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Laszlo Goerke

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Laszlo Goerke
University of Konstanz, Konstanz, Germany

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IZA

P.O. Box 7240
D-53072 Bonn
Germany

Tel.: +49-228-3894-0
Fax: +49-228-3894-210
Email: iza@iza.org

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ABSTRACT

The Wedge*

It is often argued that the quantity which is traded on the market is independent of the side of the market which is taxed. However, this assertion need not hold, especially in imperfectly competitive markets like that for labour. Taking an efficiency wage economy as an example, it is shown that the legal incidence of social security contributions will affect the economic incidence if unemployment compensation is subject to social security contributions. Since this is the case in numerous OECD countries, the wedge between producer costs and the net wage might be an inappropriate device for measuring the impact of social security contributions on wages and employment.

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Laszlo Goerke
Faculty of Economics and Statistics - D 138
University of Konstanz
D - 78457 Konstanz
Germany
Phone: ++49-(0)-753188-2137
Fax: ++49-(0)-753188-3130
E-mail: Laszlo.Goerke@uni-konstanz.de

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> "It makes no difference whether a tax on labor is imposed on the consumer (in this case, the firms who pay for the use of labor) or on the producers (in this case, the individuals who are selling their labor services). The incidence of the tax is the same." (Stiglitz 1988, p. 421)

1. Introduction

The economic incidence of a tax on labour depends on the market structure, but it is independent of the side of the market on which this tax is imposed. This "most basic theorem of public finance" (Blinder 1988, p. 12) implies that all political debates about who, for example, should bear the burden of social security contributions reveals a fundamental ignorance of elementary economics. In competitive (labour) markets, the irrelevance theorem or invariance of incidence proposition can be phrased in two equivalent ways: (1) A shift of taxation from employers to employees, which leaves overall tax revenues constant, does not affect employment. (2) A shift of taxes, which leaves the wedge between producer costs and net wages constant, does not alter employment. Accordingly, many empirical investigations on wage or employment determination only include a wedge variable but do not use information on the legal incidence of labour taxes. Therefore, the validity of the irrelevance theorem or invariance of incidence proposition (IIP) is simply assumed. The studies by Layard et al. (1991) and Bean et al. (1986) might serve as examples. However, some authors explicitly test for the validity of the wedge restriction. For example, Tyrväinen (1995) estimates long-run real product wage equations for ten OECD countries and finds that a wedge variable is rejected in favour of separate estimates for payroll and income tax rates for Sweden and the United States (see also OECD 1990). Calmfors (1990, p. 43) reports that changes in income taxes have no impact on the real product wages in Denmark and Norway, while increases in payroll taxes raise them. Lockwood and Manning (1993) also find differential wage effects of changes in taxes incident on employees and firms employing UK data.

Theoretically, the IIP has been questioned since the adjustment process subsequent to tax changes can take a considerable amount of time. Moreover, there is a substantial literature which shows that revenue neutral shifts of taxes on labour can alter wage and employment outcomes in collective bargaining models if they affect the structure of the tax system. Since the structure, as well as the level of a tax on labour, influences employment in collective bargaining models, version (1) of the IIP need not hold.[1] However, once version (1) of the IIP does not apply, it need no longer be equivalent to version (2), that is, a constant wedge does not imply constant revenues, or vice versa. Therefore, the question arises if the IIP in the form of 'a constant wedge does not affect the quantity traded' will hold for plausible assumptions about labour markets. By focusing on linear (ad valorem) taxes on wages, the results which are derived below are not affected by differential tax structures to which, for example, tax exemptions can give rise and by

[1] See, for example, Holm and Koskela (1996), Holm et al. (1997), Holmlund (1981), Koskela and Schöb (1999), and Rasmussen (1997).

which payroll and income taxes are often characterised. Thus, the findings are directly applicable to social security contributions. In addition, potential costs or benefits which might arise on the expenditure side and which could influence labour supply do not play a role. The focus is, therefore, solely on the incentive aspects of tax rate variations. Below, the referral is to social security contributions (SC). The (perceived) entitlements owing to SC are assumed to be independent of the legal incidence of these payments. SC levied on firms are denoted FSC, while the acronym for those SC which employees have to pay is ESC.

In order to introduce notation and to recapitulate the IIP, in Section 2, it is shown for a competitive labour market that a shift from FSC to ESC does not affect the market outcome. However, if the labour supply is a decreasing function of the net alternative income, a shift from FSC to ESC will raise employment. In Section 3, a general efficiency wage mechanism is presented and the labour market equilibrium is derived. For a given labour supply, a shift from FSC to ESC - holding the wedge constant - will raise employment if unemployment benefits are subject to ESC. For a variable labour supply the IIP does not hold either, although the change in the level of (un-) employment becomes ambiguous. In the long-run, when the number of firms is endogenised, these results continue to apply. Evidence is presented in Section 4 that ESC are deducted from unemployment benefits in many OECD countries. Therefore, a change in the legal incidence of SC alters the equilibrium quantity which is traded on the market. Section 5 concludes.

2. Competitive Labour Market

There are ρ, $\rho >> 1$, identical firms in the economy, which are characterised by a strictly concave production function $f(en)$ ($f' > 0$, $f'' < 0$, $f(0) = 0$). The production function contains efficiency units of labour (en) as its argument, where e is the effort of employees and n the number of employees. The capital stock per firm is given and its costs are normalised to h, $h > 0$. Moreover, in this section, effort e is held constant at $e = 1$. The output price is normalised to unity. Firms pay an ad valorem payroll tax or FSC τ. Profits per firm are defined by:

$$\Pi = f(en) - wn(1+\tau) - h \tag{1}$$

The firm's labour demand curve is given by $n = n(w, \tau)$. Since all firms are identical, aggregate labour demand N is determined by:

$$N - \rho n(w, \tau) = 0 \tag{2}$$

Labour supply is assumed to be an increasing function of the net wage $w^n = w(1 - t)$, $\partial L/\partial w^n = L_1 > 0$, where t is the ad valorem contribution rate of employees or ESC, and decreases with the alternative or non-wage income $\overline{w}$, $\partial L/\partial \overline{w} = L_2 < 0$. These assumptions imply that the income effect is dominated by the substitution effect. Denote aggregate labour supply by S:

$$S - L(w^n, \overline{w}) = 0 \tag{3}$$

In equilibrium, labour supply S equals aggregate demand N. Totally differentiating $L(w^n, \overline{w}) - \rho n(w, \tau) = 0$ generates the wage effects of variations in t and τ. Suppose, therefore, that the ESC

are raised by a marginal amount while the FSC are reduced by a multiple or a fraction of the marginal amount such that $\tau = \tau(t)$ holds. The alteration in employment or labour supply S of such a policy measure, taking into account the wage effect, is given by:

$$\left.\frac{dS}{dt}\right|_{\substack{\tau=\tau(t)\\ L=L(w^n,\overline{w})}} = \frac{\partial L}{\partial w}\left(\frac{\partial w}{\partial t}+\frac{\partial w}{\partial \tau}\frac{d\tau}{dt}\right)+\frac{\partial L}{\partial t} = \frac{\rho L_1 w}{f''L_1(1-t)-\rho(1+\tau)}\left(1+\tau+(1-t)\frac{d\tau}{dt}\right) \qquad (4)$$

A change of employers' and employees' contribution rates by exactly the same amount ($d\tau = - dt$), as it is often debated in public, lowers employment since revenues rise. To illustrate this effect, note that revenues R from SC are given by $R = wS(t + \tau)$. Suppose employment remains unaffected by a rise in t and the required reduction in τ. The fall in FSC raises wages since labour demand increases for a given wage, and the rise in ESC also has a positive wage impact. Thus, if employment were constant, revenues would have risen. However, higher revenues are inconsistent with the assumption of a constant level of employment, since any rise in taxes reduces employment in a competitive labour market. Suppose, therefore, that the reduction in FSC is more pronounced than before, namely, that the fiscal changes leave the wedge γ between producer costs $w(1 + \tau)$ and the net wage $w(1 - t)$ constant, $\gamma \equiv (1 + \tau)/(1 - t)$. Then, the reduction in τ owing to the rise in t is given by $d\tau/dt = - (1 + \tau)/(1 - t) < - 1$. The assumption of a constant wedge implies version (2) of the IIP referred to above since equation (4) yields $dS/dt = 0$. Moreover, the wedge restriction entails constant revenues $R = wS(t + \tau)$, that is, version (1) of the IIP.

$$\left.\frac{dR}{dt}\right|_{\substack{d\gamma=0\\ L=L(w^n,\overline{w})}} = \frac{dw}{dt}S(t+\tau)+\frac{dS}{dt}w(t+\tau)+wS\left(1-\frac{1+\tau}{1-t}\right)$$

$$= \frac{f''L_1 w f''-\rho w(1+\tau)/(1-t)}{f''L_1(1-t)-\rho(1+\tau)}S(t+\tau)+0-wS\left(\frac{t+\tau}{1-t}\right)=0 \qquad (5)$$

If labour supply is not determined by equation (3), but if L is a function of the net alternative income $\overline{w}^n = \overline{w}(1-t)$, since the non-wage income is subject to ESC as well, $S - L(w^n, \overline{w}^n) = 0$ will hold. Labour supply declines with the net alternative income, in line with the above assumption of $L_2 = \partial L/\partial \overline{w}^n < 0$. Accordingly, the IIP no longer applies to a competitive labour market.

$$\left.\frac{dS}{dt}\right|_{\substack{d\gamma=0\\ L=L(w^n,\overline{w}^n)}} = \frac{\rho(1+\tau)L_2\overline{w}}{f''L_1(1-t)-\rho(1+\tau)} > 0 \qquad (6)$$

This result gives rise to:

Proposition 1:
In a competitive labour market in which labour supply is an increasing function of the net wage and decreases with the net alternative income, a rise in the employees' SC and a reduction in the firms' SC, holding the wedge constant, raises employment.

This increase in employment is due to a rise in labour supply which is caused by a reduction in the net alternative income, for a given equilibrium wage. Moreover, a non-zero employment effect of a change in the legal incidence does not depend on the assumptions with respect to the

sign of L_2, as long as $L_2 \neq 0$ holds. Moreover, for $L_2 \neq 0$ altering the legal incidence of SC and holding the wedge constant does no longer imply constant tax revenues since employment changes. Following the same methodology as in the derivation of (5), substituting N for S and defining the labour demand elasticity ε as $\varepsilon = -(dN/dw)(w/N) > 0$, the change in revenues R from SC is given by:

$$\frac{dR}{dt}\Big|_{\substack{d\gamma=0 \\ L=L(w^n,\overline{w}^n)}} = \frac{L_2\overline{w}(t+\tau)N(1-\varepsilon)}{L_1(1-t)-\frac{\rho}{f''}(1+\tau)} < (>)\,0\text{ , if }\varepsilon < (>)\,1 \tag{7}$$

Assuming plausible values of labour demand elasticities of below unity (cf. Hamermesh 1993, pp. 135ff), a shift of SC from employers to employees, holding constant the wedge, will not only raise employment if labour supply is a function of the net alternative income but will also reduce revenues from SC, presuming that the receipts from the contributions levied on the alternative income remain constant.[2] Proposition 1 establishes that even in a competitive labour market the IIP will not hold if the alternative income is subject to SC and if labour supply is a function of the alternative income. Since the question whether SC are levied on the alternative income also determines the validity of the IIP in an efficiency wage setting, as it is shown in the next section, evidence on the relationship between alternative income and SC is reviewed in Section 4.

3. Efficiency-Wage Economy

3.1 Labour Market Equilibrium

There are numerous versions of the efficiency wage theory. In many if not most of these approaches an employees' productivity is a positive function of the net income w^n and a decreasing function of the net alternative income $\overline{w}^n$. Moreover, effort e is generally non-decreasing with the rate of unemployment u. These relationships are also the basis for this investigation which, therefore, applies to a variety of efficiency wage models.

$$e = e(w(1-t), \overline{w}(1-t), u), \tag{8}$$

where $e_1 \equiv \partial e/\partial w^n > 0$, $e_2 \equiv \partial e/\partial \overline{w}^n < 0$, $e_3 \equiv \partial e/\partial u \geq 0$. The firm's profits are given by equation (1). It has wage setting power, and given an optimal wage, the firm determines employment. All employees are characterised by the same effort function. Thus, the first-order conditions for the firm's profit maximisation problem are:

$$\Pi_w = f'e_1(1-t) - (1+\tau) = 0 \tag{9a}$$

$$\Pi_n = f'e - w(1+\tau) = 0 \tag{9b}$$

From equation (9a), the wedge γ is given by $\gamma = f'e_1$ at the firm's optimal choice of wages. The combination of (9a) and (9b) yields a modified Solow-condition (Solow 1979):

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[2] If the change in revenues from the tax on the alternative income is taken into account, the overall revenue impact will depend on the initial number of contributors at the wage w and the alternative income $\overline{w}$, the change in employment, and the level of the tax rate t, inter alia, and can, thus, not be signed without further assumptions.

$$e_1(1-t)w - e = 0 \tag{10}$$

The Solow-condition (10) and the aggregate labour demand curve (2), where n is given by n = n(w, $\overline{w}$, t, τ, u), define the equilibrium of the system. Employment is decreasing with the wage at the firm's optimal choice of w and - given $e_3 > 0$ - will increase with unemployment, if (f ''en + f ') > 0. This requirement is warranted, for example, for a Cobb-Douglas production function and is, henceforth, assumed to hold.[3] For the analysis of changes in the composition of SC, initially, the labour supply S is held constant, while in Section 3.3, variations in S are allowed for.

3.2 Fixed Labour Supply

To calculate the employment effects of a change in the legal incidence of SC which keeps constant the wedge, equations (2) and (10) are totally differentiated, making use of N = S(1 - u).

$$\begin{bmatrix} e_{11}(1-t)w^n & e_{13}w^n - e_3 \\ \dfrac{\rho f''ene_1(1-t)}{f''e^2} & -S + \dfrac{\rho(f''en + f')e_3}{f''e^2} \end{bmatrix} \begin{bmatrix} dw \\ du \end{bmatrix} = \begin{bmatrix} e_{11}ww^n + \overline{w}\alpha & 0 \\ \beta & \dfrac{\rho w}{f''e^2} \end{bmatrix} \begin{bmatrix} dt \\ d\tau \end{bmatrix}, \tag{11}$$

where $\alpha = e_{12}w^n - e_2$ and $\beta = \rho(f''en + f')(e_1w + e_2\overline{w}) / (f''e^2)$. A sufficient condition for the determinant D of the matrix on the left hand side of (11) to be positive is $e_{13}w^n - e_3 \leq 0$. This restriction implies that a rise in the unemployment rate u will not decrease work effort e, also if the wage reducing effects which might occur have been taken into account. For $e_3 \geq 0$, this assumption will always be fulfilled if effort is additively separable in utility from income and unemployment since this implies $e_{13} = 0$.

As a preliminary exercise note that a rise in the FSC increases the unemployment rate u and the level of unemployment U ≡ S(1 - u) (cf. Pisauro 1991). Higher ESC will have ambiguous consequences for the unemployment rate if the alternative income is subject to ESC. If, however, ESC are not levied on the alternative income, the rise in t will unambiguously drive up the unemployment rate, since all terms including e_2 or e_{12} drop out (see Hoel 1990 or Goerke 1999a).

$$u_\tau \equiv \frac{du}{d\tau}_{|t=const} = \frac{e_{11}(w^n)^2\rho}{Df''e^2} > 0 \tag{12}$$

$$u_t \equiv \frac{du}{dt}_{|\tau=const} = \rho\frac{e_{11}w^n\left(w^n f'e_1 + e_2\overline{w}^n(f''en + f')\right) - f''ene_1\overline{w}^n\alpha}{Df''e^2} \tag{13}$$

Combining the effects of tax rate variations on the unemployment rate, imposing a constant wedge, that is $dt/d\tau = -\gamma$, and using $f'e_1 = (1 + \tau)/(1 - t)$, implies that a (marginal) shift in the

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[3] More generally, f ''en + f ' > 0 implies in a model in which capital is endogenous that the elasticity of substitution between labour and capital is not too low. For a CES production function Pisauro (1991) shows that this is tantamount to an elasticity of substitution between labour and capital which is greater than 1 minus labour's share of output. The respective derivatives for the employment effects of changes in the wage and effort are defined by:

$$\frac{dn}{dw} = -\frac{f''ene_1(1-t) + f'e_1(1-t) - (1+\tau)}{f''e^2} = -\frac{e_1(1-t)n}{e} < 0, \quad \frac{dn}{du} = -\frac{f''en + f'}{f''e^2}e_3$$

legal incidence from employers to employees will lower unemployment, if the alternative income is reduced by increases in ESC and if a rise in the alternative income raises the efficiency wage as defined by the Solow-condition, since this implies $\alpha = e_{12}w^n - e_2 > 0$.

$$\left.\frac{du}{dt}\right|_{\substack{d\gamma=0 \\ e=e(w^n,\overline{w}^n)}} = u_t - u_\tau \frac{1+\tau}{1-t} = \rho \frac{e_{11}w^n e_2 \overline{w}^n (f''en + f') - f''ene_1 \overline{w}^n \alpha}{Df''e^2} < 0 \qquad (14)$$

But irrespective of the sign restriction on $\alpha = e_{12}\, w^n - e_2$, the alteration in the legal incidence, in general, affects employment. The characteristics of the effort function then determine the direction of the employment variation. The implication of equation (14) can be summed up as:

Proposition 2:
In an efficiency wage economy with fixed labour supply in which the worker's effort is a decreasing function of the net alternative income $\overline{w}^n$, a rise in the employees' SC and a reduction in the firms' SC, holding the wedge constant, will raise employment if a rise in $\overline{w}^n$ increases the firm's optimal wage.

Proposition 2 implies that the IIP does not hold. If SC are shifted towards employees, their net income and effort will fall. Companies raise the efficiency wage. A new equilibrium could be reached if labour costs $w(1 + \tau)$ were the same as before the tax alterations, and if the net wage $w(1 - t)$ was unchanged such that there would be no variation in the incentives to alter the wage. The aggregate level of unemployment would remain unaltered. However, this reasoning will only hold if the alternative wage is unaffected by changes in the ESC. Formally, the IIP will only apply if changes in wages and ESC affect the Solow-condition symmetrically. This will, for example, be the case if $e = e(w^n, \overline{w}, u)$. Then, the direct labour demand effect is exactly balanced by the wage alteration. If the Solow-condition is affected symmetrically, the firm's optimal choice of wages entails a constant net wage and a constant level of effort. The first-order condition (9a) then implies that employment will not change if the wedge is held constant. However, $e = e(w^n, \overline{w}^n, u)$ implies an asymmetrical impact on the Solow-condition. The rise in t is no longer fully compensated by the increase in wages, for given labour costs, because $\overline{w}^n$ is reduced. This increases effort. Therefore, the liability of the alternative income to ESC ensures the positive employment effect of a shift in SC.[4]

If, instead of being given by a fixed amount $\overline{w}^n$, the alternative income depends on the wage w, it can be shown that the IIP does not hold under two institutional set-ups: First, if ESC are deducted from the alternative income, the correlation between the wage and the alternative income

[4] The importance of the tax treatment of the alternative income for the wage and employment effects of tax changes has first explicitly been demonstrated by Pemberton (1992) in a collective bargaining approach. After the manuscript was completed, a paper by Picard and Toulemonde (1999) became available in which the authors analyse a balanced-budget restructuring of SC akin to the one investigated here for a competitive, a minimum wage, and an efficiency wage economy, and also for a collective bargaining set-up. Picard and Toulemonde (1999) derive a condition which ensures that the legal incidence affects the economic incidence of SC which generalises the requirement that $d\overline{w}^n/dt \neq 0$.

must not be perfect, such that the net replacement ratio $\overline{w}^n/w^n$ can vary with w. In such a case, the impact of changes in wages and ESC on the Solow-condition is asymmetrical. Hence, the variation in FSC, which alters labour demand, cannot fully compensate the impact of the variation in ESC, holding the wedge constant. The IIP does not hold. The same reasoning will apply to the second case, namely, if the alternative income is not subject to ESC and given by a fixed - or variable - fraction of the gross wage. Then, the net replacement rate is not constant and the impact of variations in the wage and ESC on the Solow-condition is again asymmetrical.

This result implies that if the alternative income were influenced by, say, the competitive wage since the economy consisted of two sectors, in one of which efficiency wages were paid while in the other market clearing conditions prevailed, the IIP would only hold if (a) the alternative wage were solely determined by the competitive wage and (b) if the net alternative wage were constant. In most (European) economies, however, there are floors for the competitive wage, for example, because of social assistance payments. If these payments restrict the adjustment of a competitive gross wage to changes in ESC, the net wage will be affected by variations in the legal incidence, as it has been demonstrated in Section 2. Thus, even in a general equilibrium framework in which the alternative income is not given exogenously but determined endogenously, the correlation between the wage and the alternative income is likely to be imperfect and the IIP does not hold.

3.3 Variable Labour Supply and Endogenous Number of Firms

Thus far, it has been shown that a shift from FSC to ESC, holding the wedge constant, will reduce unemployment in an efficiency wage framework if the alternative income is subject to ESC and either constant or not fully proportional to the wage. The unambiguously positive employment impact, however, is due to the assumption of a given labour supply S. Suppose that, in contrast to Section 3.2, labour supply varies with the net income and the gross alternative income, as depicted in equation (3). The intuition for combining a variable labour supply with an efficiency wage mechanism is that (prospective) employees face a two stage decision problem. First, they decide whether to supply labour. Given this decision, they might obtain a job and, given a job, choose an optimal level of effort.

The equilibrium of the efficiency wage economy with variable labour supply is defined by equations (2), (3), and (8), for $n = n(w, \overline{w}, t, \tau, u)$. Totally differentiating the labour supply equation (3) yields $dS - L_1 (1 - t)dw = - L_1 wdt$, since L is independent of u and τ. Combining this information with the derivatives of (2) and (8) defines a system which describes the adjustment to changes in SC. The determinant of the matrix of this system is labelled D_b. A sufficient condition for $D_b > 0$ is $e_{13} w^n - e_3 \leq 0$. The change in the unemployment rate owing to a shift of SC from employers to employees, holding the wedge constant, is found to be:

$$\left.\frac{du}{dt}\right|_{\substack{d\gamma=0\\ e=e(w^n,\overline{w}^n)\\ L=L(w^n,\overline{w})}} = \frac{\overline{w}^n}{D_b e}\left[\frac{e_{11}w^n\rho(f''en+f')e_2}{f''e} - \{\rho n e_1 + L_1(1-u)e\}\alpha\right] < 0 \qquad (15)$$

A substitution of FSC by ESC will reduce the rate of unemployment u unambiguously if $\alpha = e_{12}w^n - e_2 \geq 0$. Thus, the finding for the case of a fixed labour supply, namely that a shift from FSC to ESC will lower the unemployment rate if effort is a function of the net alternative income $\overline{w}^n$, will also hold if the labour supply is variable. However, the labour supply effect is ambiguous, such that the level of unemployment U can vary in either direction.

$$\left.\frac{dS}{dt}\right|_{\substack{d\gamma=0\\ e=e(w^n,\overline{w}^n)\\ L=L(w^n,\overline{w})}} = \frac{L_1\overline{w}^n}{D_b}\left[\frac{(f''en+f')w^n\rho(e_3e_{12}-e_{13}e_2)}{f''e^2} - S\alpha\right] \qquad (16)$$

Aggregate employment N is given by N = (1 - u)S. From the comparison of the change in labour supply S and the variation in the unemployment rate u it can be noticed that these alterations depend on different parameters, such as e_{11} and e_{13}. Therefore, in general, there is a change in aggregate employment N owing to a shift of SC from employers. However, whether employment rises or declines cannot be determined. These findings are summarised in:

Proposition 3:
In an efficiency wage economy in which labour supply is an increasing function of the net wage and decreasing with the alternative income, and where the worker's effort is a decreasing function of net alternative income, a rise in the employees' SC and a reduction in the firms' SC, holding the wedge constant, will reduce the unemployment rate if a higher net alternative income $\overline{w}^n$ raises the firm's optimal wage. The impact on the level of unemployment is ambiguous.

The employment impact of a shift from FSC to ESC can be determined and will be positive, for example, if the effort function is additively separable in its arguments, such that $e_{12} = e_{13} = 0$. Moreover, labour supply is reduced. The level and rate of unemployment fall.

$$\left.\frac{dN}{dt}\right|_{\substack{d\gamma=0,\ e=e(w^n,\overline{w}^n)\\ L=L(w^n,\overline{w}),\ e_{12}=e_{13}=0}} = \frac{dS}{dt}(1-u) - S\frac{du}{dt}$$

$$= -\frac{e_{11}(f''en+f')w^n + f''ene_1}{D_b f''e^2}S\overline{w}^n e_2\rho > 0 \qquad (17)$$

Finally, not only labour supply but also the number of firms may be endogenised. Assuming that, first, the number of firms is determined by a constant profit constraint (Albrecht and Vroman 1996, Rasmussen 1998, Goerke 1999b), second, effort is given by $e = e(w^n, \overline{w}^n, u)$, third, labour

supply is determined by equation (3) and that, finally, a constant wedge is imposed, it can be shown that the unemployment rate will fall if SC are shifted towards employees.[5] Moreover, labour supply and aggregate employment change, although the direction cannot be determined unambiguously. For an effort function which is additively separable in its arguments, $dS = 0$ and $dN > 0$ apply. Finally, if the labour supply is given, a profit restriction holds, and effort is a function of the net alternative income, the change in the unemployment rate owing to a rise in t and a reduction in τ, holding the wedge constant, will be negative and given by $du/dt = e_2\overline{w}/e_3 < 0$. The results are summed up in table 1.

Table 1: Labour Market Effects of a Shift from Firms' to Employees' Social Security Contributions in an Efficiency-Wage Economy Assuming a Constant Wedge

If, as it is often argued, labour supply is inelastic in the long-run and, thus, independent of the wage, a shift from FSC to ESC will increase employment persistently and not only temporarily.

4. Social Security Contributions and Alternative Income

It has been shown above that a change in the legal incidence of SC can have an impact on the level of employment in a competitive labour market and efficiency wage settings if the alternative income is subject to ESC. The same finding applies to simple trade union.[6] Therefore, the question arises: What determines the alternative income? Although, for example, the OECD (1994, p. 192) claims that the alternative income and (the extent of) labour force participation is positively influenced by the level of unemployment compensation, implying $L_2 > 0$, since the receipt of benefits is conditional on offering work, there are numerous other determinants of non-wage income. For example, the value of household activities might be an appropriate measure of the alternative income. In competitive labour markets, the alternative income can also be influenced by returns from wealth or transfer payments unrelated to work, such as child benefits. Such income is, in general, not subject to ESC. Hence, labour supply might well be independent of the *net* alternative income.

In trade union models, the alternative income is usually interpreted either as the competitive wage, wages paid in another union sector, or as unemployment compensation. In a general

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[5] The derivation of these and subsequent results follows the same procedure as it is used above.

[6] See footnote 1, or suppose a utilitarian trade union can set the wage unilaterally. For simplicity, employees are risk-neutral and the labour demand elasticity $\varepsilon = -n_w w/n > 0$ is constant. The union's first-order condition for a maximum is given by $G = \varepsilon(u(w^n) - u(\overline{w}^n)) - wu'(1 - t) = 0$. The second-order condition requires $G_w < 0$ and $\varepsilon > 1$. Since $dw/d\tau = 0$ if ε is constant and $dw/dt = 0$ because of the assumption of risk neutrality, a shift from FSC to ESC, holding the wedge constant, will increase employment per firm.

$$\left.\frac{dn}{dt}\right|_{d\gamma=0,\,\overline{w}^n=\overline{w}(1-t)} = \frac{\partial n}{\partial w}\left(\frac{\partial w}{\partial t}+\frac{\partial w}{\partial \tau}\frac{d\tau}{dt}\right)+\frac{\partial n}{\partial \tau}\frac{d\tau}{dt} = -\frac{\partial n}{\partial \tau}\frac{1+\tau}{1-t} = -\frac{w(1+\tau)}{f''(1-t)} > 0$$

Muysken and v. d. Veen (1996) and Picard and Toulemonde (1999) also demonstrate that the legal incidence has an impact on the economic incidence in a right-to-manage union model.

equilibrium setting, the alternative income is a combination of some or of all these components (Manning 1990). In efficiency wage models, the alternative to working in a specific firm and obtaining the efficiency wage is finding a job in another firm or becoming unemployed. Since at least a fraction of the unemployed obtain unemployment benefits, the question of whether the alternative income in efficiency wage models is subject to ESC reduces to the issue of whether ESC are applied to unemployment compensation. Therefore, in models of non-clearing labour markets the alternative income is influenced if not determined by unemployment benefits. The question whether the alternative income is subject to ESC, thus, reduces to the issue whether ESC are deducted from unemployment compensation. Encompassing information on this topic is provided by the OECD and summarised in table 2.

Table 2: Deductions from Unemployment Benefits and Relation of Benefits to Previous Earnings

The OECD publications contain evidence that in a substantial number of countries ESC are deducted from unemployment benefits either at the regular or at a reduced rate, implying that the alternative income is given by $\overline{w}^n$ and not by $\overline{w}$. Looking at the second column in table 2, it can be noted that ESC reduce the alternative income in 13 of the countries included in the table, as indicated by the entry 'yes' in the respective cells. In another four countries (Belgium, Italy, New Zealand, and the United States) not only ESC but also income taxes are deducted from benefits. From those 17 countries in which either ESC and/or income taxes are subtracted from unemployment benefits, at least 12 have non-proportional replacement rates, fixed benefit levels or ceilings on insurable wages which are close to the income of an average production worker, as indicated by the last column of table 2. Therefore, in half of the 24 countries under investigation, the alternative income, interpreted as unemployment insurance payments, varies with ESC in such a way that equilibrium effort is affected by the legal incidence of SC. In at least ten of the countries in which ESC are deducted from benefits, the replacement rate can vary with the wage. In seven more countries, replacement rates are calculated as a percentage of previous gross earnings but no ESC are deducted. In all these countries, the IIP will not hold for SC if efficiency wages determine or affect labour market outcomes. Since unemployment benefits are subject to income taxation in more countries than to ESC and since in many of them the replacement rate can vary with the previous income, a shift from FSC to income taxes, which takes into account the differential tax bases but leaves the (adjusted) wedge unchanged, also influences the level of unemployment. Therefore, the available empirical evidence suggests that the wedge might be an unsuitable device for measuring the impact of labour taxes on wages and employment.

5. Conclusions

A change in the legal incidence of labour taxes, holding the wedge constant, alters the quantity traded: it does matter which side of the market is taxed. This will be true if either the alternative income is given and subject to income taxes or social security contributions or if the alternative

income is defined by the net unemployment compensation which is related to but not fully proportional to previous net earnings. Then, the 'most basic theorem of public finance' does not hold. It has been shown that empirically either of the above requirements holds for many OECD countries. The central mechanism which brings about the employment effects of changes in the composition of the tax wedge is that a reduction in social security contributions levied on firms enables employers to compensate employees for the fall in their net income owing to higher contributions paid by workers, namely by altering wages. However, this is not feasible to the same extent for variations in the alternative income. Social security contributions, therefore, induce a kind of externality from the firms' perspective. A change in the net alternative income does not alter the price of labour but has a direct impact on effort and, hence, productivity. The alteration in aggregate employment occurs since firms cannot fully make good the variation in effort by an adjustment of the wage, without varying the number of jobs.

Unemployment benefits are an important determinant of the alternative income in efficiency wage models. Therefore, a change in the legal incidence of social security contributions, holding the wedge constant, has repercussions on the level of employment in efficiency wage models. This finding can also apply to unionised labour markets. The political debate about who should bear the burden of social security contributions in order, for example, to alleviate unemployment might, thus, not reveal a fundamental ignorance of elementary economics. Moreover, the finding that the legal incidence of labour taxes can influence the economic incidence has strong implications for empirical work. The results suggest that there are a priori good reasons for including separate measures of employer and employee taxes into wage and (un-) employment equations. In particular, the restriction imposed by including a wedge variable instead of separate indicators should always be tested since the wedge variable might only capture the level but not the structural impact. In imperfectly competitive labour markets, the composition of the wedge can also have non-negligible incentive effects.

6. References

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Table 1: Labour Market Effects of a Shift from Firms' to Employees' Social Security Contributions in an Efficiency-Wage Economy Assuming a Constant Wedge

	$e = e(w^n, \overline{w}, u)$	$e = e(w^n, \overline{w}^n, u)$		$e = e(w^n, \overline{w}^n, u)$, $e_{12} = e_{13} = 0$	
		Variable Profits	Constant Profits	Variable Profits	Constant Profits
Fixed Labour Supply	$dN = 0$	$dN > 0$	$dN > 0$	$dN > 0$	$dN > 0$
$L = L(w^n, \overline{w})$	$du = 0$	$du < 0$	$du < 0$	$du < 0$	$du < 0$
	$dS = 0$	$dS \neq 0$	$dS \neq 0$	$dS < 0$	$dS = 0$
	$dN = 0$	$dN \neq 0$	$dN \neq 0$	$dN > 0$	$dN > 0$

Table 2: Deductions from Unemployment Benefits and Relation of Benefits to Previous Earnings

Country	Deductions		Relationship between Benefits and (Gross) Earnings
	ESC (fully or partially)	Income Taxes	
Australia	no	no	no
Austria	no	no	yes (linear, ceiling)
Belgium	no	yes[a)]	yes (ceiling)
Canada	yes	yes	yes (ceiling)
Denmark	yes	yes	yes (ceiling)
Finland	yes	yes	yes (linear)
France	yes	yes	yes (linear)
Germany[b)]	no	no	yes
Greece	yes	yes	yes (ceiling)
Hungary	yes	yes	no information available.
Iceland	yes	yes	no information available
Ireland	no	no	no
Italy	no	yes	yes (ceiling)
Japan	no	no	yes (linear, ceiling)
Luxembourg	yes	yes	yes (non-proportional, ceiling)
Netherlands	yes	yes	yes
New Zealand	no	yes	no
Norway	yes	yes	yes (ceiling)
Portugal	no	no	yes (ceiling)
Spain	yes	yes	yes (with different rates, ceiling)
Sweden	yes	yes	yes (de facto fixed[c)], ceiling)
Switzerland	yes	yes	yes (with different rates)
United Kingdom	no	no	no
United States	no	yes	yes (ceiling)

Sources: OECD (1988, p. 120; 1991, pp. 228f; 1993, pp. 23ff; 1994, p. 226; 1997, p. 21; 1998, p. 27). Use has been made of the most recent publication if changes have occurred over time or if details were not consistent.

a) Unemployment benefits are taxable but special allowances apply to benefit-only incomes which ensure that no tax will be payable if the unemployed is single. However, if the unemployed is married to someone who pays taxes, the Belgian principle of joint taxation will ensure that benefits are taxable.

b) Unemployment benefits are calculated as a proportion of net wages.

c) In Sweden, 12 different benefit levels exist. This introduces a non-linear element. Moreover, in 1985 97% of the recipients of unemployment compensation belonged to the highest benefit category, such that the replacement ratio is only nominally variable (Schmid et al., 1992, p. 97).