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Payroll Tax Reform and Job Distribution

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Abstract

Taxation on employment is explored in a labor search model with two types of jobs of different productivity and on-the-job search. The high-productive job is charged with both payroll and income taxes, while the low-productive jobs with income tax only. A tax reform to reduce payroll tax and raise income tax shifts the steady-state equilibrium distribution of jobs toward less productive ones. The result stands in a sharp contrast to the usual argument that replacement of payroll tax with income tax creates more of high-productive jobs.

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1 Introduction

In this paper we explore the effects of tax reform replacing payroll tax with income tax in a standard search model of labor market with heterogeneous jobs. Tax wedge is widely recognized as a major source for distortion in the labor market. For example, Prescott (2002, 2004) argues that the high tax is the principal reason why the European economies are depressed to the US economy in terms of GDP per labor force. He says that employees' incentive to work is seriously distorted toward leisure because of the high tax wedge.

Tax wedge is formed by a variety of taxes. In this paper I focus on payroll and income taxes. In the recent years, payroll tax has been increasingly recognized as a serious obstacle that prevents private sectors from creating jobs. In fact, reducing payroll tax is often proposed as a policy to create jobs and promote growth in advanced economies. In many policy discussions, it is argued that payroll tax should be replaced by income tax or consumption tax. However, it is a widely shared view that replacing payroll tax with income tax is irrelevant because the tax base is the same. There are some cases in which the irrelevance fails, due to tax exemption (Koskelaa and Schobb [1999]), tax evasion (Goerke [2005]), minimum wage (Picard and Toulemonde [2001]), and others. However, with a usual Nash wage bargaining, irrelevance is obtained in general. Therefore investigating payroll tax reform in a standard one-sector labor search model with the Nash bargaining might be trivial.

Instead, in this paper, we build a labor search model with two types of jobs to obtain non-trivial effects of a tax reform to replace payroll tax with income tax. There are high-productive, good jobs and low-productive, bad jobs. The good jobs are burdened with payroll and income taxes, while the bad jobs are charged with income tax only. We use such a language that payroll tax is charged on employers, while income tax is charged on employees. In the usual tax policy discussion, it is widely believed that reducing payroll tax will create more good jobs, and shifts the employment distribution toward good jobs. However the present model reveals something different: Replacing payroll tax with income tax *decreases* the steady-state population of workers employed at the good job, while it promotes firms' entry, reducing the unemployment rate and raising the labor market tightness. This, rather unintuitive and non-neutral result is explained as follows. Reducing payroll tax and raising income tax does not significantly change the tax wedge in the good job. However, the bad job is taxed more heavily than before. Since creating a good job is more costly than creating a bad job, and the tax reform induces firms to create less good jobs and more bad jobs.

The paper is organized as follows. In the next section, the model is presented. In Section 3, the model is solved analytically, and some policy exercises are conducted numerically. In Section 4, we discuss the remaining issues and some plausible extensions of the model. Section 5 is a supplementary discussion of payroll tax reform in the framework of collective bargaining between employers and employees. Section 6 concludes the paper.

2 The Model

In order to focus on the effects of the tax reform on job creation, we build a labor market with two types of jobs in the spirit of Acemoglu [1998]. There are two types of jobs. One is high-productive and the other is low-productive. We call the former 'good,' and the latter 'bad.' We abstract from productivity change within a job, but introduce on-the-job search at the bad job. The matching of workers to jobs is frictional: An employment chance comes to a job-seeking worker at Poisson rate $\alpha(\theta)$, where θ is the labor market tightness. The proportion of the good job offer is π, while the proportion of the bad job is given by $1-\pi$. A good job is taxed by the government with payroll and income taxes, while a bad job is burdened with income tax only. Let t_p and t_e denote the payroll and income tax rates, respectively.

Time is continuous. Workers are either unemployed, employed at a good job, or employed at a bad job. Their values are given respectively by U, W_G, and W_B. The value functions satisfy the Bellman equations such as:

$$
\begin{aligned}
rU &= b + \alpha_w(1-\pi)[W_B - U] + \alpha_w \pi [W_G - U] \\
rW_G &= (1-t_e)w_G + \sigma[U - W_G] \\
rW_B &= (1-t_e)w_B + \sigma[U - W_B] + \alpha_w s[W_G - W_B]
\end{aligned}
$$

where b is the unemployment benefit. A job seeking worker meets a job vacancy at Poisson rate $\alpha_w(\theta)$. A vacancy is 'good' with productivity π and 'bad' with productivity $1-\pi$. If a worker is employed at a good (bad) job, he receives wage w_G (w_B). The wage is taxed by income tax at rate t_e. Each job is destroyed by an exogenous shock that comes at Poisson rate σ. A worker at a bad job searches for employment at a good job. s is the parameter denoting the efficiency of on-the-job search.

The value functions of firms with a vacancy is denoted by V, while J denotes the value functions of firms with filled jobs. The subscripts G and B denote the type of jobs. The Bellman equations presented similarly:

$$
\begin{aligned}
V &= \max\{-k + V_G,\ V_B\} \\
rV_G &= \alpha_e[J_G - V_G] \\
rV_B &= \alpha_e[J_B - V_B] \\
rJ_G &= y_G - (1+t_p)w_G + \sigma[V - J_G - T] \\
rJ_B &= y_B - w_B + (\sigma + \alpha_w s)[V - J_B]
\end{aligned}
$$

$\alpha_e(\theta)$ is the Poisson rate at which a firm with a vacancy meets a job-seeking worker. The output of each job, y_G or y_B, depends on the job type, and $y_G > y_B$. The wage is taxed at rate t_p before it is paid to the employee. When a job is exogenously destroyed by a shock, each employer pays firing tax T to the government. A negative T is transfer. After a job is destroyed, each firm decides on the type of the next job vacancy. The cost to create a bad job is zero, while creating a good job is more costly by k than creating a bad one. The fraction π of the good job vacancy is determined by

$$-k + V_G = V_B \tag{1}$$

The wages are determined by the Nash bargaining. We assume that the bargaining power of the good job workers is protected by employment protection legislation (EPL) and set at $\beta \in [0,\ 1]$, while the bargaining power of the bad job workers is set at zero and their wages are determined at the sustainable level. In other words,

$$W_G - U = \beta S_G, \tag{2}$$

$$W_B - U = 0, \tag{3}$$

where

$$S_G = W_G - U + J_G - V_G$$
$$S_B = J_G - V_G$$

The government budget constraint is

$$bu = (t_p + t_e) w_G e_G + t_e w_B e_B + T\sigma e_G \tag{4}$$

where

$$u = 1 - e_G - e_B, \tag{5}$$

where $u,\ e_G,\ e_B$ respectively denote the mass of unemployed workers, workers employed at good and bad jobs.

The usual steady-state distribution accounting is given by,

$$\sigma e_G = \alpha_w \pi (1 - e_G - e_B) + \alpha_w \pi s e_B \tag{6}$$

$$\alpha_w \pi s e_B + \sigma e_B = \alpha_w (1 - \pi)(1 - e_G - e_B) \tag{7}$$

and illustrated in Figure 1.

The labor market tightness θ is defined by

$$\theta = \frac{f - e_G - e_B}{1 - e_G},$$

where the mass of firms is denoted by f, which is implicitly determined by the entry condition with cost c,

$$V_B = c, \tag{8}$$

which determines the labor market tightness θ. The Poisson rate for a worker to meet a vacancy is defined by

$$\alpha_w = \frac{m(1 - e_G,\ f - e_G - e_B)}{1 - e_G} = m\left(1,\ \frac{f - e_G - e_B}{1 - e_G}\right)$$

where $m(.,.)$ is the usual matching function which exhibits constant returns to scale. Then the Poisson rate for a firm to meet a job-seeking worker is given by

$$\alpha_e = \frac{m(1 - e_G,\ f - e_G - e_B)}{f - e_G - e_B} = m\left(\frac{1 - e_G}{f - e_G - e_B},\ 1\right)$$
$$= \frac{1 - e_G}{f - e_G - e_B} m\left(1,\ \frac{f - e_G - e_B}{1 - e_G}\right) = \frac{\alpha_w}{\theta}.$$

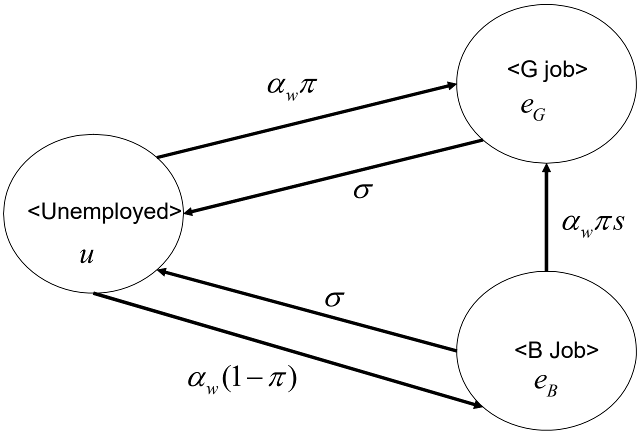

Figure 1: The Workers' Flow

3 Solving the Model

Solving the whole model analytically is a difficult task to conduct, since the steady-state accounting is not independent of the value functions, and vice versa. Therefore we divide the whole task into two steps. First, we analytically solve the system of value functions and the equations to determine the wages w_G and w_B, the labor market tightness θ, and the good job vacancy ratio π, taking the distribution of the agents as given. Second, we solve the whole model numerically.

Taking the above discussion into consideration, we can simplify the value functions to

$$
\begin{aligned}
rU &= b + \alpha_w \pi [W_G - U] \\
rW_G &= (1 - t_e) w_G + \sigma [U - W_G] \\
rW_B &= (1 - t_e) w_B + \alpha_w s [W_G - W_B]
\end{aligned}
$$

The value functions of firms are:

$$
\begin{aligned}
r(c + k) &= \alpha_e [J_G - c - k] \\
rc &= \alpha_e [J_B - c] \\
rJ_G &= y_G - (1 + t_p) w_G + \sigma [c - J_G - T] \\
rJ_B &= y_B - w_B + (\sigma + \alpha_w s)[c - J_B]
\end{aligned}
$$

Together with the job choice condition (1), the wage bargaining condition (2),

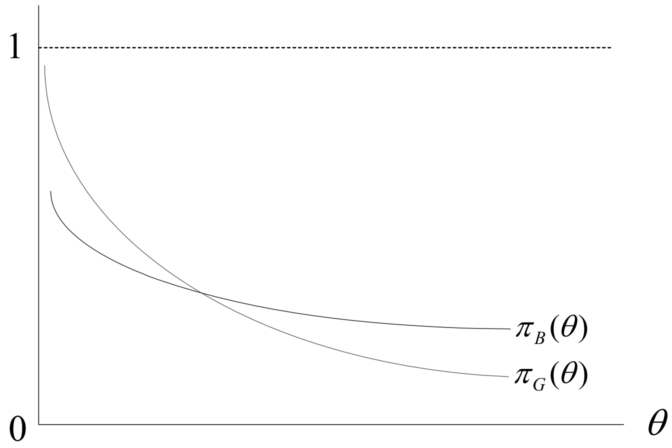

Figure 2: The Equilibrium

(3), and the competitive entry condition (8), we obtain

$$\pi_G = -\frac{(1-\beta)b}{\beta r(c+k)\theta} - \frac{\sigma + r}{\alpha_w(\theta)} + \frac{1-\beta}{\Omega}\left(\frac{y_G - r(c+k) - \sigma(k+T)}{\beta r(c+k)\theta} - \frac{\sigma + r}{\beta \alpha_w(\theta)}\right) \tag{9}$$

$$\pi_B = s - \frac{(1-\beta)b}{\beta r(c+k)\theta} + (1-t_e)(1-\beta)\left[\frac{y_B - rc}{\beta r(c+k)\theta} - \frac{(\sigma + r)c}{\beta \alpha_w(\theta)(c+k)}\right] \tag{10}$$

where

$$\Omega = \frac{1+t_p}{1-t_e} \tag{11}$$

is the tax wedge. The equilibrium set $(\theta,\ \pi)$ is determined by $\pi_G = \pi_B$, and is illustrated in Figure 2.

We can solve the complete model (2), (3), (4), (5), (6), (7), (9), (10), and (11) numerically. There is some degree of freedom in the choice of the policy variables. We assume that the government arbitrarily chooses employment benefit b and payroll tax t_p, and adjust separation tax/transfer T or income tax t_e to satisfy the budget constraint (4). We perform a few exercises. In the first one, the government reduces payroll tax t_p, and raises income tax t_e in order to maintain the tax wedge Ω constant, allowing T to fluctuate. In the second exercise, the government conducts a naive tax reform to reduce payroll tax and raise income tax by the same rate, while leaving the tax wedge being affected. In the third exercise, we consider a sort of budget-neutral tax reform with a constant tax/transfer T, by adjusting income tax rate t_e to eliminate the redundant budget surplus or deficit. The replacement of payroll tax with income tax elevates the tax base. Does the increasing tax base enable the government to reduce the whole tax burden to finance the same amount of the government transfer? The answer is no.

t_p	**.07**	**.08**	**.09**	**.10**	**.11**	**.12**	**.13**
t_e	.176	.169	.161	.153	.146	.138	.130
u	.0483	.0485	.0485	,0488	.0489	.0491	.0442
e_G	.829	.830	.831	.832	.833	.834	.834
e_B	.121	.120	.119	.118	.117	.116	.115
Ω	**1.30**	**1.30**	**1.30**	**1.30**	**1.30**	**1.30**	**1.30**
T	-20.7	-20.6	-20.5	-20.5	-20.5	-20.4	-20.4
w_G	4.28	4.23	4.19	4.15	4.12	4.08	4.04
w_B	1.41	1.41	1.41	1.41	1.42	1.42	1.42
π	.434	.437	.440	.443	.446	.449	.452
θ	2.68	2.67	2.65	2.63	2.61	2.60	2.58

Table 1: Payroll Tax Reform with Constant Tax Wedge

The matching function is of Cobb-Douglas such that $\alpha_w(\theta) = \eta\theta^\rho$ where $\eta = .6$ and $\rho = .5$. The set of baseline parameters is as follows:

$$\beta = .7,\ \sigma = .05,\ s = .4,\ r = .05,\ b = 1,\ c = 5,\ k = 10,\ y_G = 5,\ y_B = 2.$$

In the first exercise, t_p changes from $t_p = .13$ to $t_p = .07$, while the tax wedge is fixed at $\Omega = 1.3$. The result is given in Table 1. The result is striking. The reduction in payroll tax *decreases* the share (e_G) of the good employment as well as its fraction (π) in job vacancies. The intuition behind this result is as follows. With a constant tax wedge, payroll tax is replaced by income tax in the good job sector. At the same time there is a rise in the income tax rate not only for the good job but also for the bad job. In the good job sector, tax burden is unchanged because the tax wedge is not affected by the reform, while tax burden increases in the bad job sector. With the increasing tax burden for the whole economy, the creation of jobs with higher productivity and higher cost is cleverly avoided. Note that the wage does not rise so proportionally to the increasing income tax. Therefore more tax burden shifts from the employer to the employee. This is largely because the tax reform reduces the worker's gain at the bad job, which is the worker's threat point in the wage bargaining at the good job. As a consequence, the labor market tightness rises and the unemployment rate declined.

In the second exercise, the government conducts a naive tax reform to adjust t_p and t_e as to satisfy $t_p + t_e = .26$. Then the tax wedge fluctuates around 1.30, and slightly rises as payroll tax is replaced by income tax. The result is given in Table 2. The result is similar to the first exercise. As payroll tax is replaced by income tax, the steady state population of workers employed at the good job decreases, while the population of workers at the bad job increases. This is caused partly by the rising tax wedge in the good job, but to the larger extent by the increasing total tax burden on the whole economy due to the rise of income tax.

In the third exercise, we set $T = -20$, that is, the government transfers 20 to each employer whenever her job is destroyed by an exogenous shock. The

t_p	**.07**	**.08**	**.09**	**.10**	**.11**	**.12**	**.13**
t_e	**.19**	**.18**	**.17**	**.16**	**.15**	**.14**	**.13**
u	.0481	.0483	.0484	.0486	.0488	.0490	.0493
e_G	.828	.829	.830	.831	.832	.833	.834
e_B	.122	.122	.120	.119	.118	.117	.115
Ω	1.32	1.31	1.31	1.30	1.30	1.30	1.29
T	-22.2	-21.9	-21.5	-21.2	-20.9	-20.6	-20.3
w_G	4.35	4.29	4.24	4.19	4.13	4.08	4.04
w_B	1.40	1.41	1.41	1.41	1.41	1.42	1.42
π	.429	.430	.437	.441	.445	.449	.453
θ	2.71	2.69	2.67	2.65	2.62	2.60	2.58

Table 2: Naive Payroll Tax Reform

t_p	**.07**	**.08**	**.09**	**.10**	**.11**	**.12**	**.13**
t_e	.170	.163	.156	.148	.141	.134	.126
u	.0484	.0486	.0487	.0489	.0490	.0492	.0493
e_G	.830	.831	.832	.832	.833	.834	.835
e_B	.120	.120	.119	.118	.117	.116	.115
Ω	1.29	1.29	1.29	1.29	1.29	1.29	1.29
T	**-20.0**	**-20.0**	**-20.0**	**-20.0**	**-20.0**	**-20.0**	**-20.0**
w_G	4.24	4.20	4.17	4.13	4.09	4.06	4.02
w_B	1.41	1.41	1.41	1.41	1.42	1.42	1.42
π	.436	.439	.442	.445	.448	.451	.454
θ	2.67	2.65	2.64	2.62	2.60	2.59	2.57

Table 3: Constant Government Expenditure

government adjusts income tax rate t_e to finance the constant unemployment benefit b and transfer T. Once again the irrelevance holds: The tax wedge is not significantly affected by the reform. The job distribution shifts to less of the good job and more of the bad job. The good job wage slightly rises as payroll tax is replaced by income tax, but does not fully reflect the increasing income tax. The tax reform favors the entrants' advantage, raising the labor market tightness and slightly reducing the unemployment rate.

4 Discussion

Through these exercises, we have confirmed that the replacement of payroll tax with income tax creates less of more productive jobs. This unintuitive result is interpreted as follows. The tax wedge is not affected by the reform in the good job sector, while tax burden rises in the bad job sector. Then creation of high-productive jobs with high cost is carefully avoided. Since the worker does not save in this model. Income tax is identified as consumption tax. The simulation above has the following implication. As payroll tax is replaced by consumption tax, distortion, previously concentrated on the good job sector, now prevails the whole economy, and changes the job distribution toward less productive jobs.

The model above has many restrictions and some potential extensions are discussed as follows. First, the job market is integrated over unemployed workers with or without previous employment experiences. Remaining in the unemployment pool for a long time deteriorates the worker's productivity. In the present model, the advantage or disadvantage of workers at the bad job depends on the way how we interpret the bad job. If employment at the bad job opens the door to employment at the good job, it holds that "bad jobs are better than no jobs." Employees at the bad job has advantage over the unemployed and $s > 1$. However, there might be many cases that working at the bad job makes it for you even more difficult to be accepted by the good jobs. In the latter case, $s \leq 1$. In the model above, it is difficult to distinguish the former case from the latter. If $s > 1$, it is advantageous to work at a bad job and unemployed workers with previous job experiences should be separated from workers with none. If $s \leq 1$, there is no distinction between workers with and without previous experiences, and the labor market should be integrated. The current model is the latter case. Extending the model into the former case is a more complicated task but is to be done.

Second, in the present model, the job is differentiated not only by productivity but also by bargaining power. More paternal employment protection is reflected by a higher wage bargaining power β. We assume that the bad job is not protected at all and the bargaining power is zero, which might be too much simplification. It is more plausible to explore a positive bargaining power in the bad job.

Third, in the present model, job separation is exogenous and the transfer T plays no essential role except to balance the government budget. The study of joint design of unemployment benefit and employment protection legislation (EPL) has been initiated recently by Blanchard and Tirole [2005]. We can discuss the optimal design of intervention into a segmented labor market by assuming productivity change within a job, which is another complicated but plausible task.

Fourth and finally, the existing distribution of different types of jobs is not efficient in general. A complete welfare analysis of the model should be presented. The inefficiency is caused mainly by the arbitrary choice of bargaining power in different sectors. Due to the decentralized nature of labor market, an equilibrium with an arbitrary bargaining power is inefficient (Hosios [1990]). Acemoglu [2001] shows that there are too much bad jobs in equilibrium. We can discuss the implication of tax reform on this issue.

5 Supplement: Collective Bargaining

In this section, we discuss the non-neutrality of payroll tax reform in the models of collective bargaining between employers and employees, developed by McDonald and Solow [1981, 1985] among others.

5.1 No disutility from work

Consider a collective bargaining between a firm or an industry and the union of workers. Let start with the case in which working hour is fixed and the number of employed workers is endogenously determined. The wage w per worker and the mass n of workers employed are determined by a general Nash bargaining with bargaining power $\beta \in [0,\ 1]$:

$$\max_{w,\ n}[w(1-t_e)n]^{\beta}[y(n)-w(1+t_p)n]^{1-\beta}$$

where $y(n)$ is an increasing and concave function of n, and t_p and t_e are the payroll and income tax rates respectively. Note that the t_e does not matter with the joint decisions for $(w,\ n)$.

The FOC for w:

$$wn = \frac{\beta y(n)}{1+t_p}$$

The FOC for n:

$$wn = \frac{\beta y(n) + (1-\beta)ny'(n)}{1+t_p}$$

Eliminating wn, we obtain

$$(1-\beta)ny'(n) = 0 \Longleftrightarrow y'(n) = 0$$

That is, the firm employes as many workers as the marginal productivity goes to zero, while the payroll tax does not matter.

Proposition 1 *In the model with collective Nash bargaining with no disutility from work, the division into income tax and payroll tax is irrelevant to employment: The income tax t_e does not matter with the joint decisions for $(w,\ n)$. An increase in the payroll tax t_p does not matter with the choice of n, but lowers the wage w.*

The proposition is a formal statement of the well-known neutrality theorem on the tax/subsidy incidence.

5.2 The model with disutility from work

Consider an alternative model with disutility from work. The production function is

$$y(n)e$$

which is concave in n, and linear in e, which is effort. We can plausibly interpret e as working hours. Then the joint maximization is set as

$$\max_{w,\ n,\ e} \{[w(1-t_e)-c(e)]n\}^{\beta}[y(n)e-w(1+t_p)n]^{1-\beta}.$$

The FOCs are:

$$\begin{aligned} e: &\quad \frac{y(n)}{\Omega} - nc'(e) = 0 \\ n: &\quad \frac{y'(n)e}{\Omega} - c(e) = 0 \\ w: &\quad w = \frac{\beta y(n)e}{n(1+t_p)} + \frac{(1-\beta)c(e)}{1-t_e} \end{aligned} \tag{12}$$

where Ω is the tax wedge, and is defined as,

$$\Omega :\ = \frac{1+t_p}{1-t_e} \geq 1.$$

Note that a rise in the tax wedge decreases not only effort but also employment and output.

The surplus splitting implies:

$$[w(1-t_e)-c(e)]n = \beta\left[\frac{y(n)e}{\Omega} - c(e)n\right], \tag{13}$$

$$y(n)e - w(1+t_p)n = (1-\beta)\left[y(n)e - \Omega \times c(e)n\right]. \tag{14}$$

The higher tax wage reduces the total surplus as well as the individual gains for the worker and the firm.

We impose the government budget constraint as follows.

$$w(t_p+t_e)n = E$$

where E is a given government expenditure. Consider an ex-ante revenue-neutral tax restructuring such that

$$\begin{aligned} w(dt_p+dt_e)n &= dE \\ dt_p + dt_e &= 0 \quad \text{if} \quad dE = 0 \end{aligned}$$

That is, the government changes tax rates assuming that wage and employment are constant. This assumption looks naive, but tax incidence is often discussed by assuming that the wage is not affected by tax reform. So this exercise is worth for consideration. Under this circumstance, we consider replacing the payroll tax t_p with the income tax t_e. We have

$$\left.\frac{d\Omega}{dt_p}\right|_{dt_e=-dt_p} = \frac{1}{1-t_e}\left(1-\frac{1+t_p}{1-t_e}\right) = \frac{1}{1+t_e}(1-\Omega) \leq 0$$

In other words, the tax wedge goes *down* if the government marginally raises the payroll tax while reducing the income tax to maintain the ex-ante balanced budget. The lower tax wedge increases output and employment. On the other hand, if the government replaces payroll tax with income tax, the increasing tax wedge reduces output and employment.

Proposition 2 *A (naive) ex-ante revenue-neutral replacement of payroll tax with income tax raises the tax wedge and reduces output and employment.*

We can confirm this result by performing another simple exercise. Consider a tax restructuring to raise the payroll tax rate by $\theta > 0$ and the reduce income tax rate by the same amount. Then the tax wedge alters to

$$\Omega(\theta) = \frac{1 + t_p + \theta}{1 - t_e + \theta}$$

However, it is straightforward to see

$$\Omega(\theta) - \Omega(0) = \frac{1 + t_p + \theta}{1 - t_e + \theta} - \frac{1 + t_p}{1 - t_e} = \frac{-\theta(t_p + t_e)}{(1 - t_e + \theta)(1 - t_e)} < 0$$

That is, raising payroll tax reduces tax wedge. This rather unintuitive result can be interpreted as follows. In this model, the Nash bargaining brings efficient levels of employment and effort. The only source of inefficiency is the tax wedge, which is increasing in t_p and t_e, and no less than one. A marginal increase in t_p associated with a marginal decrease in t_e of the same size always reduces the tax wedge, and increases output and employment. This tax replacement reduces wage w. Therefore the ex-ante government budget yields deficit, which means that the social cost of employment declines and output increases.

In order to avoid this unpleasant outcome, we have to assume an ex-post balanced budget to be met:

$$t_e = \frac{E}{wn} - t_p$$

Together with the wage bargaining condition, $(t_e,\ w)$ is uniquely determined by t_p and illustrated in Figure 3, which is drawn under the assumption that n and e is not affected. A rise in the payroll tax incidentally results in the reduction of the gross wage.

The tax wedge is now written as

$$\Omega = \frac{1 + t_p}{1 + t_p - \frac{E}{wn}} = 1 + \frac{\frac{E}{wn}}{1 + t_p - \frac{E}{wn}}$$

Therefore the sign of a change in the tax wedge depends on what the subsequent change in w is. If we neglect any change in w, we always have

$$\left.\frac{d\Omega}{dt_p}\right|_{w=\text{constant}} < 0,$$

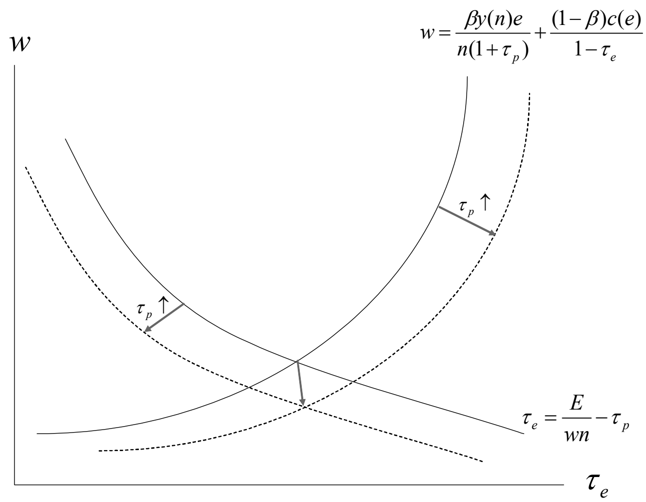

Figure 3: Tax Incidence

that is, a rise in payroll tax reduces the tax wedge. However, a rise in t_p reduces wage, which tends to raise the tax wedge for a given t_p. Therefore the total effect is ambiguous.

Now consider an exercise to replace payroll tax with income tax. A reduction in t_p increases the tax wedge for a given wage. However a lower payroll tax raises the wage, and the total effect on the tax wedge is ambiguous. We summarize the result as follows.

Lemma 3 *An ex-post revenue-neutral replacement of payroll tax with income tax increases the gross wage. Its effects on employment and output are ambiguous.*

A general analysis of an ex-post revenue-neutral tax reform is too difficult to be performed, because it affects effort and employment by changing tax wedge. Instead we raise a more tractable question: can we design a revenue-neutral tax restructuring which is irrelevant to employment or output? The answer is yes. Consider a tax reform to reduce payroll tax by θ_p and increase income tax by θ_e, but keep tax wedge constant. This tentative tax reform package $(\theta_p,\ \theta_e,\ w)$ satisfy three conditions, for a given set $(n,\ e)$. First, it must be revenue neutral:

$$w(t_p - \theta_p + t_e + \theta_e)n = E \tag{15}$$

Second, it must not alter the tax wedge:

$$\Omega(\theta) = \frac{1 + t_p - \theta_p}{1 - t_e - \theta_e} = \frac{1 + t_p}{1 - t_e} \tag{16}$$

Third and finally, the wage must be adjusted to

$$w = \frac{\beta y(n)e}{n(1+t_p-\theta_p)} + \frac{(1-\beta)c(e)}{1-t_e-\theta_e}. \tag{17}$$

It is a matter of algebra to obtain that

$$\theta_p - \theta_e = \frac{(t_p+t_e)}{w}\left[w - \frac{\beta y(n)e}{n(1+t_p)} - \frac{(1-\beta)c(e)}{(1-t_e)}\right] > 0$$

In other words, the payroll tax cut must be greater than the income tax rise in a wedge-neutral tax reform. The last inequality follows from the initial equilibrium wage condition (12), since a reduction in t_p associated with a rise in t_e increases the wage. If we replace income tax with payroll tax, an opposite inequality holds and the payroll tax rise must be greater than the income tax cut increase. Thus we obtain the following 'irrelevant tax reform proposition.'

Proposition 4 *A revenu-neutral tax reform is irrelevant to output and employment if it satisfies (15), (16), and (17). If we replace payroll tax with income tax in order for the tax reform to be revenue-neutral and irrelevant to employment, the payroll tax cut must be greater than the income tax rise.*

The irrelevant tax reform proposition is interpreted as follows. If the government reduces payroll tax and increases income tax, the negotiated wage increases and the tax base extends. In order to maintain the same revenue, the income tax rise must be less than the payroll tax cut.

On the contrary, a naive replacement of payroll tax with income tax tends to raise both the negotiated wage and the tax revenue. However, this increasing revenue effect is partially cancelled by the increasing distortion associated with the higher tax Ω. On the opposite, if we reduces income tax and raises payroll tax by the same rate, the negotiated wage and the tax revenue decline. However, this decreasing revenue effect is partially cancelled by the decreasing distortion associated with the lower tax wedge.

Corollary 5 *A naive replacement of payroll tax with income tax tends to increase the tax revenue, while the increasing distortion reduces employment and output.*

The non-neutrality of a naive tax reform is quite intuitive. A shift from payroll tax to income tax is more distortionary than the shift into the opposite direction, if it is naive.

6 Conclusion

Taxation on employment is explored in a labor search model with two types of jobs of different productivity and on-the-job search. The high-productive job is charged with both payroll and income taxes, while the low-productive jobs with income tax only. A tax reform to reduce payroll tax and raise income tax shifts the steady-state equilibrium distribution of jobs toward less productive ones. The result stands in a sharp contrast to the usual argument that replacement of payroll tax with income tax creates more of high-productive jobs.

This rather unintuitive result is interpreted as follows. The tax wedge is not affected by the reform in the good job sector, while tax burden rises in the bad job sector. Then creation of high-productive jobs with high cost is carefully avoided. Since the worker does not save in this model. income tax is identified as consumption tax. The simulation above has the following implication. As payroll tax is replaced by consumption tax, distortion, previously concentrated on the good job sector, now prevails the whole economy, and changes the job distribution toward less productive jobs.

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