivity y:

$$\phi(t) \equiv \lambda F(\tilde{\varepsilon}(t, y)), \tag{1}$$

with $F(\tilde{\varepsilon}(t, y))$ the probability that the shock is lower than the reservation value.

During the subsidized period, the reservation shock evolves over time, as formalized in Lemma 1[2]:

Lemma 1 *The reservation shock satisfies the following differential equation:*

$$\frac{d\tilde{\varepsilon}(t)}{dt} = -(\lambda + r)\dot{J},$$

where

$$\begin{aligned} \dot{J} &= -(y + \tilde{\varepsilon}(t) + s - w) - \frac{\lambda}{\lambda + r}\int_{\tilde{\varepsilon}(t)}^{\varepsilon_u}(1 - F(x))\,dx \leq 0, \ \textit{if } t \in [0, \Delta), \\ &= 0, \ \textit{otherwise.} \end{aligned}$$

The reservation productivity $y + \tilde{\varepsilon}(t)$ thus increases over time and so does the hazard rate, which is an increasing function of $\tilde{\varepsilon}(t)$ (see equation 1). The reason is that the amount of subsidy that remains to be earned by the employer decreases with job duration until the expiration date. As a result $\dot{J}$ is negative. Let us define $\tilde{\varepsilon}_s$ and $\tilde{\varepsilon}_0$ as the reservation values that would prevail in stationary environments with and without a (permanent) subsidy:

$$\begin{aligned} y + \tilde{\varepsilon}_s - w + s + \frac{\lambda}{\lambda + r}\int_{\tilde{\varepsilon}_s}^{\varepsilon_u}(1 - F(x))\,dx &= 0, \\ y + \tilde{\varepsilon}_0 - w + \frac{\lambda}{\lambda + r}\int_{\tilde{\varepsilon}_0}^{\varepsilon_u}(1 - F(x))\,dx &= 0. \end{aligned}$$

As soon as the subsidy is strictly positive, we have $\tilde{\varepsilon}_s < \tilde{\varepsilon}_0$, because the subsidy allows to compensate for lower productivity. Define $\phi_s \equiv \lambda F(\tilde{\varepsilon}_s)$ and $\phi_0 \equiv \lambda F(\tilde{\varepsilon}_0)$.

Proposition 1 ***The subsidy decreases the hazard rate of any given job during the subsidized period.*** *More precisely:*

- *During the subsidized period, the hazard rate is lower than if there were no subsidy, but higher than if the subsidy were permanent:* $\phi_s < \phi(t) < \phi_0, \forall t \in (0, \Delta)$.
- *It increases with job duration:* $\phi'(t) > 0, \forall t \in (0, \Delta)$ *and becomes equal to* ϕ_0 *as of the expiration date and beyond:* $\phi(t) = \phi_0, \forall t \in [\Delta, +\infty)$.

Thanks to this reduction in the hazard rate, individual job survival increases. It is however important to stress that Proposition 1 describes the impact of the subsidy on jobs of a given type. As we see below, the composition of the supply of vacancies and thus of created jobs is itself affected by the subsidy. As expected, high (low) productivity jobs of any given duration have a lower (higher) hazard rate: $\partial\phi(t)/\partial y < 0, \forall t$. Low-productivity jobs are thus more rapidly destroyed.

[2] Proofs are available in the mathematical appendix.

2.2.2 Vacancy supply

The supply of a vacancy by an employer follows two steps: the employer first decides whether to draw a type y and then whether to open a vacancy. Solving backwards, a vacancy is opened if and only if, given its type y, the asset value of the vacancy is positive:

$$rV(y) = m(\theta)(J(y) - V(y)) > 0 \iff J(y) > 0.$$

Notice that I make the assumption that the filling rate is orthogonal to the job's type. At creation date, the asset value of a job is linearly increasing in its type: $\partial J(y)/\partial y = 1/(\lambda + r) > 0$. Hence, there exists a threshold value $\tilde{y}$ such that $J(\tilde{y}) = 0$, above which the job is opened. This entry threshold $\tilde{y}$ determines the composition of vacancies. The mass of vacancies is determined by the entry condition, i.e the expected return to drawing a job of a certain type must compensate for its cost in equilibrium:

$$\Pi_J \equiv E_y[\max\{V(y), 0\}] = \frac{m(\theta)}{r + m(\theta)} \int_{\tilde{y}}^{+\infty} J(y)\, dH(y) = \kappa.$$

By the assumption that the filling rate $m(\theta)$ is decreasing in market tightness, the left-hand side is decreasing in θ. This ensures that the problem is well-behaved because, as long as the expected profit Π_J is positive, vacancies are being created, thereby increasing the level of tightness until the condition reaches equality.

Proposition 2 ***Effect on vacancy supply:*** *The hiring subsidy decreases the entry threshold and increases market tightness:* $\partial\tilde{y}/\partial s < 0; \partial\theta/\partial s > 0$.

The increase in market tightness indicates that the subsidy stimulates the supply of vacancies, as expected. But the subsidy also affects the composition of jobs by lowering the entry threshold. Because market tightness increases, the congestion externality gains in strength and the filling rate $m(\theta)$ decreases, also for high-productivity jobs. Therefore, depending on whether the mass effect compensates or not for the decrease in the filling rate, the number of high-productivity jobs may or may not be higher. What is unambiguous, however, is that the average productivity of created jobs is lower, which has adverse consequences on average (over types) job survival since $\partial\phi(t; y)/\partial y < 0, \forall t$.

2.3 Survival and destruction

Let us analyze the impact on average job survival and on the destruction rate.

Let $g(t)$ and $G(t)$ denote the density and distribution functions of job duration, respectively. Let $\bar{G}(t) \equiv 1 - G(t)$ be the survival function. Average survival among jobs that are opened is then noted $E_{y\geq\tilde{y}}\left[\bar{G}(t; y)\right]$.

Besides, the destruction rate at calendar time τ, noted q, is defined by the ratio of separations taking place at τ over the mass of existing job at this point in time:[3]

$$q \equiv \frac{\int_{-\infty}^{\tau}\int_{\tilde{y}}^{+\infty} g(\tau - c; y)\, h(y)\, dy dc}{\int_{-\infty}^{\tau}\int_{\tilde{y}}^{+\infty} \bar{G}(\tau - c; y)\, h(y)\, dy dc},$$

where c stands for a job's creation date, so that $t = \tau - c$ is the job duration at calendar time τ. Notice that, at any point in time, there are more old high-productivity than old low-productivity jobs, because the former have a lower hazard rate.

[3] I look at the steady state.

In both cases, the total effect is the sum of the direct partial effect of subsidies and the indirect effect that derives from the change in job composition. The former increases survival and decreases the destruction rate thanks to a lower hazard rate during the subsidized period. The latter has the opposite effect because the subsidy adversely affects job composition by lowering the entry threshold (productivity). Total effects are thus ambiguous and so is the impact on unemployment.

Finally, let α denote the share of subsidized jobs (younger than Δ) in the economy:

$$\alpha \equiv \frac{\int_{\tau-\Delta}^{\tau} \int_{\tilde{y}}^{+\infty} \bar{G}\left(\tau - c; y\right) h\left(y\right) dydc}{\int_{-\infty}^{\tau} \int_{\tilde{y}}^{+\infty} \bar{G}\left(\tau - c; y\right) h\left(y\right) dydc}.$$

I obtain the following:

Proposition 3 *The hiring subsidy increases the share of subsidized jobs:* $d\alpha/ds > 0$.

This means that hiring subsidies increase the prevalence of younger relative to older jobs. Two effects are at play and push in the same direction: on the one hand, because the entry threshold is lower, more jobs are being created at any time, which makes the average job younger. On the other hand, the survival of low-productivity jobs is shorter as they are more likely to be destroyed at any date.

3 Conclusion

While hiring subsidies are expected to stimulate the supply of vacancies and the creation of jobs, the literature highlights that the wage increases that may result from these subsidies could also increase the number of job destructions. One might think that this effect is absent under wage rigidities, typically for the low-skilled under centralized wage bargaining and/or the existence of a minimum wage. In this paper, I have explored the likely mechanism by which hiring subsidies modify job composition with more low-productivity jobs entering the market. Given that low-productivity jobs on average survive less long, this composition effect increases the job destruction rate. For any given job, I have shown that the hazard rate is lower during the subsidized period, but less than under a permanent subsidy of equal amount and that this effect is the strongest at creation date and then decreases over time. Besides, low type vacancies are encouraged, which increases congestion externalities for all types and adversely affects job composition. The impact on average survival is ambiguous because, even though there is a temporary decrease in the hazard rate for young jobs, there is an inflow of low-productivity jobs that survive less long. For the same reasons, this ambiguity also holds true for the separation rate. Finally, I have shown that the share of young / subsidized jobs on the market is increasing in the subsidy.

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