

Vasilev, Aleksandar

**Preprint**

**Payroll Tax and Welfare**

*Suggested Citation:* Vasilev, Aleksandar (2008) : Payroll Tax and Welfare, ZBW - Deutsche Zentralbibliothek für Wirtschaftswissenschaften, Leibniz-Informationszentrum Wirtschaft, Kiel, Hamburg

This Version is available at:

<https://hdl.handle.net/10419/154751>

**Standard-Nutzungsbedingungen:**

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

**Terms of use:**

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*

# Payroll Tax and Welfare

Aleksandar Vasilev

May 6, 2008

This paper takes a general equilibrium approach to payroll taxation. The focus of the study will be to estimate the welfare costs due to that distortionary policy.

More specifically, the research questions we are after is how much do we lose by ignoring firm heterogeneity, and what exactly do we lose by not accounting for heterogeneity. Firms of different characteristics will be affected in a different way. Therefore, a model with homogeneous firms will not take these effects in consideration, and will underestimate the welfare cost of payroll taxation. By allowing for heterogeneous firms, we will be able to capture the effects on the industry structure and entry/exit decisions.

Payroll taxes are the state and federal taxes that the employer is required to withhold and/or pay on behalf of the employees. Those are federal and state income taxes, as well as social security and Medicare taxes. The employer is also required by the US law to pay a matching amount of social security and Medicare taxes for the employees (called the FICA tax) and to pay State and federal unemployment tax. As a result of that policy, labor supply and demand decisions will be affected, and welfare will decrease.

The payroll taxes are fundamentally different from other types of taxes because they represent a future payment to the contributor. They are more like payment into insurance fund.

According to Wikipedia.com

”As of 2007, the employer must withhold 6.2 percent of an employee’s wages and pay a matching amount in social security taxes until the employee reaches the wage base for the year. The total is 12.4 percent for the employee and the employer. The wage base for social security tax in 2007 is USD 97,500. Once that amount is earned for a given year, neither the employee nor the employer owe any additional social security tax for that year.

The employer must withhold 1.45 percent of an employee's wages and pay a matching amount for Medicare tax. The total is 2.9 percent for the employee and the employer. Unlike the Social Security tax, there is no maximum wage base for the Medicare portion of the FICA tax. Both the employer and the employee continue to incur and pay Medicare tax on each additional amount of gross compensation, with no limit on the amount of gross compensation on which the tax is imposed.

Each employer also must pay State and Federal Unemployment Taxes (SUTA and FUTA). The FUTA rate is 6.2 percent but normally nets to 0.8 percent because the employer is allowed to take a credit up to 5.4 percent for SUTA taxes that it pays...The wage base for FUTA is USD 7,000 (i.e., the employer is liable for FUTA only on the first USD 7,000 of compensation paid to each employee per calendar year)."

A necessary ingredient in the model is decreasing returns to scale (DRS) on individual firm level, so that different skills coexist. With homogeneous firms, however, all firms choose the same level of employment.

Payroll tax will be included in Hopenhayn and Rogerson (1993) model without firing costs. Hopenhayn and Rogerson themselves extend the industry equilibrium model of Hopenhayn (1992) to a general equilibrium setting. In a stationary equilibrium of this model, the aggregate properties of the economy are constant over time, although individual firms are continually adjusting, by growing, shrinking, entering or exiting. This environment stresses the heterogeneous development of firms and provides a natural setting in which to analyze policies that affect firm-level adjustments.

The analysis will address only the long-run or steady-state effects of these policies and does not consider the short-run response of an economy to changes in policies. The model excludes physical capital, and equilibrium will be computed by iterating on  $w, \tau$  (or TR). Intuition, as pointed in Hopenhayn and Rogerson (1993), suggests that if it were included the employment effects that result would be larger, since payroll tax creates an incentive for firms to accumulate more capital than hiring more labor.

When payroll taxes increase, both per-period and discounted profits will fall. There will be more exit and more selection: inefficient firms will leave, while more productive will stay. More productive firms will enter, and thus average productivity will increase in the industry. In this paper, we will try to find out where the difference comes from - average productivity and/or labor demand. Does the latter shift by more or less than in the homogeneous case?

## The Model Economy

### Consumer side

There will be a unit mass of consumers, distributed uniformly and continuously on the unit interval. There will be employment lotteries, which allows us to aggregate consumers following the approach by Hansen(1985) and Rogerson(1988). Therefore, on the aggregate level, the problem becomes

$$\max_{c_t, h_t} \sum_{t=0}^{\infty} \beta^t u(c_t) - A h_t,$$

$u_c > 0$ , concave  $v_h > 0$ , convex.  $u(\cdot), v(\cdot)$  are both  $C^2$ , Inada conditions hold.  
s.t  $0 \leq c_t \leq w_t h_t + TR$ ,  $c \geq 0$ ,  $0 \leq h_t \leq 1$ , for all  $t$ .

Due to the linear disutility of providing labor services, the model will have different dynamics than a model with convex disutility of working. As a robustness check, we will also simulate the model with a representative agent model.

### Government

Government follows a balanced budget rule. The revenue generated from the payroll tax can be used for two different purposes:

- wasteful spending -  $TR=0$  under this scenario
- lump-sum transfer to consumers.

In the paper we concentrate on the latter case, and shortly discuss wasteful spending case at the end as a possible future extension.

The framework described below is designed for the purpose of studying a competitive economy that is in a stationary or long-run equilibrium. In this equilibrium, individual firms will be undergoing change over time, with some of them expanding, others contracting, some closing down, and others starting up. Despite all this change at the level of the individual firm, however, all aggregate variables-such as price, employment, output, and the number of firms-will be constant over time. Each firm has a production function using labor as its only input. If a firm employs  $n_t$  workers in period  $t$ , when the output price is  $p_t$  it receives period  $t$  profits equal to

$$\pi_t = p_t n_t^\alpha - (1 + \tau) w_t n_t$$

There is an setup cost  $\eta$ . It will be measured in terms of output, and in stationary equilibrium  $p_t = 1, \forall t$ ,

$0 \leq \alpha \leq 1$ , so that we have some curvature.

Each firm has decreasing returns to scale. Therefore, each firm will obtain positive economic profits. Still, there is going to be entry and exit, although in an artificial way, since all entrants will be identical to the firms that have left. Let  $\eta$  denote the start-up cost. With exogenous prob  $x$  a firm dies every period. Thus, on the aggregate level, there is no uncertainty: a fixed proportion  $x$  of incumbents leaves the market every period.

If there is a unit mass of entrants and in equilibrium, entry = exit, then  $\mu x = 1$ , where  $\mu$  is the mass of incumbents.  
Thus,  $\mu = \frac{1}{x}$ .

Let  $q = \frac{1}{1+r}$  be the discount factor of the firm. There is no capital, so there is no interest rate in the model.

$\frac{\pi}{1-q(1-x)} = \eta$ , i.e discounted profits equal startup cost.

Aggregate profits

$\Pi = \mu \frac{\pi}{1-q} - \eta.1 \neq 0$  because

$$\mu \neq \frac{1-q}{1-q(1-x)}$$

$$0 < x < 1$$

$$\mu = \frac{1}{x} > 1$$

$$\frac{1}{1-q(1-x)} > 1$$

$\Pi = \pi(\mu - \frac{1}{1-q(1-x)}) > 0$  There is some selection going on.

There will be some general equilibrium effects on optimal employment because the wage is going to change. That is because labor demand will be affected by the payroll tax: Firm profits are a function of the wage, and they are lower now. Firms employ less workers in order to increase discounted profits and make free entry condition hold with equality:  $\frac{\pi}{1-q(1-x)} = \eta$  and  $\frac{\partial \pi}{\partial \tau} < 0$ . The wage will fall, but the transfer payment will increase. The conjecture is that leisure will increase, i.e labor supply will decrease because consumers take the transfer as given.

As the equilibrium wage depends on transfer, firm dynamics is affected and the number of firms will change, as the number of firms is determined endogenous to satisfy free entry condition. If payroll taxes increase, there will be even fewer firms to compensate. There will be losses on the consumer side.

The Bellman equation to the firm's decision problem is:

$$v(p, w) = \max_{n \geq 0} ((\pi(p, w) + \beta(1-x)v'(p, w)))$$

The value of entry is  $v^e(p, w)$ .

With heterogeneous firms, we need an idiosyncratic shock that evolves following a Markov process  $z \sim G(z, z')$ . Firms are ex ante identical, but ex post different because of different realizations of the idiosyncratic shock.

The Bellman equation to the firm's decision problem with heterogeneity is:  

$$v(z, p, w) = \max_{n \geq 0} ((\pi(z, p, w) + \beta \int v'(z', p, w) dG(z'|z))$$

The state of an individual firm is fully described by employment  $n$ . The aggregate state is described by the distribution of the state variables for all individual firms, which we express as  $\mu(n)$ . In the computation part,  $n$  will be restricted to take a finite number of values. The evolution of the measure follows  $\mu' = T(\mu, M, p, w)$ , and the operator is linearly homogenous in  $(\mu, M)$ .

Labor demand and profit are given by

$$L^d(\mu, M, p, w) = \int N(n; p, w) d\mu(n) + MN(0; p, w)$$

$$\Pi(\mu, M, p, w) = pY(\mu, M, p, w) - L^d(\mu, M, p, w) - Mp\eta.$$

Aggregate output can be determined from Walras' Law

As claimed by Hopenhayn and Rogerson (1993), it is straightforward to show that  $Y, L^d$ , and  $\Pi$  are linearly homogenous in  $\mu$  and  $M$  jointly.

From consumer side we obtain the labor supply rule  $N = L^s(p, \Pi + TR)$   
Stationary equilibrium:

A stationary equilibrium consists of an output price  $p^* = 1$ , a measure of incumbents  $\mu \geq 0$ , and a mass of entrants  $M$  s.t.

(i)(labor market clearing)

$$L^d(\mu^*, M^*, p^*) = L^s(p^*, \Pi(\mu^*, M^*, p^*) + TR(\mu^*, M^*, p^*));$$

(ii) (consistency)

$$T(\mu^*, M^*, p^*) = \mu^*, \text{ and}$$

(iii)(free entry condition)

$$v^e \leq \eta, \text{ with equality if } M^* \geq 0.$$

Existence and uniqueness

Assumption: the income effect on labor supply is negative. The expected age at exit is also finite. Together with the assumptions on the utility and production functions, we can prove that there exists a unique RCE, and there is a unique stationary RCE with positive entry and exit.

Simulate Hopenhayn-Rogerson with payroll tax and no firing costs.  $\tau$  will be taken from US data,  $x=0.1$ ,  $u(c) = \ln(c)$ ,  $v(n) = An$ ,  $A \geq 0$ .  $\alpha$  equals the labor share in the total revenue, and the discount factor  $\beta$  is an inverse function of the interest rate.  $\eta$  has to be consistent with the free-entry condition. In a stationary equilibrium with entry and exit, an increase in  $\eta$  means lower wages. This increases profit and lowers the exit rate.

Changing  $\alpha$  or  $\beta$  is not expected to change results significantly. The major driving force in the model will be exit rate  $x$  and tax rate  $\tau$ .

We will report statistics by size, such as size distribution of firms and size distribution of employment, average size of entering and existing firms, hiring by entrants, variance in growth rates.

We can do variational compensation - by how much we need to compensate so that we achieve steady-state consumption corresponding to that in the  $\tau = 0$  case.

Extensions - wasteful government spending - Since consumers will not be receiving the transfer any more, income falls. They want to supply more labor, but firms demand less labor. Wage falls even more because total income depends on the supply elasticity of labor. We expect a further fall in consumption, since part of output is thrown away, and a decrease in welfare.

The conjecture is to find that a payroll tax reduces the steady-state labor hours. Firms are hiring less people, and are paying them less. We also expect to find large welfare losses, resulting from a decrease in the average labor productivity. Marginal cost of hiring a worker is constant, while the benefit varies.

## REFERENCES

- Hansen, Gary D. (1985): "Indivisible Labor and the Business Cycle." *J. of Mon. Econ.*, Vol.16, pp. 309-27.
- Hopenhayn, H. and R. Rogerson (1993): "Job Turnover and Policy Evaluation: A General Equilibrium Analysis." *Journal of Political Economy*, Vol.101, No.55, pp.915-38.
- Hopenhayn, H.(1992): "Entry, Exit, and Firm Dynamics in Long-Run Equilibrium." *Econometrica*, Vol.60, No.5, pp.1127-1150.
- Rogerson, Richard.(1988): "Indivisible Labor, Lotteries, and Equilibrium." *Journal of Monetary Economics*, Vol. 21, pp. 3-16.

