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Hiring subsidies, job creation and job destruction☆

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ABSTRACT

We quantify the effects of hiring subsidies using the model of Mortensen and Pissarides (2003). The job creation effect can be large in a weak labor market. However, in the long-run, subsidies raise the wage and equilibrium unemployment.

1. Introduction

The key to a recovery in the labor market after recessions is a robust re-creation of jobs.[1] Relatively little, however, is known about the effects of a subsidy on stimulating employment.[2] This paper evaluates the impact of a job creation subsidy using an equilibrium model of Mortensen and Pissarides (1994) and the framework of Mortensen and Pissarides (2003) calibrated to the labor market conditions in 2009.

2. Model

Denote the number of job vacancies by v and the number of unemployed workers by u. Job–worker matches are created according to the matching function that exhibits constant returns to scale; $m(v,u) = m(1,u/v)\,v \equiv q(\theta)v$, where $\theta = v/u$ represents market tightness. Unemployed workers find jobs at the average rate of $\theta q(\theta)$ and vacancies are filled at the rate $q(\theta)$. The product of a match depends on the type-specific skill p and the idiosyncratic productivity x. The productivity shock arrives at a Poisson rate λ and takes a value on the interval $[\gamma, 1]$ according to the cumulative distribution function of $F(x)$. A match is destroyed if the realized productivity falls below the reservation threshold R. The equilibrium unemployment rate is given as $u = \lambda F(R)/[\lambda F(R) + \theta q(\theta)]$.

A firm posts a job vacancy for a worker of skill p at a flow cost of recruiting cp. A hiring subsidy H is provided to the employer when a worker is hired. The employer and the worker bargain to agree on the initial wage w_0. The agreed wage is paid until the productivity shock arrives at rate λ, upon which the wage is renegotiated and set at $w(x)$, based on the new productivity x. If the productivity is below the reservation level R, the job is terminated.

An unemployed worker receives unemployment benefit of $\rho\overline{w}$, which replaces a fraction ρ of the average wage $\overline{w}$, and values the leisure at an imputed income of b. Workers and firms maximize the expected present value of net income streams. A search equilibrium is given by a pair of reservation productivity R and market tightness θ for each skill type. As in Mortensen and Pissarides (2003), we assume market segmentation by skill groups. The value of a continuing match for an employer with productivity

☆ The views expressed in the paper are those of the authors and do not necessarily reflect those of the Federal Reserve Bank of New York or the Federal Reserve System.

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1 In response to the recent economic downturn, the Hiring Incentives to Restore Employment (HIRE) Act was enacted in early 2010. The policy provides businesses with an exemption from payroll taxes and a $1000 credit for a new employee under certain conditions.

2 Most of empirical work focuses on understanding the effects of "targeted employment subsidies". See for example Katz (1994). Katz (1998) reviews empirical studies that examine the role of the New Jobs Tax Credit (NJTC) in 1977–78, which is a job creation subsidy similar to the HIRE Act.

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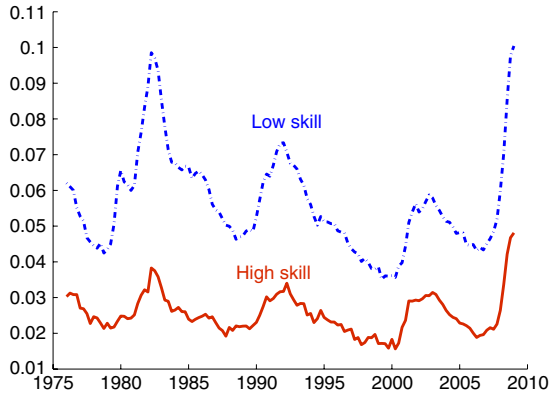

Fig. 1. Unemployment rates for high-skill and low-skill workers. CPS data for individuals of age 25 and above.

x is denoted by $J(x)$.

$$rJ(x) = px - a - (1+t)w(x) + \lambda \int_R^1 [J(z) - J(x)]\mathrm{d}F(z) + \lambda F(R)[V - J(x)] \quad (1)$$

where r is the riskless interest rate and V is the value of posting a vacancy. The value of a match for a worker $W(x)$ is defined as

$$rW(x) = w(x) + \lambda \int_R^1 (W(z) - W(x))\mathrm{d}F(z) + \lambda F(R)[U - W(x)] \quad (2)$$

where U is the value of unemployment.

The wages are determined through bilateral bargaining and the worker's relative bargaining power is given as β. The earnings are subject to the proportional tax at rate t. Substituting the equilibrium wages to the value equations, we obtain two equations that characterize the equilibrium conditions for job destruction (3) and job creation (4), which pin down the reservation productivity and market tightness in equilibrium.

$$R + \frac{\lambda}{r+\lambda}\int_R^1 (z-R)\mathrm{d}F(z) = \frac{a + (1+t)(b+\rho\overline{w})}{p} + \frac{\beta}{1-\beta}c\theta. \quad (3)$$

The condition equates the sum of the reservation product and the option value of continuing the match with the opportunity cost of continuing the match. A higher market tightness θ implies a higher reservation productivity R since it implies more ease with finding a job and increases the value of a worker's outside option.

$$\frac{c}{q(\theta)} = (1-\beta)\left[\frac{1-R}{r+\lambda} + \frac{H}{p}\right]. \quad (4)$$

The condition equates the firm's expected recruiting cost with the expected surplus of a newly created job to the firm. A higher reservation productivity implies a lower market tightness, since the job is expected to last for a shorter period and the value of posting a vacancy falls.

3. Calibration

The model is calibrated to the labor market conditions at the end of 2009. We assume that the skill level is either "low" or "high". The high type corresponds to workers with a college degree or above and the low type covers the rest of the workers, who constitute approximately two-thirds of the labor force.

Table 1
The effects of lump-sum and proportional hiring subsidies.

Subsidy	JC effect			Total (JC + JD) effect			
	u (%)	u_H (%)	u_L (%)	u (%)	u_H (%)	u_L (%)	Δw (%)
\$1000	8.1	4.5	9.9	9.4	5.5	11.4	+0.6
\$2000	7.4	4.2	8.9	9.9	6.1	11.7	+1.3
\$5000	5.8	3.6	6.9	11.1	8.1	12.6	+3.3
6.2% of wage	7.3	3.8	9.1	10.2	7.3	11.7	+1.4

The model period is a quarter. The interest rate is set at 4% on annual basis. The matching function takes the Cobb–Douglas form; $m(v,u) = v^{1-\eta}u^{\eta}$ with the elasticity parameter η at 0.5. The bargaining weight of workers β is set at the same value. The productivity shock arrives with probability λ at 0.1 and it is uniformly distributed over the range $[\gamma, 1]$.

The unemployment rates for high- and low-skilled workers are very different as shown in Fig. 1. We use the CPS data to compute the outflow and inflow probabilities using the method proposed by Shimer (2005). As shown in Fig. 2, the unemployment outflow probability is almost identical for high- and low-skilled workers and the unemployment rate differences between skill groups are driven by heterogeneity in inflow rates. On monthly basis, the inflow rate into unemployment was around 2.5% for low-type workers, much higher than the rate for high type workers, which was approximately 1.0% in 2009. The outflow rate for both types of workers has fallen during the recession to approximately 20% at the end of 2009. We calibrate the two type-specific parameters γ and b to match these inflow and outflow rates.[3]

The skill level p is set at $\{0.75, 1.5\}$ for each type, which implies the ratio of average earnings between two types at about 2.0 as in the data. The recruiting cost c is set at 0.6. The wage tax is 30% and the replacement rate of unemployment insurance is set at 40%.

4. Policy experiments and numerical results

Benchmark equilibrium

In benchmark equilibrium without hiring subsidies, the unemployment rate of high-skill workers is 4.8% while it is 11.1% for low-skilled workers. This difference is driven by the different job loss probabilities faced by two types of workers as discussed in Section 3. High-skill workers also have higher wages as a result of their higher match productivity.

Lump-sum hiring subsidy

A hiring subsidy increases firm's expected net surplus and stimulates job creation. As shown in Fig. 3, in the (R, θ) diagram of job creation and job destruction curves, this first effect is captured by the rightward shift of the job creation curve and a rise in the market tightness from θ_0 to θ_1. We call this as the "job creation (JC) effect", which assumes a constant reservation productivity. The unemployment rate through the job creation effect is computed as $\lambda F(R_0)/(\lambda F(R_0) + \theta_1 q(\theta_1))$.

A higher labor market tightness would shorten the expected duration of unemployment. But it does not necessarily imply a lower unemployment rate in equilibrium since it improves employed workers' outside option value and affects the reservation productivity. As a result, job destruction increases as well, raising the incidence of unemployment, a shift from (θ_1, R_0) to (θ^*, R^*) in Fig. 3. We call this effect "the job destruction (JD) effect". The unemployment rate in the new equilibrium that takes into account both effects is $\lambda F(R^*)/(\lambda F(R^*) + \theta^* q(\theta^*))$.

Table 1 reports the effects of subsidies in different amounts on the unemployment rate and wages. When we only consider

[3] The values are $\{\gamma_L, \gamma_H\} = \{0.683, 0.887\}$ and $\{b_L, b_H\} = \{0.19, 0.40\}$.

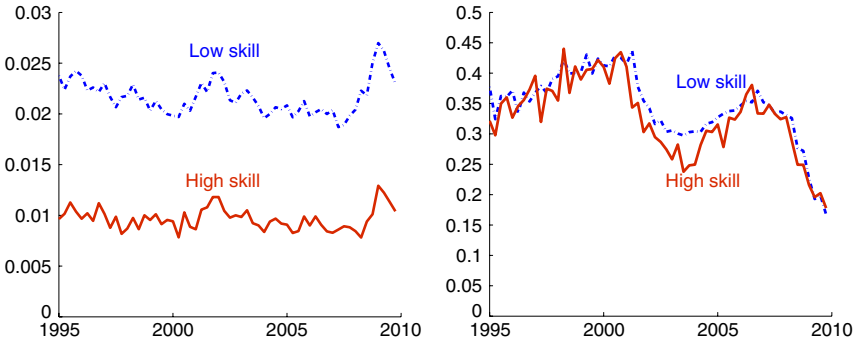

Fig. 2. Unemployment inflow (left panel) and outflow (right panel) probabilities for high-skill and low-skill workers, quarterly averages of monthly probabilities.

the job creation effect, a $1000 subsidy would reduce the average unemployment rate from 9.0% to 8.1%. The decline is mostly driven by increased employment of low-skilled workers. With the job destruction effects, the hiring subsidy no longer reduces the unemployment rate and the unemployment rate rises from 9.0% to 9.4%. Therefore a hiring subsidy can generate more employment in the long-run. In practice, however, if the goal of a stimulus such as the HIRE Act of 2010 is to provide countercyclical hiring incentives when the labor market conditions are weak, the policy is likely to be temporary and repealed once the economy recovers. If job destruction does not immediately adjust to the temporary policy, the policy can stimulate job creation and may generate a temporary boost in employment. Workers in the model are fully aware of the improving labor market conditions, which increases their wages and thus lowers the surplus of firms. As a result firms destroy the jobs that they would have kept at lower wages. In reality there may be an adjustment period until the job destruction channel starts to operate. The wage may not adjust upward immediately in recessionary environment with an elevated level of unemployment and its durations. It is possible that the unemployment rate declines for a short period of time. Therefore the job creation effect can be considered as the maximum positive effect of a hiring subsidy that would prevail if the job destruction effect is somehow mitigated or occurs with a delay. Our analysis suggests that an attempt to further delay and minimize the job destruction effect might be useful in the design of a hiring subsidy.[4]

An increase in the labor force participation could also delay the job destruction. The labor force participation rate is mildly procyclical and the recent downturn also seems to be following this pattern. The model abstracts from participation decisions but the unemployment rate can stay high due to an increase in participation while more job creation takes place. As a result, labor market tightness would stay low and delay the job destruction effect to emerge.

In order to understand whether the effect of a hiring policy is quantitatively different by the aggregate economic environment, we recalibrate the model to match the pre-recession labor market conditions and simulate the same policy. The economy is characterized by slightly lower inflow rates and much higher outflow rates, about 50% above the baseline calibration, which together imply the average unemployment rate of 5% in equilibrium. Although the qualitative effects are identical, quantitative effects differ significantly. We find that the policy has much stronger job creation effects during recessionary periods. For example, the job creation effect of a $1000 subsidy is a reduction of the average unemployment rate by 0.36 percentage point during

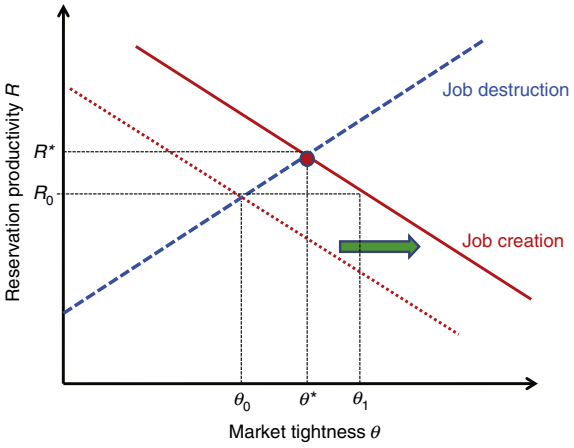

Fig. 3. Effect of a hiring subsidy.

expansions, while it is a 0.90 percentage-point reduction under the benchmark calibration.[5]

Proportional hiring subsidy

Lastly we consider a proportional hiring subsidy, corresponding to 6.2% of the average wage of the two types of workers.[6] Qualitative effects are analogous to those of the lump-sum subsidy studied above. The unemployment rate declines through the job creation effect, but the total effect results in an increase in the unemployment. The lump-sum subsidy is more effective in lowering the unemployment rate of unskilled workers through the job creation effects while the proportional subsidy affects the unemployment rate of skilled workers more.

5. Conclusion

A hiring subsidy can stimulate job creation, but would cause the equilibrium unemployment to be higher in the long-run. A $1000 lump-sum hiring subsidy lowers the unemployment rate from 9.0% to 8.1% through the job creation effect but increases the steady-state unemployment rate to 9.4% if the job destruction effect is also taken into account. The policy is shown to have a greater job creation effect on low-skilled workers. The job creation effect of a subsidy can be much larger during recessionary periods as it stimulates the outflow from unemployment, which is suppressed at an extremely low level.

[4] The HIRE Act provides the tax credit only if the worker is retained for 52 weeks, which is an attempt at restricting job destruction once a match is formed.

[5] The total effect of a $1000 subsidy is an increase in the average unemployment rate by 0.32 percentage point in normal times and by 0.45 percentage point under the benchmark calibration.

[6] The magnitude of the subsidy is equivalent to the proportional hiring subsidy in the HIRE Act.

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