A Search Model of the Lost Generation

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Abstract

We study the effects of labor market policies on the employment distribution in a search-theoretic model of dual labor markets with regular and non-regular jobs. The labor market is dual in the sense that the senior market is separated from the junior one. The regular jobs are charged with payroll and income taxes, while the non-regular jobs with only income tax. In this frame work, the policies protecting the employee's gain have some aggregate effects into the same directions, while the tax policies work with negative feedbacks between sectors. A replacement of payroll tax with income tax, keeping tax wedge constant, does not affect the creation of regular jobs, while it reduces the creation of non-regular jobs.

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1. Introduction

We entered society after the collapse of the bubble. I call this the post-bubble generation. Many of us will continue to live in the face of humiliation. By contrast, many of those of the "economic growth age generation" will continue to live comfortably. This after all is the meaning of "a peaceful society."

.....Right after the collapse of the bubble, both enterprises and workers were thinking only about how to escape the collapse. Companies planned to reduce personnel and labor unions dropped their base-up demands and prioritized restructuring. Both agreed that it was necessary to reduce to the minimum the hiring of new workers. Enterprises cut new hires and tried avoid hiring regular employees. They did so by using agency workers, part-timers and arbeiters.

Society sympathized with middle aged and older workers who were spared restructuring and ignored freeters who could not get regular jobs and were pushed to low-wage work. Because they were not employed from the start, staying unemployed was not considered a problem.

.....In that unequal society in which the haves and the have nots are deeply divided and there is no mobility between them, war ceases to be taboo. Far from it. The anti-war peace slogan is the very thing that is understood as the arrogance of the haves, which keeps us locked in poverty throughout our lives.

Tomohiro Akagi (2007):
"War is the Only Solution.
A 31-year-old freeter explains
the plight and future of
Japan's marginal workers."

The conflict of interests between generations has been a serious issue of the labor market in the OECD countries. Many economists and policy analysts point out that the deregulation on labor contracts and working condition developped in the last few decades has created a huge gap in compensation, other fringe

benefits, and the access to social security between the generations before and after the deregilation. In this paper, I construct a search model of dual labor markets separated markets between junior and senior workers.

It is widely recognized that the employment opportunites for young workers have been deteriorating in the last few decades. Of course, the stagnant economic growth is a major reason of the low employment opportunities for the youth. However, it is increasingly recognized that market institutions and policies are crucial to the long-run labor market performance. There are many plausible stories in which the labor market policies and institutions affect youth unemployment.

First, taxation on employment such as income and payroll taxes might increase youth unemployment by reducing the business' incentive to create jobs. Second, government regulation on working conditions such as hours and intensity may increase hiring costs for firms directly and indirectly: It might prevent employers from allocating labor input effectively, and increase the unit labor costs by strengthing the workers' bargainig power in wage nagotiations. Third, a stronger enforcement of employment protection legislation (EPL) might prevent efficient job destruction and produces more mismatches between jobs and workers: EPL might induce firms to hold old workers with low productivity and prevents them from creating vacancies for talented, young workers.

Tax wedge is a key determinant of long-run labor force participation and working hours in the neo-classical growth model. Prescott (2002, 2004), Alesina-Glaeser-Sacerdote (2006), Coenen-McAdam-Straub (2008) and others, argue that the high tax wedge in Europe is the major cause of its low labor-market participation and low output per workers relative to the US, while the negative supply effect is reported to be relatively small by Nickel (2003). In the search-theoretic analysis of the labor market, however, much work have not yet been done on the tax and subsidy policies except for Mortensen-Pissarides (2003).

In the present paper, the labor market is "dual" in the sense that the job market for workers with previous job experiences is separated from the one for those with no experiences. It becomes increasingly difficult for new school graduates to find adequate and stable jobs in the OECD countries. The longer they stay in the unemployment pool, the more likely they become unemployable, since firms are less willing to hire workers who have been spending so much time in the pool of the unemployed. Unemployed workers might loose their employablity because their trainability deteriorates as time goes on. The gap in job opportunities among workers are anlyzed by various authors, focussing on the skill-biased technological progress. As is in Saint-Paul (1996), Acemoglu (1999), Albrecht-Vroman (2002),

job creation is endogenous in this paper, althoug skill formation is not formally analyzed.

The situation becomes even worse, because the junior unemployed are usually excluded from the social security system. Eligibility for unemploment insurance benefits is often restricted to the unemployed with sufficiently long tenure at previous full-time jobs.

In the present model, there are two types of jobs, good and bad, following the terminology of Accemoglu (2001). The good job is more productive than the bad one. The labor market is frictional, and each worker-firm pair produces a match surplus, to be shared by them through the Nash bargaining. Workers employed at the good job is more protected by law than workers employed at the bad job. Therefore a larger share of match share goes to the former than to the latter. However, the bad job has its own advantage over the good one, which is charged not only with income tax but also with payroll tax, while the bad job is charged only with income tax. Job vacancies are created endogenously by entrepreneurs, who consider the productivity gap, the legal protection, and the tax burden at once. Young workers enter the economy as "good" unemployed, who can be hired at both the good and bad jobs. However, a random shock deteriorates them to bad workers, who can be hired only at the bad job. I share a similar intuition with Moen (2003) on the externality that the good jobs impose on the bad jobs. In Moen, workers are heterogeneous, while workers are homogeneous and jobs are heterogeneous in this paper.

The main results of the paper are as follows. I interpret the workers' bargaining power in the surplus division as the degree of employee protection by law. The good job is more protected by law and then the larger share of the match surplus goes to the employee, while a zero or only fixed amount of the surplus is obtained by he employee at the bad jobs. The difference of the bargaining power between the jobs types distinguishes my paper from Acemoglu (2001), in which the worker's share is identical in both types, and the fraction of the good job is always too low, since the wage is not equated between the types due to the constant sharing of the match surplus. That is, the wage at the good job is too high, while the wage at the bad job is too low. Acemoglu does not discuss the overall efficiency of job creation. In the present paper, however, the worker's bargaining power is $\beta \in [0,\ 1]$ in the good job but zero in the bad job. Therefore there are too many vacancies of the bad job, while the efficiency of the good job sector depends on the comarison of the worker's share with the elasticity of the matching function.

The effects of taxation are even more complicated with the interation between

the sectors. The labor market tightness in the good job sector is determined solely by the tax wedge, and is not affected by the ratio of payroll tax to income tax. However, the labor market tightness in the bad job sector is affected by the tax wedge in the good job sector as well as by the income tax in the bad job sector. The higher tax wedge with constant income tax reduces employment in the good sector, while it increases employment in the bad sector, since the latter is exempt from payroll tax.

The goal of this paper is to explore the impacts of the labor market policies on the welfare of the young unemployed, good or bad. The welfare of the unemployed is a weighted average of the discounted present values of the upcoming states of the good and bad employment. A rise in the employee's gain increases the values, and reduces the chances, of being employed. Therefore its impacts on the welfare of the employed are mixed and ambiguous. It should be noted that the effects of employee protection are not restricted to the sector where the policy is imposed, but spread to the whole economy with a positive feed back in values, and a negative feed back in propabilities: More protection of the good job employees improves the value of the bad job employment through the consideration of future job prospects. More protection of the bad job increases the value of being unemployed, which results in the rise of the threat point in the wage bargaining of the good job. However, the employee protection reduces job creation in the bad jobs as well as in the good jobs.

However, tax reforms affect the creation of both the jobs in opposite directions. A reducing tax wedge with constant income tax rate increases the good job creation and reduces the bad job creation, with increasing values of filled jobs in the both sectors. However, a replacement of payroll tac with income tax under constant tax wedge reduces the bad job creation, with no effects on the good jobs. Therefore the bad unemployed workers *suffer welfare reduction*. If the increasing tax base asscoated with a rise in income tax rate enables the government to reduce the tax wedge under a given tax revenue, it alleviates the welfare loss and might yield a slight gain, depending on the parameters. On the contrary, a tax reform into the opposite direction improves the welfare. The governemnt should replace income tax with payroll tax, if the tax wedge is constant.

The paper is organized as follows. The next section presents the simple model. which is esential to the complete analysis. In section 3, the simple model is extended to the full model, and the implications of the labor market policies and institutions on the young unemployed are explored. More detailed discussions are presented in section 4. Section 5 concludes the paper.

2. The Model

Before presenting the model, I would like to define the labor market policies and institutions explored in this paper.

In the present paper, I discuss the two types of taxation on employment. One is payroll tax, and the other is income tax. Let w be the pre-tax instaneous wage paid to the employee, and τ_p and τ_e be the payroll and income tax rates respectively. Then the effective instantaneous cost of hiring an employee is $(1+\tau_p)w$, and the effective compensation fro an employee is $(1-\tau_e)w$. The tax wedge is defined as

$$\omega = \frac{1+\tau_p}{1-\tau_e} > 0,$$

and is the well-known measure of labor-market distortion. In the present model, income tax is identical to consumption tax, since there is no saving.[1]

Employment protection legislation (EPL) is not explicitly modelled in this paper, since job destruction is exogenous here. I consider the situation in which the government's regulation on working hours and environments is reflected by the worker's bargaining power β in the Nash wage bargaining. It is widely know that a simple transfer of income within a match such as severance pay does not affect the threshold productivity of job destruction. See. for instance, Cahuc and Zilberberg (2004).[2] However, EPL affects the threat points of the bargaining participants and tends to reduce firms' entry. I abstrac the model from these details and adopt a simple 'reduced form' approach to treat β as the measure of employment protection.

We start the analysis with a simple model, in which there is no deterioration of unemployed workers' quality. The transition of agents is illustrated in Figure 1.

Time is continuous. Agents discount the future with discount rate r. There are numerous workers and firms. The population on the worker is normalized to one. The population of firms is determined by the zero-profit condition. Per unit time, δ workers enter the economy, and they die at Poisson rate δ. Thus the workers' population is kept at unity. There are three states of workers: Unemployed,

[1] An interesting politico-economic analysis of the replacement of income tax with consumption is presented by Rios-Rull et al (2006).

[2] Saint-Paul (1995) argues that severance payment should be considered in the employer's match payoff, while it should no be included in that of the employee, since the transfer of severance payment occurs only when one side of them voluntarily destroys the match. Then even a simple transfer affects the match surplus and affects the threshold match productivity.

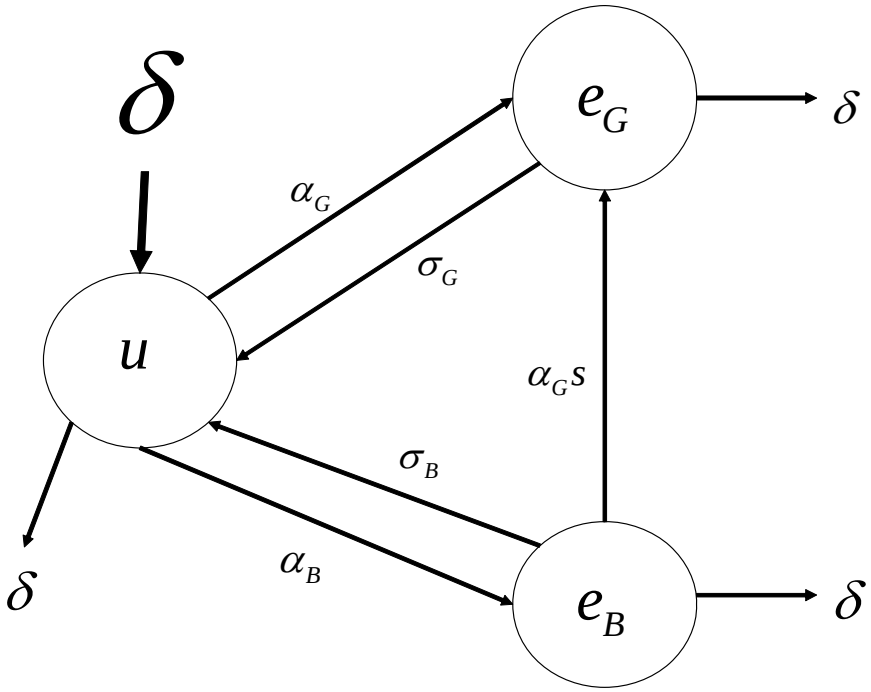

Figure 1: The Simple Model

employed at a good job, and employed at a bad job. The value functions of these three states are denoted by U, W_G, and W_B, respectively, and satisfy the following Bellman equations.

$$\begin{aligned} rU &= z + b + \alpha_G(W_G - U) + \alpha_B(W_B - U) - \delta U \\ rW_G &= (1 - t_e)w_G + \sigma_G[U - W_G] - \delta W_G \\ rW_B &= (1 - t_e)w_B + s\alpha_G(W_G - W_B) + \sigma_B[U - W_B] - \delta W_B \end{aligned} \tag{1}$$

An unmeployed worker consumes home-production output z, and receives unemployment insurance benefit b. At Poisson rate α_G, he is employed by a good employer, while employed by a bad employer at Poisson rate α_B. While employed, a workers receives wage w_G (w_B), which is taxed at income tax rate τ_e. A good (bad) job is destroyed by an exogenous shock that comes at rate σ_G (σ_B), and $\sigma_G < \sigma_B$. An employee at a bad job is engaged in on-the-job search for a good employment, of which the good job chance comes at Poisson rate $s\alpha_G$, where s stands for the relative advantage of disadvantage of on-rhe-job search.

A firm creates a vacancy for a good or bad job when it enters the economy. The value of a firm with a vacancy is denoted by V_i, $i = G,\ B$, while the value of a firm employing a worker is denoted by V_i, $i = G,\ B$. c denotes the instantaneous cost of maintaining a vacancy. A firm with a good (bad) vacancy hires a worker at rate φ_G (φ_B). A good job yields output y_G and a bad job yields y_B ($< y_G$). A payroll tax is charged on all the good jobs at rate t_p, while no payroll tax is charged on a bad job. Both jobs are destroyed by an exogenous shock (at rate σ_G or σ_B) and by the employee's death (at rate δ). A bad job is destroyed more often than a good job, then $\sigma_G < \sigma_B$. In addition, a bad job is destroyed by the employee's quit that occurs rate $s\alpha_G$. The value functions satisfy the following Bellman equations.

$$\begin{aligned} rV_G &= -c + \varphi_G\eta_G[J_G - V_G] \\ rV_B &= -c + \varphi_B\eta_B[J_B - V_B] \\ rJ_G &= y_G - (1 + t_p)w_G + (\sigma_G + \delta)[V_G - J_G] \\ rJ_B &= y_B - w_B + (\sigma_B + \delta + s\alpha_G)[V_B - J_B] \end{aligned} \tag{2}$$

where α_G, α_B, φ_G, and φ_B are the functions of the labor market tightness, θ_G and θ_B, and dereived from a standard CRS matching technology, satisfying

$$\varphi_G = \frac{\alpha_G}{\theta_G}, \quad \varphi_B = \frac{\alpha_B}{\theta_B}.$$

Note that the concavity of the matching function implies

$$\begin{aligned} \alpha'_G(\theta_G) &> 0, \quad \alpha'_B(\theta_B) > 0 \\ \varphi'_G(\theta_G) &< 0, \quad \varphi'_B(\theta_B) < 0. \end{aligned}$$

η_G and η_B are the probabilities that the job applicant is employable. Note that

$$\eta_G = \frac{u + se_B}{u + e_B}, \ \eta_B = 1.$$

We consider such a situation that an on-the-job searcher is not more likely to be matched for employment. Therefore $s \leq 1$ and $\eta_G \leq 1$, while everyone is hired once he meets an employer and $\eta_B = 1$. In order to make the analysis tractable, I assume that $s = 1$ and $\eta_G = 1$. Later I will present some numerical excercises by allowing for the case $s < 1$.

The worker and the firm in a filled job bargain over the wage. The wage bargaining is forward-looking: The worker's threat point is U, the value of unemployment. In a good job, the worker takes fraction β of the surplus, while the worker in a bad job takes a certain reservation value, h, which reflects the degree of legal protection of the bad job.

$$\begin{aligned} W_G - U &= \beta[W_G - U + J_G - V_G], \\ W_B - U &= h. \end{aligned}$$

Each firm chooses its type when it enters the economy. Creating a good job costs k, while creating a bad one costs nothing. Then the job choice condition is given by:

$$V = \max\{V_G - k, \ V_B\}$$

or equivalently,

$$V_G - k = V_B. \tag{3}$$

The entry condition is:

$$V_B = 0 \tag{4}$$

We solve the model as follows. First we solve the value functions of incumbent workers,

$$\begin{aligned} rU &= z + b + \alpha_G(W_G - U) + \alpha_B(W_B - U) - \delta U \\ rW_G &= (1 - t_e)w_G + \sigma_G[U - W_G] - \delta W_G \\ rW_B &= (1 - t_e)w_B + s\alpha_G(W_G - W_B) + \sigma_B[U - W_B] - \delta W_B \end{aligned}$$

to obtain

$$D_G \equiv W_G - U, \quad D_B \equiv W_B - U.$$

Second, with (3) and (4). we solve the firm's value functions,

$$\begin{aligned} rk &= -c + \varphi_G \eta_G [J_G - k] \\ 0 &= -c + \varphi_B \eta_B J_B \\ rJ_G &= y_G - (1+t_p) w_G + (\sigma_G + \delta)[k - J_G] \\ rJ_B &= y_B - w_B - (\sigma_B + \delta + s\alpha_G) J_B \end{aligned}$$

to obtain the reduced forms of φ_G, φ_B, J_G, and J_B, as functions of wages, w_G and w_B. Note that

$$E_G \equiv J_G - k, \quad E_B \equiv J_B.$$

Third, we find the wages to solve the Nash bargaining:

$$D_G = \beta(D_G + E_G), \quad D_B = h.$$

We substitute the reduced forms of the wages into the expressions of φ_G and φ_B obtained at the the second step. To obtain clear analytical results, we assume $h = 0$. The labor market tightness in the good job sector, θ_G, is implicitly determined by

$$\varphi_G(\theta_G) = \Lambda_G, \tag{5}$$

where

$$\Lambda_G = \frac{(rk + c)[(r + \delta + \sigma_G)(1 - \beta + \beta\omega) + \alpha_G(\theta_G)]}{\eta_G(1 - \beta)\{y_G - rk - \omega[b + z]\}}$$

and

$$\omega = \frac{1 + t_p}{1 - t_e}$$

is the tax wedge. The left-hand side of (5) is decreasing in θ_G, while the right-hand side is increasing in θ_G. Therefore the equilibrium is uniquely determined. Note that Λ_G does not depend on t_p or t_e, but only on ω, the tax wedge. Hence we have obtained the well-known irrelevance proposition: any tax reform which does not affect the tax wedge is irrelevant for the good job employment. The determination of the labor market tightness is illusrtaed in Figure 2.

It is straightforward to see that

$$\frac{d\Lambda_G}{d\omega} = \frac{(rk + c)\{(r + \delta + \sigma_G)(1 - \beta)(b + z) + (y_G - rk)[r + \delta + \sigma_G + \alpha_G(\theta_G)]\}}{[rk - y_G + \omega(b + z)]^2 (1 - \beta)\eta_G} > 0.$$

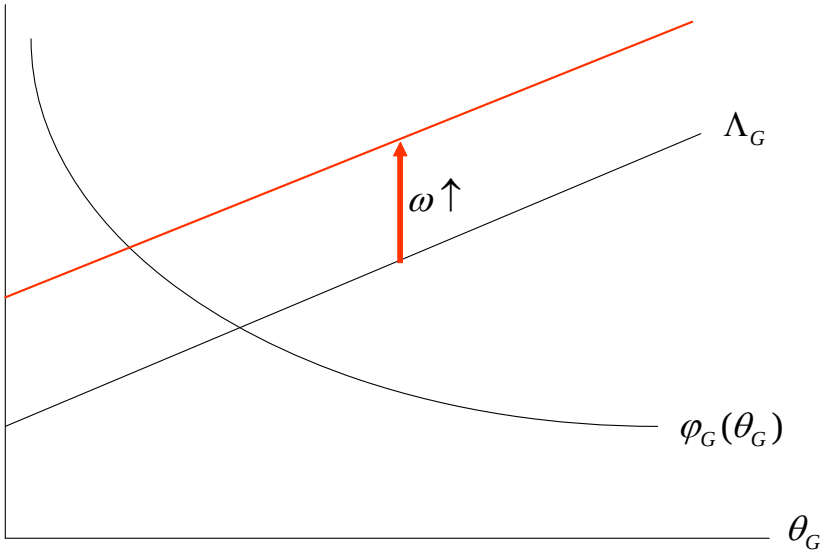

Figure 2: The Determination of θ_G

that is, Λ_G shifts up as the tax wedge increases, which reduces the tightness in the good job sector, as is illusrated in Figure 2.

Let us turn our attention to the bad job employment. We obtain

$$\frac{1}{\varphi_B(\theta_B)} = \Lambda_B, \tag{6}$$

where the expression of Λ_B is too complex to be presented here. Note that the left-hand side of (6) is increasing in θ_B, and its right-hand side is not affected by θ_B, and then the solution is unique. It is straightforward to see that

$$\frac{d\Lambda_B}{d\omega} = \frac{(1-s)\{(r+\delta+\sigma_G)(b+z)(1-\beta)+(r+\sigma_G+\alpha_G)(y_G-rk)\}\alpha_G\beta\eta_B}{(1-t_e)[(r+\delta+\sigma_G)(1-\beta+\beta\omega)+\alpha_G\beta\omega][r+\delta+\sigma_B+s\alpha_G(\theta_G)]c} > 0$$

Then a rise in the tax wedge in the good job sector increases the entry into the bad job sector, as is illustrated in Figure 3.

Consider the replacement of payroll tax with income tax, which is identical to increasing income tax rate t_e for a given tax wedge. We have

$$\frac{d\Lambda_B}{dt_e} = \frac{-(b+z)\{(r+\delta+\sigma_G)[\beta(\omega-1)+1]+\alpha_G(\theta_G)(1-s)\beta(y_G-rk)]\}\eta_B}{(1-t_e)^2\{(r+\delta+\sigma_G)[\beta(\omega-1)+1]+\alpha_G(\theta_G)\beta\omega]\}[r+\delta+\sigma_B+s\alpha_G(\theta_G)]c} < 0.$$

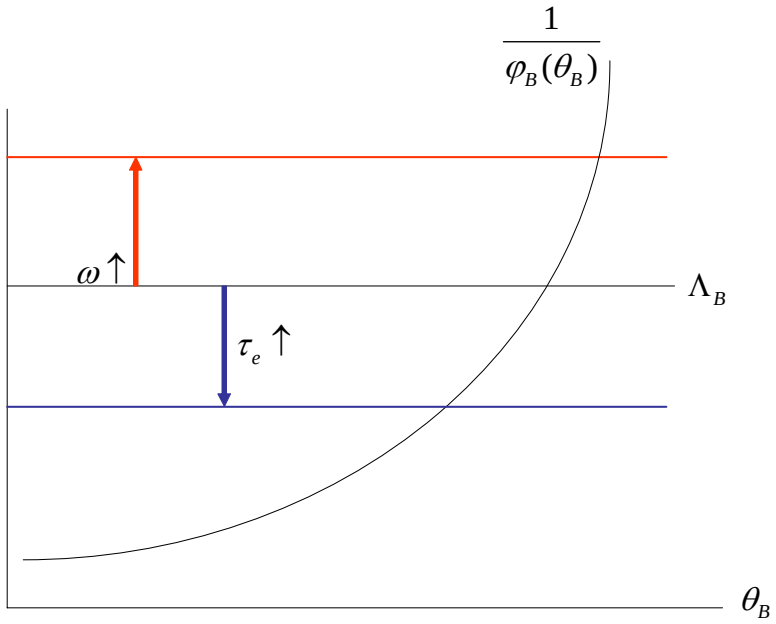

Figure 3: The Determination of θ_B

That is, a rise in the income tax shifts the Λ_B locus down, and decreases θ_B. Therefore a replacement of payroll tax with income tax decreases the entry into the non-regular sector as is illustrated in Figure 3, while it does not affect the job creation in the regular sector. The comparative statics are summarized in the following proposition.

Proposition 1. *In the simple model of dual labor markets, we have the following.*

1. *In the good sector, the labor market tightness and the job creation are solely determined by the tax wedge. A rise in the tax wedge reduces the good job creation.*

2. *In the bad job sector, the labor market tightness is determined not only by the tax wedge but also by the income tax rate. A rise in the tax wedge shifts employment from the good to the bad sector.*

3. *A tax-wedge neutral replacement of payroll tax with income tax does not affect the good job creation, while it reduces the bad job creation.*

The interpretation of the last result in the proposition is straightforward. Increasing income tax with no change in the tax wedge does not change the tax burden on the good job sector, while it increases the burden on the bad job sector. Then the economy is more distorted after the reform. Due to the reduction in the bad job creation, in order to make the same tax revenue, the government might need to raise the income tax rate, which makes the situation even worse. Increasing income tax rate is compensated by a reduction in the payroll tax rate with no substantial effect in the good sector. In the bad sector, increasing tax revenue with the income tax rise is partially offset by the reduction of job creation.

Given tax wedge, a tax reform to substitute payroll tax with income tax has no effect on the good job creation, while it reduces the bad job creation because the bad job creation is more distorted by the reform. Therefore, a wedge-neutral tax reform to replace payroll tax with income tax might yield a government surplus or deficit, depending on the extent to which the reduction in job creation is compensated by the larger tax base. If the reduction in the labor market tightness is relatively small, the government would obtain a surplus. In other words, the governemnt can reduce the tax wedge on the good job by further reducing the payroll tax rate to finance the fixed expenditure. On the contrary, if the job creation in the bad job sector is sufficiently elastic to the income tax rate, a revenue-neutral

reform requires a higher tax wedge in the good job sector. Futhermore, a simple (not wedge-neutral) replacement of payroll tax with income tax raises tax wedge, and even reduces the labor market tightness in the good job sector.[3]

3. The Extended Model

In the simple model, the unemployed worker's quality does not deteriorate. The labor market is integrated over the two types of jobs, and all the unemployed workers are endowed with equal job opportunities. In this section I will extend the model to introduce a true duality into the labor market as follows. Once the unemployed worker's quality deteriorates, he can no longer apply for the good job, and is allowed to apply only for the bad job. In other words, good workers are entitled to apply both the good and bad jobs, while bad workers are allowed to apply only for the bad jobs. Another source of duality is the access to social security. All the unemployed workers with previous good or bad job experiences can receive the unemployment benefit, while all the workers with no previous job experience is not eligible for the unemployment benefit. The labor market is divided by the workers' history with or without job experiences. Once workers are hired, they are promoted to the upper market in which they are protected by the government's social security program, and would never go back to the pool of the unemployed with no legal protection. The simple model is a world of workers with previous job experiences, who are legally protected and allowed to obtain a part of job match surplus. The extended model has the simple model as a submarket, which does not depend the rest of the labor market.

Time is continuous. There are numerous workers and firms. There are two types of jobs: good and bad, which are endogenously created. The workers' population is normaliezed to one, while the firms' poluation is determined by entry and exit. Workers are either employed or unemployed. Per unit time, δ workers enter the economy, while each worker dies at Poisson rate δ, so the population is kept at unity. The new workers are good in the sense that they can be employed

[3]Let τ_p and τ_e be the payroll and income tax rates respectively. Then the tax wedge is written as $\frac{1+\tau_p}{1-\tau_e}$. With a simple replacemnt of payroll tax with income tax, the income tax rates is raised by ϵ and the payroll tax rate is reduced by the same amount. Then the tax wedge increase since

$$\frac{1+\tau_p-\epsilon}{1-\tau_e-\epsilon}-\frac{1+\tau_p}{1-\tau_e}=\frac{\epsilon(\tau_p+\tau_e)}{(1-\tau_e-\epsilon)(1-\tau_e)}>0.$$

not only at bad jobs but also at good jobs. They become bad workers at Poisson rate λ. Bad workers are so in the sense that they can be hired only at bad jobs. The good unemployed can find an employment opportunity at good jobs at rate $\alpha_G(\theta_G)$ and at bad jobs at rate $\alpha_B(\theta_B)$, where $\theta_i,\ i = G,\ B$, is the labor-market tightness of the good (bad) job sector. An employee at a bad job is engaged in on-the-job search for a good job. He is employed by a good employer at Poisson rate $\alpha_G(\theta_G)s$, where $q \in [0,\ 1]$: It is less often for an employee at a bad job to be employed at a good job than for a good unemployed worker. As is found by Nakajima (2008), on-the-job search is not so effective as off-the-job search. A filled job is destroyed by a shock at rate σ_G or σ_B. A bad job is destroyed more often than a good job, then $\sigma_G < \sigma_B$. Once a job is destroyed, a worker goes to the same unemployment pool, u, no matter if they were employed at a good or bad job. They resume employement at a good job with Poisson rate $\alpha_G(\theta_G)$, and at a bad job with Poisson rate $\alpha_B(\theta_B)f$.

I introduce some minor parameters to match the model to the real labor market in the numerical exceicises. Good unemployed workers with no job experiences, always accept a good job offer, while accepting a bad one with probability $f \in [0,\ 1]$. Bad workers receive no good job offer, and a bad job offer with probability $\alpha_B(\theta_B)q$ where $q \in [0,\ f]$. That is, a bad worker is no more likely to be employed at a bad job than a good worker. The transition of workers is illustrated in Figure 4.

The good job is distinct from the bad job in the three senses. First, the former is more productive than the latter, that is, $y_G > y_B$. Second, the former is destroyed less often than the latter, that is, $\sigma_G < \sigma_B$. Third, the former is charged on not only with income tax but also with payroll tax, while the latter is charged on only with income tax. Let t_p and t_e denote the payroll and income tax rates respectively. All the unemployed workers with no previous job experiences receive instantaneous income z, while the unemployed with job experiences receive unmployment benefit b in addition to z.

The extended model is identical to the simple model except for the two additional value functons. The value functions of the good unemployed U_G, the bad unmployed U_B, satisfy the following Bellman equations.

$$\begin{aligned} rU_G &= z + \alpha_G(W_G - U_G) + f\alpha_B(W_B - U_G) + \lambda(U_B - U_G) - \delta U_G \\ rU_B &= z + q\alpha_B(W_B - U_B) - \delta U_B \end{aligned} \tag{7}$$

The Bellman equations for $U,\ W_G,\ W_B$ are identical to (1).

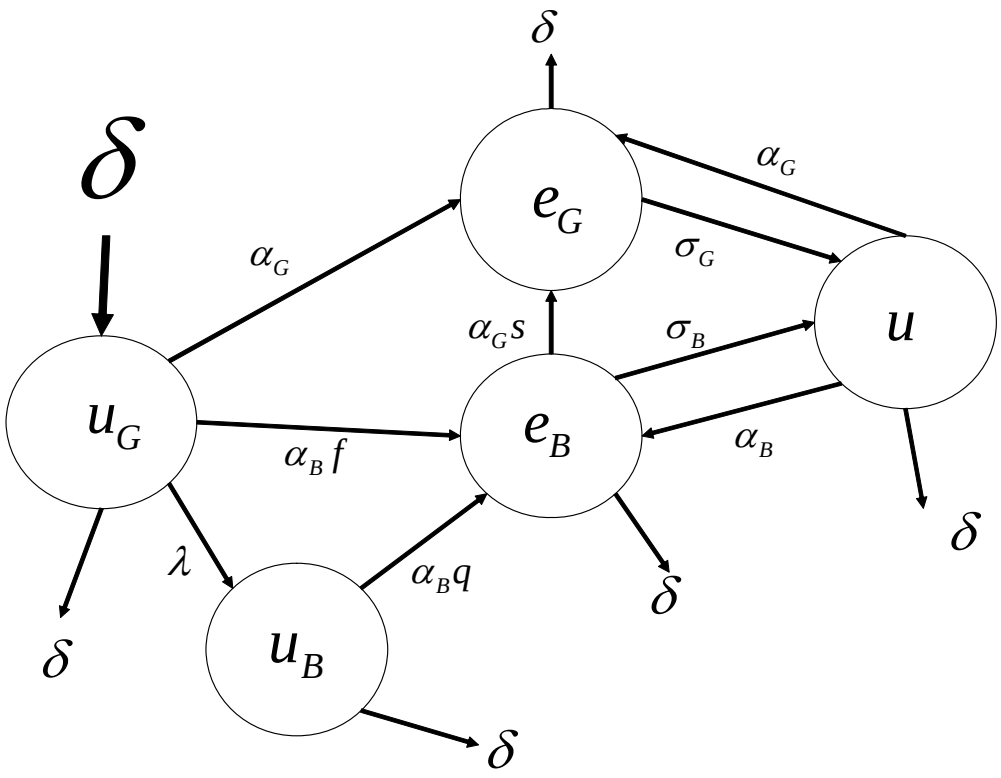

Figure 4: The Extended Model

Firms create good or bad job vacancies when they enter the economy. Creating a good job vacancy costs k, while creating a bad job costs nothing. They pay instantaneous vacancy cost c. A firm with a vacancy meet a job-seeking worker at Poisson rate $\varphi_i(\theta_i),\ i = G,\ B$. The firm hire him with probability $\eta_i,\ i = G,\ B$. Both $\varphi_i(\theta_i)$ and η_i are endogenously determined in the model. The employer of a filled good (bad) job pays wage w_G (w_B) to the employee and payroll tax $t_p w_G$ ($t_p w_B$) to the government. A filled job is destroyed by an exogenous shock that comes at Poisson rate σ_G (σ_B) and the employee's death that comes at rate δ. In addition, a bad job is destroyed as the employee quits to switch to a good job at rate $s\alpha_G$. The Bellman equations for the firms are identical to the the firms' value functions satisfy are identical to (2), except for the hiring probabilitues:

$$\eta_G = \frac{u_G + se_B + u}{u_G + e_B + u},\ \eta_B = \frac{fu_G + qu_B + u}{u_G + u_B + u}$$

q and s are exogenously given, while f is chosen by the good worker unemployed as follows.

$$f \left\{ \begin{array}{c} = 1 \\ \in (0,\ 1) \\ = 0 \end{array} \right\} \quad \text{if} \quad \min[W_B - U_G,\ W_B - U] \left\{ \begin{array}{c} > \\ = \\ < \end{array} \right\} 0$$

That is, the good unemployed accepts a bad job if it yields a positive gain.

The wage bargaining and the vacancy creation are similar to those of the simple model with relevant notation changes. We assume that the wage bargaining is forward-looking. That is, the worker's threat point is U, the value of the unemployed with previous job experiences.

$$\begin{aligned} W_G - U &= \beta[W_G - U + J_G - V_G], \\ W_B - U &= h. \end{aligned}$$

The matching technology exhibits the CRS:

$$\begin{aligned} \alpha_G(\theta_G) &= \frac{m(u_G + e_B + u,\ v_G)}{u_G + e_B + u} = m\left(1,\ \theta_G\right) \\ \alpha_B(\theta_B) &= \frac{m(u_G + u_B + u,\ v_B)}{u_G + u_B + u} = m\left(1,\ \theta_B\right) \end{aligned}$$

where

$$\theta_G = \frac{v_G}{u_G + e_B + u},\ \theta_B = \frac{v_B}{u_G + u_B + u_O}$$

φ_G and φ_B are defined as

$$\varphi_G(\theta_G) = \frac{\alpha_G(\theta_G)}{\theta_G}, \quad \varphi_B(\theta_B) = \frac{\alpha_B(\theta_B)}{\theta_B}$$

Note that the concavity of the matching function implies

$$\begin{aligned} \alpha'_G(\theta_G) &> 0, \quad \alpha'_B(\theta_B) > 0 \\ \varphi'_G(\theta_G) &< 0, \quad \varphi'_B(\theta_B) < 0. \end{aligned}$$

That is, the tighter the market is, the more often the worker meets a firm with a vacancy, and the less often the firm meets a worker.

We solve the model recursively: First, we solve the market for the workers with previous experiences, (1) and (2). Then we substitute the solution into (7) to obtain the whole equilibrium. We finally obtain the labor market tightness θ_G in the good job sector implicitly by

$$\varphi_G(\theta_G) = \Lambda_G,$$

where Λ_G is identical to the expression obtained in (5):

$$\Lambda_G = \frac{(rk+c)[(r+\delta+\sigma_G)(1-\beta+\beta\omega)+\alpha_G(\theta_G)]}{\eta_G(1-\beta)\{y_G - rk - \omega[b+z]\}}$$

and

$$\omega = \frac{1+t_p}{1-t_e}$$

is the tax wedge. Here we assume $h = 0$; the non-regular employment is not protected by law, in order to make the analysis tractable. The labor market tightness θ_B in the bad job is determined by

$$\frac{1}{\varphi_B(\theta_B)} = \Lambda_B$$

The expression for Λ_B is identical to the one in (6).

The extended model has a recursive structure and the firm section and the experienced section are independent of whatever occurs to workers with no experience. Therefore we obtain the same analytical results obtained in Proposition 1.

The property of the senior market is identical to the simple model. Our interest rests on the impacts of the labor market policies on the junior market. The value

functions of the junor workers are weighted average of the value functions of the good and bad employment, and can be written as

$$\begin{aligned} U_G &= \frac{(r+\delta+q\alpha_B)\alpha_G W_G + [fq\alpha_B + \lambda q + f(r+\delta)]W_B + (q\alpha_B + \lambda + r + \delta)z}{(r+\delta+q\alpha_B)(\alpha_G + f\alpha_B + \lambda + r + \delta)}, \\ U_B &= \frac{z + q\alpha_B W_B}{r+\delta+q\alpha_B}. \end{aligned}$$

Note that a rise in W_G is assoiciated with a decline in $\alpha_G(\theta_G)$, while a rise in W_B is assiciated with a decline in $\alpha_B(\theta_B)$. That is, the more attractive a job is, the more difficult it is to get it. Therefore a rise in W_G or W_B increases both U_G and U_B, while the increasing value is partly cancelled by the associated reduction in the labor market tightness.

$\beta,\ \omega,\ \tau_e,\ h,\ s,\ q$ are the policy or institutional variables in this model. β is the bargaining power of workers reflecting the government's regulation on various working conditions. ω is the tax wedge determining the efficiency of the good job. A tax reform to replace payroll tax with income tax under a constant tax wedge is captured by a rise in τ_e. The protection of the bad job is reflected by h. s is a measure of the easiness of on-the-job search. q is the degree of disadvantage of the bad unemployed relative to the good unemployed. $(\theta_G,\ \theta_B,\ W_G,\ W_B)$ is a set of variables keen to our interests. These policy variables pin down the equilibrium values of them.

The whole system is reduced to the two equations, (5) and (6), which determine θ_G and θ_B. The reduced forms of W_G and W_B are complex. However, the partial derivatives of them with respect to thse policy variables are obtained as follows.

$$\begin{aligned} \frac{\partial W_G}{\partial \beta} &= \frac{(r+\delta+\alpha_G)(r+\delta+\sigma_G)[y_G - rk - \omega(z+b+\alpha_B h)]}{(r+\delta)[something]^2} > 0 \\ \frac{\partial W_B}{\partial \beta} &= \frac{(r+\delta+\sigma_G)[y_G - rk - \omega(z+b+\alpha_B h)]\alpha_G}{(r+\delta)[something]^2} > 0 \end{aligned}$$

A rise in the worker's bargaining power tends to increase not only the value of a good job employee but also that of the bad job employee.

$$\frac{\partial W_G}{\partial s} = \frac{\partial W_B}{\partial s} = 0.$$

A rise in the effectiveness of on-the-job search does not affect W_G or W_B. On-the job search increaes the continuation value of the match bu reduces its current

	β	s	h	ω	τ_e
θ_G	$-$	0	$-$	$-$	0
θ_B	$-$	$-$	$-$	$+$	$-$
W_G	$+$	0	$+$	$-$	0
W_B	$+$	0	$+$	$-$	0

Table 1: Comparative Statics

value, therefore, a rise in s does not change W_B.

$$\begin{aligned}
\frac{\partial W_G}{\partial h} &= \frac{\alpha_B[(1-\beta)(r+\delta+\sigma_G)+\omega(\sigma_G-\delta)]}{(r+\delta)[(1-\beta)(r+\delta+\sigma_G)+\omega(r+\sigma_G+\alpha_G)]} > 0 \\
\frac{\partial W_B}{\partial h} &= \frac{r+\delta+\alpha_B}{r+\delta} - \frac{\beta\omega\alpha_G\alpha_B}{(r+\delta)[(1-\beta)(r+\delta+\sigma_G)+\omega(r+\sigma_G+\alpha_G)]} > 0
\end{aligned}$$

A rise in the worker's gain at the bad job increases the welfare of the value not only of the bad but also good employee. A similar result is pointed by Acemoglu (2001) as the effect of minimum wage.

The derivatives of W_G and W_B w.r.t. ω are complex. However, we obtain

$$\begin{aligned}
&\frac{\partial W_G}{\partial \omega} \\
= &\left(\frac{r+\delta+\alpha_G}{\alpha_G}\right)\frac{\partial W_B}{\partial \omega} \\
\propto &\ \beta(rk-y_G)(r+\sigma_G+\alpha_G) - (1-\beta)(r+\delta+\sigma_G)(z+b+\alpha_B h) < 0
\end{aligned}$$

The larger tax wedge on the good job sector with a constant income tax rate and an increasing payroll tax rate, reduces the values of the employed workers, with the larger extent for the good job employee. On the contrary, we have

$$\frac{\partial W_G}{\partial \tau_e} = \frac{\partial W_B}{\partial \tau_e} = 0.$$

The replacement of payroll tax with income tax has no direct effect on the values of the employed. However, it has indirect effects through the firms' entry.

The effects of policy changes are listed in Table 1.

The policy implications are summerized as follows.

1. A rise in the general protection of the good job increases the welfare of both types of jobs, while it reduces the availability of jobs. Its overall effects on

the welafare of the junior unemployed are ambiguous, since they can get higher job welfare with lower probabilities.

2. On-the-job search does not affect the employees' values and the labor market tightness in the good job sector. However, it reduces the creation of the bad jobs. Then the over all effects on the junior unemployed tend to be negative.

3. A stronger protection of the bad job employees increases the values of both types of jobs, while it reduces the creation of them. Again the overall effects on the welfare of unemployed are ambiguous.

4. A higher tax wedge on the good job reduces the value of the employees of both types and the creation of the good jobs. However it increases the creation of the bad jobs, since it is associated with a constant income tax rates and an increasing payroll tax rates. It also reduces the values of the employees at both types of jobs. The overall effects on the junior employed might be negative.

5. A tax reform to replace payroll eax with income tax under constant tax wedge reduces the creation of the bad jobs, while the employees' values and the labor market tightness of the good job are not affected. The overall effects on the junior unemployed might be slightly negative.

A rise in the employee's gain (β and h) increases the values, and reduces the chances, of being employed. Therefore its impacts on the welfare of the employed are mixed and ambiguous. It should be noted that the effects of employee protection are not restricted to the sector where the policy is imposed, but spread to the whole economy with a positive feed back in values, and a negative feed back in propabilities: More protection of the good job employees improves the value of the bad job employment through the consideration of future job prospects, while it reduces the job creation in both the sectors. More protection of the bad job increases the value of being unemployed, which results in the rise of the threat point in the wage bargaining of the good job. However, it also reduces job creation not only in the bad jobs but also in the good jobs.

However, tax reforms affect the creation of both the jobs in opposite directions. A reducing tax wedge with constant income tax rate increases the good job creation and reduces the bad job creation, with increasing values of filled jobs in the both sectors. However, a replacement of payroll tac with income tax under constant tax wedge reduces the bad job creation, with no effects on the good jobs.

Therefore the bad unemployed workers *suffer welfare reduction*. If the increasing tax base asscoated with a rise in income tax rate enables the government to reduce the tax wedge under a given tax revenue, it alleviates the welfare loss and might yield a slight gain, depending on the parameters. On the contrary, a tax reform into the opposite direction improves the welfare. The governemnt should replace income tax with payroll tax, if the tax wedge is constant.

4. Discussion

To be completed. The social optimum and numerical examples.

5. Conclusion

To be Completed

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