

The Legal and Economic Incidence of Payroll Taxes

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May 12, 2016

Abstract

We apply the distinction between the legal and the economic incidence of a tax to payroll taxes in the labor market. We derive a simple formula showing when shifts of the legal tax obligations between employers and workers do not affect the equilibrium on the labor market.

We show that it may happen that different combinations of payroll taxes lead to the same new equilibrium on the labor market, while the resulting different adjustment paths between the initial and the new equilibrium can have very different welfare properties.

JEL Codes: H30, J20, K34

Keywords: payroll taxes, labor market equilibrium

In the literature on the effects of taxation in competitive markets it is common to make a clear distinction between the legal and the economic incidence of a tax. The legal incidence of a tax refers to the tax laws specifying which side of the market - demand or supply - is legally responsible for paying the tax to the government. The economic incidence of a tax refers to the effect of the tax on the market equilibrium, and on the sharing of the tax burden between the demand and supply side. An important result of this literature states that the tax laws, specifying which side of the market is responsible for paying a tax, have no effect on the market equilibrium and on the sharing of the tax burden between demand and supply. For nice treatments of this result, see, e.g., Neshiba, [2], Chapter 19, and [3], Chapter 14.

In this note we model and interpret this result in the context of the labor market. In this market there typically exist various payroll taxes, some of which have to be paid by employers, while others have to be paid by workers. We

*The author wants to thank B. De Borger and A. Decoster for useful comments on an earlier version of the paper. Of course, all remaining errors are mine.

derive a simple formula showing to which extent these legal obligations can be shifted between employers and workers, without changing the existing market equilibrium.

We further argue that it may happen that different combinations of tax rates ultimately lead to the same new market equilibrium, but that the resulting dynamic adjustment paths between the initial and the new equilibrium may have very different welfare properties.

The structure of this note is as follows. In a first section we briefly describe the system of payroll taxes as it exists in many Western countries. In a second section we identify shifts of the legal obligations to pay a tax which do not affect the equilibrium on the labor market. In section three we draw attention to the dynamic adjustment paths resulting from different combinations of tax rates. A final section concludes.

1 Payroll taxes

In this section we give a short overview of the system of payroll taxes as it exists in many Western countries. Social security contributions are often paid both by employers and by workers. These contributions are based on the gross wage earned by a worker. In addition, workers also pay income taxes.

We first consider the employer's social security contribution. This is a fraction t_e of the gross wage w . The employer's contribution equals $t_e w$. The employer's wage w_e is defined as

$$w_e = (1 + t_e)w. \quad (1)$$

It is the total cost to the employer of hiring one unit of labor.

Workers pay social security contributions and income taxes. These contributions and taxes are paid directly to the government by the employer on behalf of the worker. The worker's social security contribution is a fraction t_w of the gross wage w . This contribution is $t_w w$. The worker's taxable income is defined as

$$(1 - t_w)w. \quad (2)$$

Workers also pay a withholding tax. This is an income tax withheld from the worker's taxable income. This tax is a fraction t_y of the worker's taxable income, and is given by $t_y(1 - t_w)w$. Finally, the worker's net wage is

$$w_n = (1 - t_y)(1 - t_w)w. \quad (3)$$

This is the amount of money a worker actually receives in exchange for one unit of labor.

It is clear that the above tax system drives a wedge between the employer's wage w_e and the worker's wage w_n . This tax wedge on labor can be formally defined in absolute or in relative terms. The tax wedge in absolute terms is defined as the difference $w_e - w_n$. This difference is made up of the employer's

and the worker's social security contributions, and of the worker's withholding tax. We have

$$w_e - w_n = t_e w + t_w w + t_y (1 - t_w) w. \quad (4)$$

This difference is expressed in Euros, and requires the knowledge of the gross wage w . A relative measure of the tax wedge is given by $\frac{w_e}{w_n}$. Using (1) and (3) we see that

$$\frac{w_e}{w_n} = \sigma, \quad (5)$$

where

$$\sigma = \frac{1 + t_e}{(1 - t_w)(1 - t_y)}. \quad (6)$$

This measure is a dimensionless real number, fully determined by the tax rates t_e , t_w and t_y . It is clear that $\sigma > 1$ (unless all tax rates are zero), and that it is an increasing function of t_e , t_w and t_y . σ will play an important role in the following two sections.

2 Shifting legal obligations to pay taxes

In this section we first analyze the notion of equilibrium in the labor market, giving special attention to the presence of the various payroll taxes. We then show how we can model shifts of the legal rules specifying which side of the market - workers or employers - have the legal obligation to pay certain taxes. Finally, we identify shifts of these legal rules which do not affect the labor market equilibrium¹.

We start our analysis of the labor market equilibrium with the aggregate demand for labor. It is natural to write the demand for labor as a function of the employer's wage w_e . We denote this demand function as

$$L^d = D(w_e),$$

or as its inverse function

$$w_e = D^{-1}(L^d) \equiv d(L^d). \quad (7)$$

The function $d(L^d)$ gives, for every possible value of total employment L^d , the maximum wage w_e employers are willing to pay for one additional unit of labor.

Using (1), we can also write (7) as

$$w = \frac{1}{1 + t_e} d(L^d). \quad (8)$$

The RHS of (8) gives the maximum gross wage w employers are willing to pay for an additional unit of labor, at a given level of total employment L^d .

¹After a first version of this note was written, the author discovered that the basic result of this section was already derived in [1]. This derivation is mainly graphical, and assumes that there is no withholding tax.

Employers realize that, when employing one more unit of labor, they will have to pay the social security contribution $t_e w$ on top of the gross wage w . This causes a downward shift of the demand curve, relative to (7). This is illustrated in Figure 1. The vertical distance between the two demand functions, at a given level of L^d , is given by $t_e w$.

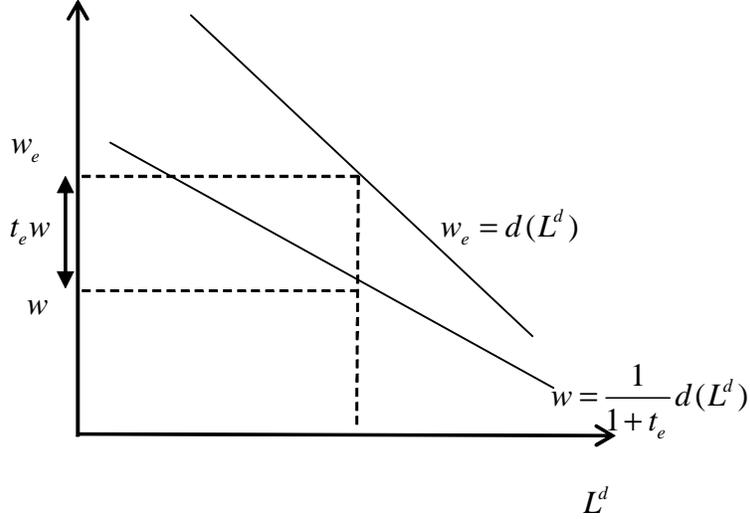


Figure 1

We now turn to the supply side of the market. We start with the supply function of labor, written as a function of the worker's net wage w_n . We denote this function as

$$L^s = S(w_n).$$

The inverse labor supply function is written as

$$w_n = S^{-1}(L^s) \equiv s(L^s). \quad (9)$$

This function gives the minimal net wage w_n at which a worker is willing to sell one more unit of labor, at a given level of total employment L^s .

Using definitions (3) and (2), we can derive two related supply functions, viz.,

$$(1 - t_w)w = \frac{1}{1 - t_y} s(L^s), \quad (10)$$

and

$$w = \frac{1}{(1 - t_w)(1 - t_y)} s(L^s). \quad (11)$$

These functions specify the minimal taxable income $(1 - t_w)w$ and the minimal gross wage w at which a worker is willing to sell one more unit of labor, at a given level of total employment L^s . These two supply functions represent an upward shift of the supply function, relative to (9). This is illustrated in Figure 2. The interpretation of the vertical distance between the three supply functions, at any given level of L^s , is also indicated in the figure.

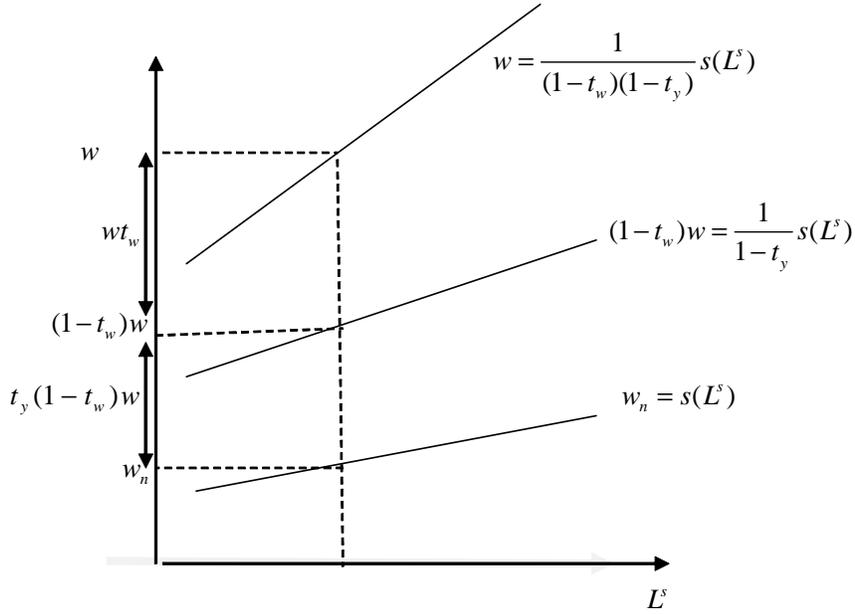


Figure 2

Equilibrium on the labor market can now be defined as that level of employment $L^{d*} = L^{s*} = L^*$ at which the maximum gross wage employers are willing to pay for one more unit of labor equals the minimal gross wage on which workers insist in exchange for one more unit of labor. This is equivalent to the condition

$$w^* = \frac{1}{1 + t_e} d(L^*) = \frac{1}{(1 - t_w)(1 - t_y)} s(L^*). \quad (12)$$

This equilibrium is illustrated in Figure 3. The equilibrium absolute tax wedge on labor, defined in (4), is given by the difference between $w_e^* = d(L^*)$ and $w_n^* = s(L^*)$. The three components of this tax wedge - $t_e w^*$, $t_w w^*$ and $t_y(1 - t_w)w^*$ - can also be read from the figure. From the equilibrium condition (12) it is easy

to derive that

$$w_n^* \leq \frac{1}{(1-t_w)(1-t_y)} w_n^* = w^* = \frac{1}{1+t_e} w_e^* \leq w_e^*. \quad (13)$$

Hence, the equilibrium gross wage w^* is always between w_n^* and w_e^* . This is obvious from Figure 3.

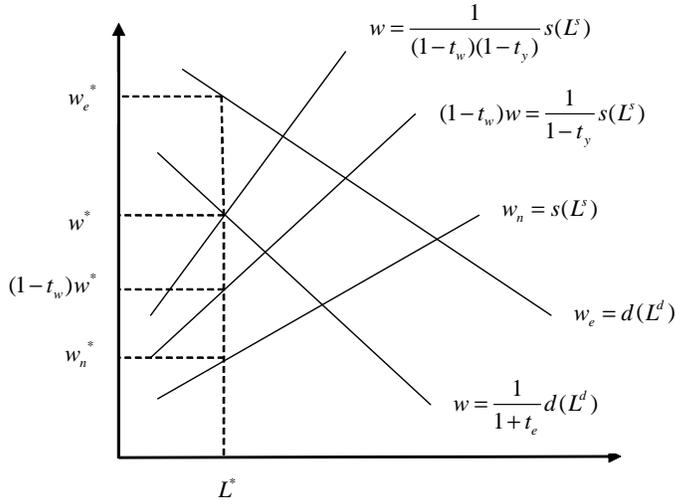


Figure 3

From (12) it is clear that the condition for equilibrium on the labor market can be written as

$$d(L) = \sigma s(L), \quad (14)$$

where σ is given by (6). If the employment level L^* solves this equation, we must have that

$$\frac{d(L^*)}{s(L^*)} = \frac{w_e^*}{w_n^*} = \sigma. \quad (15)$$

Comparing (15) and (5), we observe that the equilibrium occurs at that value of L where the ratio $\frac{d(L)}{s(L)} = \frac{w_e}{w_n}$ exactly equals σ .

The following important result also immediately follows from (14). All combinations of tax rates (t_e, t_w, t_y) which give rise to the same value of σ , give rise to the same equilibrium equation (14), and hence also determine the same

equilibrium values L^* , w_e^* and w_n^* . For all these combinations of tax rates the welfare created in this equilibrium and the sharing of the tax burden between employers and workers are the same.

This result allows us to formalize the idea of shifting the legal responsibility to pay a payroll tax from employers to workers, or vice versa. Such a shift of responsibilities involves a change of the tax rate t_e , together with a simultaneous, compensating change of t_w or t_y . If as a result of these changes the value of σ does not change, such a shift of legal responsibilities will not affect the equilibrium on the labor market. Obviously, we can also define compensating changes of the tax rates t_w and t_y (both paid by workers) such that the value of σ remains unchanged.

To illustrate, consider the following numerical example. Suppose that we start from an initial situation 0 in which $t_e^0 = .32$, $t_w^0 = .13$, and $t_y^0 = .4$, so that $\sigma^0 = \frac{1.32}{(.87)(.6)} = 2.5287$. Assume now that in a new situation 1 the government decides to lower t_e to $t_e^1 = .25$. This gives a new value for σ , viz., $\sigma^1 = \frac{1.25}{(.87)(.6)} = 2.3946$. This same outcome could have been obtained by keeping $t_e^0 = .32$ unchanged, while lowering t_w to $t_w^1 = .0813$. The resulting value of σ would then be $\frac{1.32}{(.9187)(.6)} = 2.3946$, which is exactly equal to σ^1 . The shift from $(t_e^0, t_w^0) = (.32, .13)$ to $(t_e^1, t_w^1) = (.25, .13)$ is an example of a simultaneous, compensating change of t_w and t_e , not affecting σ . In this example, a smaller share of the social security contributions is paid by the employers, while workers pay a larger share. This policy shift has no effect on the equilibrium level of employment, and it has no welfare effects. The burden of taxation for employers and for workers is unaffected, and the total tax revenue of the government remains the same.

We now examine an experiment involving two extreme possibilities of compensating changes of payroll tax rates. Suppose the government wants to make only one side of the market - employers or workers - responsible for paying all the payroll taxes to the government, while leaving the equilibrium values of L , w_n and w_e and total tax revenue unaffected. Let us start from a given value of σ , leading to the equilibrium values L^* , w_n^* and w_e^* . As a first extreme possibility, assume that the government prefers that all payroll taxes are paid by employers. It can then choose the tax rates $t_w = t_y = 0$ and $t_e = \sigma - 1$. In this tax structure the value of σ is unaffected. The equilibrium gross wage level now equals w_n^* , and

$$w_e^* = w_n^* + t_e w_n^* = w_n^* + (\sigma - 1)w_n^*.$$

Employers buy labor at a price w_n^* , and pay $(\sigma - 1)w_n^*$ taxes to the government.

As a second extreme possibility, suppose the government wants the workers to pay all payroll taxes. The government can then choose the tax rates $t_e = t_y = 0$, and t_w such that $\sigma = \frac{1}{1-t_w}$, or $t_w = 1 - \frac{1}{\sigma}$. Again, in this tax structure the value of σ is unaffected. The equilibrium gross wage level w^* now equals w_e^* , and

$$w_n^* = w_e^* - t_w w_e^* = w_e^* - (1 - \frac{1}{\sigma})w_e^*.$$

Workers sell labor at the price w_e^* , and pay taxes $(1 - \frac{1}{\sigma})w_e^*$ to the government.

Our previous analysis shows that the equilibrium level of employment L^* and the equilibrium wage levels w_e^* and w_n^* are the same in the original situation and in each of the two extreme cases. It is interesting to see what happens to the equilibrium value of the gross wage when we move from the first to the second extreme tax structure. From (13) we see that the equilibrium gross wage level moves from w_n^* to w_e^* . This result shows that these changes of the equilibrium gross wage level do not reveal any changes in economic welfare. The only importance of the gross wage level is that it is a price explaining the behavior of both employers and workers. This allows us to use this variable when defining equilibrium on the labor market. This is what we did in (12).

There remains the question how changing the value of σ affects the equilibrium on the labor market. If we denote by $\phi(\sigma)$ the value of L that solves (14), given a particular value of σ , it is easy to show that

$$\frac{\phi'(\sigma)\sigma}{\phi(\sigma)} = \frac{1}{\frac{1}{\varepsilon_d(L^*)} - \frac{1}{\varepsilon_s(L^*)}}, \quad (16)$$

where

$$\varepsilon_d(L) = \frac{d(L)}{Ld'(L)}, \varepsilon_s(L) = \frac{s(L)}{Ls'(L)}$$

are the price elasticities of demand and supply on the labor market. As $d'(L) < 0$ and $s'(L) > 0$, it follows that $\phi'(\sigma) < 0$, so that a higher value of σ implies a lower equilibrium level of employment L^* , a higher equilibrium value of w_e^* , a lower equilibrium value of w_n^* . The equilibrium value of the absolute tax wedge $w_e^* - w_n^*$ will therefore increase. By (15) the equilibrium value of the relative tax wedge $\frac{w_e^*}{w_n^*}$ will also increase. Note that σ only depends on the tax rates (t_e, t_w, t_y) , and is independent of the shape of the demand and supply functions of labor. In fact, we can interpret the RHS of (6) as a "production function" of the tax wedge: it shows how the various payroll taxes contribute to the size of the absolute and relative tax wedge.

Interpreting (6) as a production function allows us to calculate the marginal rate of substitution of tax rate t_e for tax rate t_w . One could expect that this marginal rate of substitution is exactly one, meaning that a one percentage reduction of t_e can be compensated by a one percentage increase of t_w . In fact, using expression (6), this marginal rate of substitution equals

$$\frac{1 + t_e}{1 - t_w},$$

which always exceeds 1. This means that the percentage change of t_e required to compensate a one percent change of t_w always exceeds 1.

Finally, we note from (16) that the effect of a change in σ on the equilibrium level of employment will be larger the larger the price elasticities of demand and supply. Clearly, this result has important implications for economic policy.

3 Dynamic adjustments

From the analysis in the foregoing section one might conclude that shifting the responsibilities for paying payroll taxes has no economic effect, provided this shifting does not affect the value of σ . For example, if the government wants to change the value of σ , there are an infinite number of possible changes of t_e , t_w and t_y that will realize this new value of σ . All these possible changes lead to the same new equilibrium on the labor market. The social welfare in the new equilibrium created by these policy measures must be the same, for all the parties involved. Does it follow that the choice of a particular combination of changes of t_e , t_w and t_y is unimportant? The answer is a clear no.

Let us start from a situation with a given combination of t_e, t_w and t_y , giving rise to a particular value of σ . Suppose now that the government wants to increase the equilibrium level of employment by decreasing the tax wedge on labor as measured by σ . There are various ways in which the government can achieve this. We consider two of them.

First, it can decrease σ by decreasing t_e . This is illustrated in Figure 4. The initial equilibrium, before the government intervention, is given by point A. A decrease of t_e causes an upward shift of the demand curve $\frac{1}{1+t_e}d(L^d)$. This leads to a new equilibrium, given by B. This equilibrium involves a higher gross wage level w , a lower value of w_e , and a higher value of w_n . At the old equilibrium value of w , there is now an excess demand for labor, and at the old equilibrium level of employment the employers' willingness to pay (in terms of w) for one more unit of labor exceeds the existing value of w .

Secondly, the government can also decrease σ by decreasing t_w . This is illustrated in Figure 5. The equilibrium before the intervention is given by point A, which is the same as point A of Figure 4. A decrease of t_w causes a downward shift of the supply curve of labor $\frac{1}{(1-t_w)(1-t_y)}s(L^s)$. At the old equilibrium level of w there is now an excess supply of labor, and at the old equilibrium level of employment the existing wage w exceeds the workers' reservation wage. The gross wage will therefore decrease. In the new equilibrium the value of w_e will be lower and the new equilibrium value of w_n will be higher than in the old equilibrium.

Each of the above two policy options leads to the same new equilibrium on the labor market, provided they both realize the same lower value of σ . Hence, when we limit our attention to the comparison between the social welfare in the old equilibrium and the social welfare in the new equilibrium, the two policy options are equivalent. It then seems that the government can switch from one policy option to the other, without worrying about any welfare implications. This conclusion, however, is not correct. Let us have a closer look at the adjustment processes taking place when moving from one equilibrium to

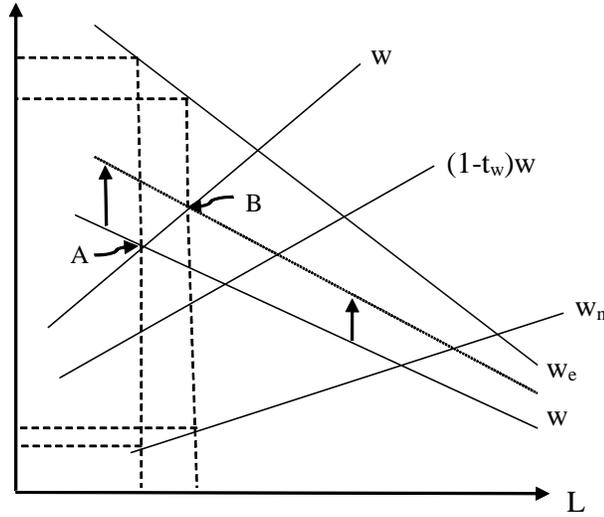


Figure 4

the other.

In Figure 4 the initial equilibrium is given by point A, and the new equilibrium is given by point B. When, as a result of the decrease of t_e , the demand curve $\frac{1}{1+t_e}d(L^d)$ shifts upward, the original combination (L^d, w) in point A is now below the new demand function. In point A there is an excess demand for labor, and the firms' willingness to pay for an additional unit of labor exceeds the existing wage level. This will remain so during the whole adjustment process from point A to point B. Clearly, firms will be able to realize supernormal profits during this adjustment process.

Consider now, in Figure 5, the effect of a decrease of t_w , causing a downward shift of the supply function $\frac{1}{(1-t_w)(1-t_y)}s(L^s)$. The original equilibrium (L^s, w) in point A is now above the new supply function. In point A there is an excess supply of labor, and at the original level of employment the wage offered to the workers exceeds their reservation wage. Clearly, during the adjustment process from A to C workers will realize exceptional values of consumer surplus.

When comparing the two policy options, it is clear that firms will prefer the first policy option, while workers will prefer the second policy option.

The conclusion of this analysis is that it is important to make a clear distinction between (1) the welfare of the market participants during the adjustment process from one equilibrium to another, and (2) the welfare of these participants in the new equilibrium. When we limit our attention to the new equilibrium, the exact policy measures that lead to this equilibrium are irrelevant. When we are interested in the adjustment path followed by the economy from one equi-

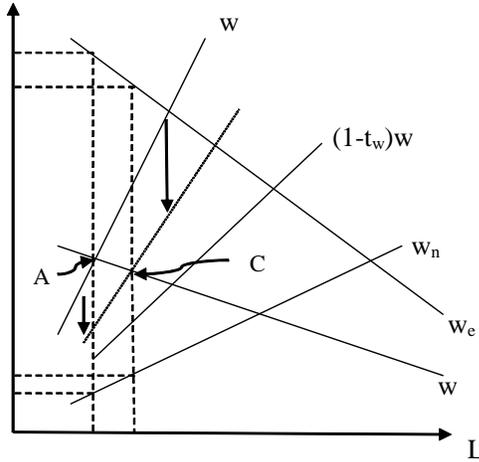


Figure 5

librium to the new equilibrium, the welfare of the market participants will be affected by the exact policy measures leading to the new equilibrium. Moreover, and apart from these welfare effects, the government will also be interested in the speed of the adjustment to the new equilibrium.

4 Conclusion

In this note we propose a simple formula allowing us to determine the net effect on the labor market equilibrium of any combination of simultaneous changes of the various payroll taxes. With respect to the welfare effects of changes of the payroll taxes, an important distinction has to be made between the welfare of the market participants during the adjustment process from one equilibrium to another, and the welfare of these participants in the new equilibrium.

Finally, it should be noted that similar conclusions can be obtained for the case of excise taxes. As subsidies are negative taxes, our analysis can also be used to analyze the effects of subsidies granted in the labor market.

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