Visibility of social security contributions and employment*

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Abstract

In most countries employers and employees share the burden of social security contributions. According to standard incidence analysis, social security contributions affect negatively employment, but it is irrelevant how they are divided between employers and employees. The magnitude of the effect depends only on the elasticities of labor demand and supply. Here I consider the possibility that: (i) workers perceive a linkage between current contributions and future benefits and, (ii) they discount more heavily employer's contributions, because they are less "visible." Under these assumptions, I find that employer's contributions have a stronger (negative) effect on employment than employee's contributions. I also find that making employer's contributions more visible to workers has always a positive effect on employment.

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Key words: Payroll tax, social security, tax incidence, tax visibility

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1 Introduction

Tax incidence studies the effect of taxes on the distribution of welfare in a society. Its basic insight is that the person who really pays the tax may not be the person who has the legal obligation to make a tax payment (see Fullerton and Metcalf (2002)). For example, if government taxes capital, owners of capital can pass some or even all of the tax to consumers through higher prices or to workers through lower wages. Economists distinguish between *statutory incidence*, who is legally responsible for the tax, and *economic incidence*, the change in the distribution of welfare induced by the tax. In general they differ because individuals react to taxes by changing their behavior and, consequently, equilibrium prices may also change. As another example, think of payroll taxes. In the USA the statutory burden of the payroll tax is the same for employers and employees. However, it is generally agreed that the economic burden is borne entirely by workers.[1] It is not surprising that economists care mainly for economic incidence.

The textbook prediction of economic theory is that, when markets are competitive, the economic incidence of a tax will be determined by the elasticities of demand and supply, and not by statutory incidence.[2] In the context of the labour market, this implies that an increase of contributions paid by employers has the same negative effect on the employment level as an increase of the same size in contributions paid by employees. Moreover, any change in how contributions are divided between employers and employees that keeps fixed the total level of contribution, has no effect either on the level of employment or on the total cost of labour.[3]

However, the revenue that government collects from payroll taxes is gen-

[1] See Fullerton and Metcalf (2002).

[2] Statutory incidence matters for real incidence when there is a (binding) minimum wage. See Salanié (2003).

[3] This result does not extend to non-competitive labor markets. See, for example, Pissarides (1998) and Koskela and Schöb (1999).

erally used to finance public programs, such as pensions or health care that benefit workers. Employees may perceive these taxes paid as equivalent to deferred payments and, therefore, not as pure taxes. In other words, workers may perceive a linkage between taxes paid today and future benefits.[4] Taken to the extreme, if workers perceive future benefits as actuarial, payroll taxes may have few distortionary effects.

Some authors have tried to calculate how contributions and future benefits are related for different individuals. For example, Feldstein and Samwick (1992) calculate net marginal tax rates as the difference between the payroll tax rate and the discounted value of the additional social security benefits per dollar of additional earnings for different individuals. Disney (2004) estimates measures of the tax component and the saving component of public pension systems across the OECD countries.

An additional complication arises because in most countries employers and employees share the statutory burden of the payroll tax. In Figure A.1 I represent contributions paid by employers and employees in the OECD countries. Average contribution by employers is 15.2%, while it is 8.6% for employees. I also construct the ratio of the employer contribution to the sum of the employer and the employee contribution. This ratio goes from 0.05 (Denmark) to 1 (Australia) in the sample of OECD countries, with a mean of 0.6. Contrary to employees, employers should perceive their part of the payroll tax as a pure tax, because they do not get any future benefit from it and, as long as they can, they will try to shift the burden of the tax to their employees. Whether they will be successful or not will depend on the corresponding elasticities of supply and demand, as commented above.

Regarding employees, they will probably give some value to the payroll taxes paid, but it may happen that they do not attach the same value to taxes paid by the employer as to taxes paid by themselves. One reason for

[4]See, for example, Summers (1989) and Gruber (1997).

this is that they may not be fully aware of taxes paid by the employer on their behalf, or they may not know the true size of those taxes. There is some evidence pointing out in this direction. In a very interesting paper, Boeri, Börsch-Supan and Tabellini (2001) survey the opinions of citizens in four European countries (France, Germany, Italy and Spain) about their welfare states and also about different possibilities of reform. When people are asked to report the fraction of their wages that both employers and employees pay as social security contributions, they tend to underestimate the true contribution rates. The most striking case is Spain. Half of individuals do not even answer the question. Of those who answer, more than two thirds choose a contribution rate far below the true number.[5] One possible explanation for this underestimation is that individuals are only fully aware of the contributions paid by themselves, but are not so sure about the size of contributions paid by employers. In Spain, for instance, contributions paid by employers do not even appear in the income statements employees receive every month with their wages. Their own contributions are, on the contrary, fully reflected. This is related to the literature on the "visibility" of taxes that goes back to Buchanan and Wagner (1977). In particular, different authors have studied whether or not the sharing of payroll taxes is irrelevant. Dušek (2002) finds that, contrary to his initial intuition, countries where employer's share is large tend to have smaller pension programs. Mulligan, Gil, and Sala-i-Martin (2010) find that the employer's share is slightly higher in democracies than in nondemocracies.[6] They also find that the share paid by the employee has a positive effect on the size of the program, although this effect is rather small. Recently, Chetty, Looney and Kroft (2009) have coined the term "salience" to refer to those taxes that are less visible for consumers. They find that the salience of taxes affect consumers' purchase

[5] In another survey conducted by the same authors in Germany and Italy, only 20% of respondents know the overall (employer plus employee) contribution rate approximately. See Tabellini, Börsch-Supan and Boeri (2002).

[6] See also Mulligan and Sala-i-Martin (1999).

decisions.[7]

The argument of this paper is this: workers may not fully consider contributions paid as taxes, since they acknowledge that these taxes give them the right to future benefits. Additionally, they behave myopically in the sense that they place a higher value on the contributions paid by themselves than in the contributions paid by the employers, because the latter are less salient.

The structure of the paper is as follows. In Section 2 I show that, provided workers value contributions, but employers contributions are less salient for them, the negative effect of taxes on employment is stronger for employers contributions than for employee contributions. I also see that this effect will be stronger for low-skilled workers than for high-skilled workers. In Section 3 I see that making more visible employers contributions is always beneficial for employment. In Section 4 I present some empirical evidence for the OECD countries. Section 5 concludes. Finally, in the appendix I consider a Right-to-manage model in which a trade union and a firm bargain over wages while the firm chooses the level of employment and prove that the main result can be extended to this alternative set-up.

2 Partial equilibrium: the competitive case

Consider the following very simple competitive labor market. Labor demand is $D(w_F)$, where $w_F = w(1 + \tau_F)$. Here w_F is the total cost of labor for the firm, w is the wage that the firm pays to workers, and τ_F is the payroll tax rate paid by the firm. Then, $\tau_F w$ is the value of social security contributions paid by the firm.

Workers receive a net wage $(1 - \tau_W)w$, where τ_W is the payroll tax rate paid by workers. The value of social security contributions paid by the worker is $\tau_W w$. The total revenue for the Social Security administration is $\tau w = (\tau_F + \tau_W)w$. Since payroll tax revenues are used to finance worker

[7] See also Chetty (2009).

benefits like pensions, workers may perceive that they are getting more compensation, since those taxes are buying them some future benefits. These can be in the form of insurance (unemployment or health insurance) or of future pensions. In other words, workers perceive the existence of a link between social security contributions paid today and the benefit they will receive in the future. That is, they do not necessarily consider contributions as pure taxes (see Summers (1989)). However, since pensions will be received in the future they discount these benefits by a factor δ. This parameter δ captures the strength of the perceived linkages between contributions and benefits. It reflects not only pure discounting, but also institutional features of social security. For instance, whether the social security system is close to an actuarially fair scheme or not. If benefits are strictly proportional to contributions, all workers will have similar values of δ. If social security is progressive, low-skilled workers may have a higher value of δ than high-skilled workers. The case $\delta = 0$ corresponds to a situation in which social security contributions are perceived as pure taxes. In Spain, for instance, this would be the case for young workers since their current earnings will not enter the formula that is used to calculate their future retirement benefits. Also this could be the case of low-skilled workers who will qualify for the minimum pension.

A second consideration, which is also a crucial ingredient here is that contributions paid by the worker and contributions paid by the firm are not equally visible ("salient", following the terminology in Chetty et al (2009)). Workers are fully aware of their own contributions, because they see every month the particular amounts paid in the income statement (pay slip) they receive. In many countries, on the contrary, they do not observe the amounts paid on their behalf by firms as social security contributions or they do not observe it as easily as their own contributions. It is not surprising, therefore, to find that when individuals are asked to report the total value of social security contributions they fail to give a correct answer. Boeri

et al. (2001) found that workers underestimate the total value of social security contributions.[8] My own reading of this phenomenon is that they fail to fully acknowledge the value of employer's contributions. To model this asymmetry, I introduce a parameter θ that takes values between 0 and 1 and that multiplies contributions paid by the firm. This parameter captures how visible ("salient") are employer's contributions. The higher is θ, the more "visible" they are. When $\theta = 1$, they are equally visible for the worker as are worker's contributions. When $\theta = 0$ they are not visible at all.

Summing up, I assume that labor supply can be written as $S(w_W)$, where $w_W = (1 - \tau_W)w + \delta(\tau_W + \theta\tau_F)w$. This formulation is similar to that in Gruber (1997), the difference being the asymmetric treatment of employer and employee contributions. In fact if I assume $\theta = 1$, we are back in Gruber's approach. For simplicity, I call $\alpha = (1-\tau_W)+\delta(\tau_W+\theta\tau_F)$. Then, $w_W = \alpha w$.

At the market equilibrium $D(w(1 + \tau_F)) \equiv S(\alpha w)$. I consider changes in τ_F and τ_W and I compare how they affect the equilibrium level of employment. I begin by studying the effect of a change in τ_F. I differentiate completely the equilibrium condition to get:

$$D'(dw(1 + \tau_F) + wd\tau_F) \equiv S'(dw\alpha + wd\alpha). \tag{1}$$

Since $d\alpha = \delta\theta d\tau_F$, I can write the above expression as:

$$D'(\frac{dw}{wd\tau_F}(1 + \tau_F) + 1) \equiv S'(\frac{dw}{wd\tau_F}\alpha + \delta\theta). \tag{2}$$

Given that $\frac{dw}{wd\tau_F} = \frac{d\ln w}{d\tau_F}$, I have:

$$\frac{d\ln w}{d\tau_F}(\alpha S' - (1 + \tau_F)D') \equiv D' - \delta\theta S'. \tag{3}$$

[8]They survey 5500 Europeans about the welfare state. The survey was conducted in 4 countries: France, Germany, Italy, and Spain. One question asked for an estimate of the combined employers' and employees' contribution. The questions was: "*As you know, both employers and employees pay pension contributions. Which fraction of your gross monthly wage goes to public pensions? (Please take into account also your employer contributions).*" Several brackets were suggested. In Spain, the brackets were 0-21, 21-35, 35+. The correct answer is 21-35. Half of the individuals did not answer the question. Of those who answered (49.2%), only 28% answered correctly while 68% chose the first bracket (0-21).

The wage elasticities of labor demand and supply (in absolute value) are $\varepsilon_D = -D' \frac{w}{D}$ and $\varepsilon_S = S' \frac{w}{S}$, respectively. Then:

$$\frac{d \ln w}{d\tau_F} = -\frac{\varepsilon_D + \delta\theta\varepsilon_S}{\alpha\varepsilon_S + (1+\tau_F)\varepsilon_D}, \tag{4}$$

which has a negative sign.

I can also obtain an expression for the effect of a change in τ_F on the level of equilibrium employment:

$$\frac{d \ln L}{d\tau_F} = -\frac{\varepsilon_D\varepsilon_S}{\alpha\varepsilon_S + (1+\tau_F)\varepsilon_D}(1 - \tau_W(1-\delta) - \delta\theta). \tag{5}$$

In general, this expression will be also negative. That is, raising τ_F is harmful for employment.

Next I study the effect of a change in employee's contributions τ_W. Similarly to what I have done above, I obtain:

$$\frac{d \ln w}{d\tau_W} = \frac{(1-\delta)\varepsilon_S}{\alpha\varepsilon_S + (1+\tau_F)\varepsilon_D}, \tag{6}$$

which is positive. Finally, the effect on the level of employment is:

$$\frac{d \ln L}{d\tau_W} = -\frac{\varepsilon_D\varepsilon_S}{\alpha\varepsilon_S + (1+\tau_F)\varepsilon_D}(1-\delta)(1+\tau_F), \tag{7}$$

which is negative as $\frac{d \ln L}{d\tau_F}$.

If all social security contributions are perceived as pure taxes, i.e. $\delta = 0$, the effect on employment of a reduction in τ_F is approximately the same as the effect of a reduction in τ_W, as long as both τ_F and τ_W are small.[9] This is the standard result that claims that the effect of an increase in τ_F is equal to the effect of an increase in τ_W, since economic incidence is determined by the elasticities of supply and demand.

[9] We see that:

$$\frac{d \ln L}{d\tau_F} = -\frac{\varepsilon_D\varepsilon_S}{(1-\tau_W)\varepsilon_S + (1+\tau_F)\varepsilon_D}(1-\tau_W),$$

and:

$$\frac{d \ln L}{d\tau_W} = -\frac{\varepsilon_D\varepsilon_S}{(1-\tau_W)\varepsilon_S + (1+\tau_F)\varepsilon_D}(1+\tau_F).$$

Next, I focus on the case in which workers perceive a linkage between contributions and benefits, i.e. $\delta > 0$. Moreover, I assume that for workers, employer's contributions are less visible than their own contributions, i.e. $\theta < 1$. If we compare the two expressions above, $\frac{d \ln L}{d\tau_F}$ and $\frac{d \ln L}{d\tau_W}$, we find that the negative effect on employment of an increase in τ_F is stronger than the effect of an increase of the same size in τ_W, as long as θ is below a certain threshold $\widehat{\theta}$. In particular, the condition is:

$$\theta < \widehat{\theta} = \frac{1 - (1 - \delta)(1 + \tau)}{\delta}. \tag{8}$$

First, note that $\widehat{\theta} < 1$. That is, the fact that employer's are less visible than employee's contributions is a necessary condition to obtain a stronger effect of employer's contributions on employment. In Table 1 below I show the value of $\widehat{\theta}$ for different combinations of τ and δ.

	$\delta = 0.25$	$\delta = 0.5$	$\delta = 0.75$
$\tau = 0.1$	0.7	0.9	0.97
$\tau = 0.2$	0.4	0.8	0.93
$\tau = 0.3$	0.1	0.7	0.9

Table 1: The threshold $\widehat{\theta}$

I see that the condition in Equation (8) is weaker the lower is τ and the higher is δ. I represent in Figure 1 the combinations of parameters θ and δ that satisfy the condition. The two lines in the figure correspond to two different values τ and τ', where $\tau' < \tau$. Once I fix a value of τ, the region where the condition holds is to the left of the corresponding line. That is, for a fixed value of δ, the parameter θ cannot be too large.

The conclusion is that, provided Condition (8) holds, a reduction of τ_F has a more positive effect on employment than a comparable reduction of τ_W. Interestingly, if social security is progressive, Condition (8) is more likely to

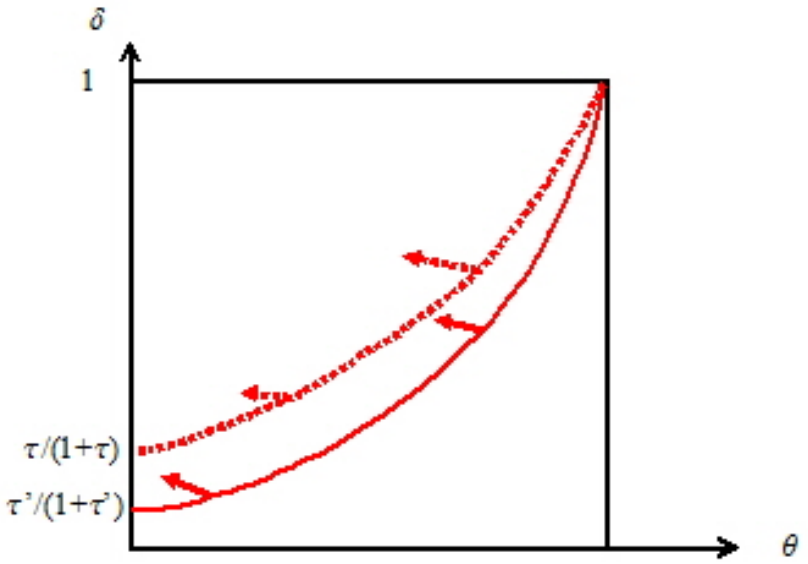

Figure 1: **Region where Condition (8) holds**

hold for low-skilled workers than for high-skilled workers. The reason is that the former may have a higher value of δ, since the system is progressive, and a lower value of θ, because they may be more myopic than high-skilled workers.

An additional and very interesting implication of the above analysis is the following. Suppose that there is a change in taxes so that employer's contributions are reduced and employee's contributions are increased such that total contributions remain constant. That is, I am considering the case in which $d\tau_F = -d\tau_W < 0$, so that the total tax τ remains unchanged. If Condition (8) holds, I prove that this change will have a positive effect on employment and it will also reduce labor costs for firms.

Given that $\alpha = (1 - \tau_W) + \delta(\tau_W + \theta\tau_F)$, then $d\alpha = (1 - \delta + \delta\theta)d\tau_F$. I have that:

$$\left.\frac{d\ln w}{d\tau_F}\right|_{d\tau_F=-d\tau_W} = -\frac{\varepsilon_D + \varepsilon_S(1-\delta+\delta\theta)}{\alpha\varepsilon_S + (1+\tau_F)\varepsilon_D}. \tag{9}$$

The effect on the gross wage $w_F = w(1+\tau_F)$ is:

$$\left.\frac{d\ln w_F}{d\tau_F}\right|_{d\tau_F=-d\tau_W} = \frac{\varepsilon_S}{\alpha\varepsilon_S+(1+\tau_F)\varepsilon_D}\frac{(\delta(1-\theta)-(1-\delta)\tau)}{1+\tau_F}. \tag{10}$$

Finally, the effect on employment is:

$$\left.\frac{d\ln L}{d\tau_F}\right|_{d\tau_F=-d\tau_W} = -\frac{\varepsilon_D\varepsilon_S}{\alpha\varepsilon_S+(1+\tau_F)\varepsilon_D}\frac{(\delta(1-\theta)-(1-\delta)\tau)}{1+\tau_F}. \tag{11}$$

If all social security contributions are perceived as pure taxes, i.e. $\delta = 0$, then:

$$\left.\frac{d\ln w}{d\tau_F}\right|_{d\tau_F=-d\tau_W} = -\frac{\varepsilon_D+\varepsilon_S}{(1-\tau_W)\varepsilon_S+(1+\tau_F)\varepsilon_D}. \tag{12}$$

This term is approximately -1, as long as τ_W and τ_F are not very large. This is the classical result of full shifting where the equilibrium wage depends only on the value of τ, and not on how this is split between employers and the employees. When $\delta = 0$, the remaining expressions become, respectively:

$$\left.\frac{d\ln w_F}{d\tau_F}\right|_{d\tau_F=-d\tau_W} = -\frac{\tau}{1+\tau_F}\frac{\varepsilon_S}{(1-\tau_W)\varepsilon_S+(1+\tau_F)\varepsilon_D},$$

and:

$$\left.\frac{d\ln L}{d\tau_F}\right|_{d\tau_F=-d\tau_W} = \frac{\tau}{1+\tau_F}\frac{\varepsilon_D\varepsilon_S}{(1-\tau_W)\varepsilon_S+(1+\tau_F)\varepsilon_D}. \tag{13}$$

When τ is small, both expressions are approximately zero. As long as the total tax τ does not change, w_F and employment L are not affected by a change in τ_F. It does not matter who bears the statutory burden of the tax.

If, however, the parameter δ is strictly positive, the signs of $\frac{d\ln w_F}{d\tau_F}$ and $\frac{d\ln L}{d\tau_F}$ are determined by the sign of the term $\delta(1-\theta)-(1-\delta)\tau$. In particular, if this term is positive, I get $\frac{d\ln w_F}{d\tau_F} > 0$ and $\frac{d\ln L}{d\tau_F} < 0$. That is, shifting some part of the contributions from employers towards employees, while holding fixed the total contribution rate, reduces labor costs for the firms and, thus, has a positive effect on employment. However, not surprisingly, Condition (8) guarantees that $\delta(1-\theta)-(1-\delta)\tau > 0$.

I find that, as long as $\delta > 0$, the visibility of employer's contributions has a real effect on wages and employment.

Finally, I also see that the effect on w does not entail full shifting. In fact, the lower is θ, the smaller will be (in absolute value) the term $\frac{d \ln w}{d\tau_F}$. Figure 2 illustrates the effect of shifting part of employers contributions to employees. Dotted lines $D(w)$ and $S(w)$ represent labor demand and supply in the absence of taxes. Bold lines $D(w(1+\tau_F))$ and $S(\alpha w)$ represent the initial situation. After the reduction of τ_F to τ'_F, labor demand shifts to the right, while supply moves to the left. The overall effect on employment is positive, since it goes from L to L'. I also see that w_F is reduced, while at the same time, w_W rises.

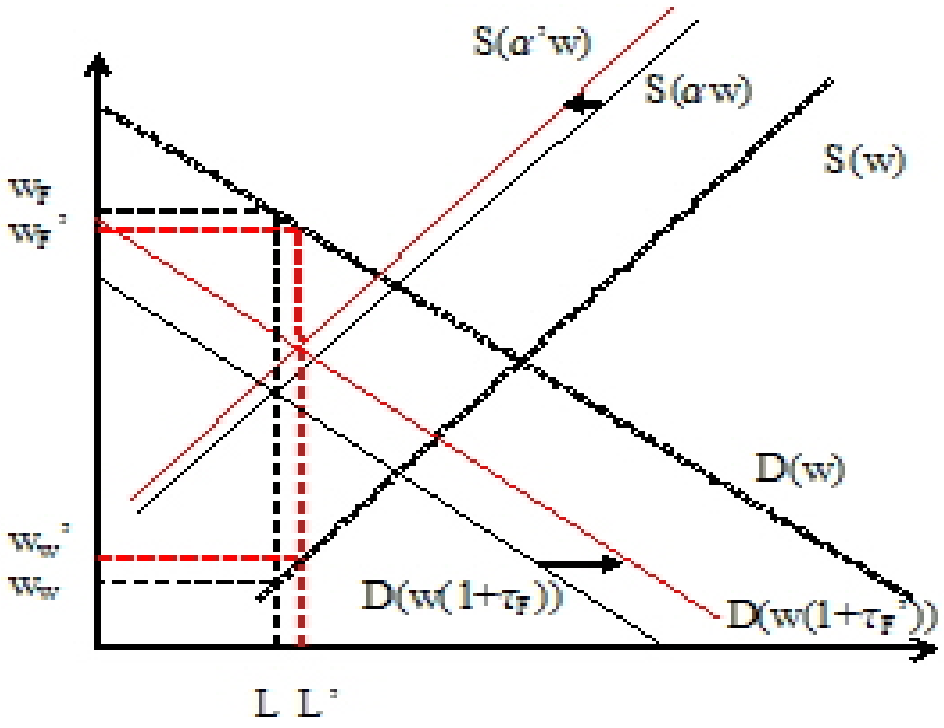

Figure 2: **A reduction on employer's contributions**

3 Making more visible employer's contributions

In principle, we could think that governments could try to make employer's contributions more visible, if this has a positive effect on employment. This could be done, for example, by making it explicit in the information that workers receive every month with their pay slips. I find that this always has a positive effect. The reason is simple. Making employer's contributions more visible for workers has no effect on labor demand but it has a positive effect on supply, as long as they give some value to employers contributions, i.e. $\delta\theta > 0$. This will have a positive effect on employment, while at the same time will reduce labor costs. This effect is illustrated in Figure 3 below, where the effect of this measure is to move labor supply to the right. This is a policy measure that entails little costs and that can prove useful for increasing employment. In fact, this was one of the proposals in the report that the Swedish government appointed to analyze the country's economic crisis. Quoting the report:

"*42. Taxes should be made as visible as possible; they should also be called taxes and not fees; the gross wage, including payroll taxes, should be reported along with the wage payment.*" (Lindbeck et al. (1994, p. 103))

4 Empirical evidence

In this section I collect some empirical data to illustrate the results on previous sections using data of the OECD countries. Unfortunately, there is no available cross country information on the visibility of social security contributions. My results below, therefore, can be seen as an illustration corresponding to the case in which all countries share the same value of θ.

In Table 2 I show data on employers and employees contributions for 30 OECD countries, together with data on (EPL) Employment Protection

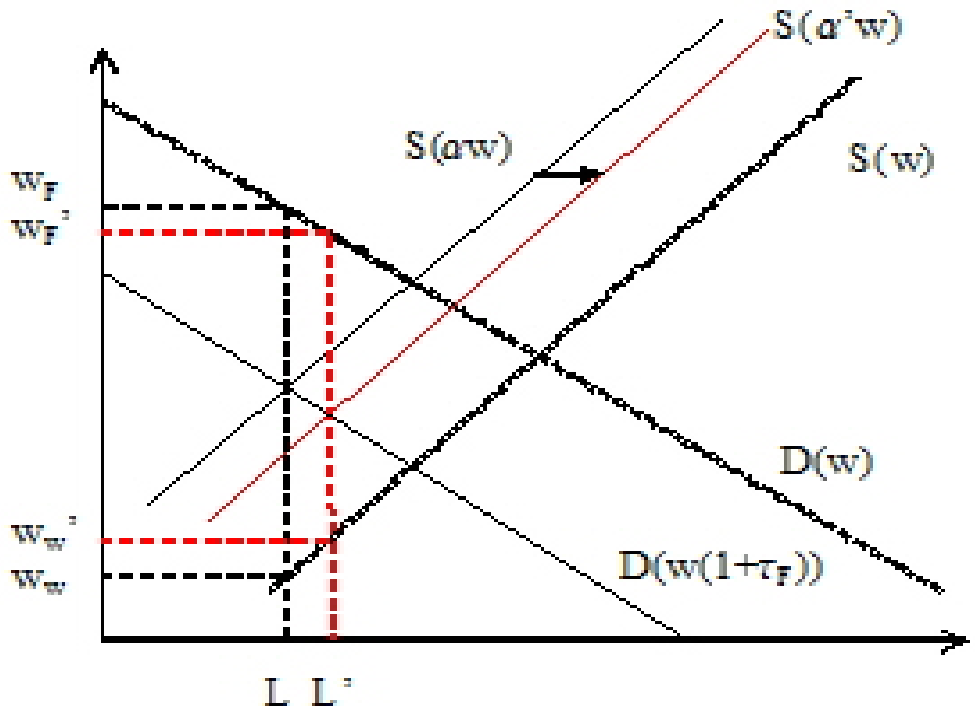

Figure 3: **Making more visible employer's contributions**

Legislation, average income taxes and employment rates. The values for EPL are built by the OECD combining several sources. It takes values from 0 to 4. The highest the value, the more stringent is employment protection. Employment rates are calculated as the ratio between the number of workers and the total number of individuals in working age:

Table 2: Summary Statistics, 30 OECD countries 2008

Variable	Min	Max	Mean	StDv
Employee contribution	0	18.13	8.65	4.85
Employer contribution	0	29.73	15.18	7.92
Total contribution	0	39.35	23.82	10.74
Income tax	3.31	30.14	13.57	6.27
Total tax wedge	15.09	55.97	37.40	10.37
Employment protection	0.85	3.46	2.23	0.71
Employment rate	46.11	87.41	70.11	8.77

Source: OECD

I run two regressions in which the endogenous variable is the logarithm of the employment rate. In the first regression I use three variables as controls: employer contributions, employee contributions, and income taxes. The results are shown in the second column of Table 3. I show in brackets the corresponding standard deviations.

Table 3: Endogenous variable is log of employment rate

Constant	4.3023** (0.0825)	4.4073** (0.0963)
Employer contribution	−0.0062** (0.0030)	−0.0037 (0.0031)
Employee contribution	−0.0039 (0.0046)	−0.0029 (0.0045)
Income tax	0.0050 (0.0036)	0.0042 (0.0034)
EPL	–	−0.0631* (0.0333)

Standard errors in brackets. ** and * denote significance at 5% and 10%.

The only variable that has a significant effect on employment is employer contributions. However, this effect becomes statistically not significant once we control for EPL, as shown in Column 3.[10] Still, its coefficient remains negative.

[10]The p-value of employer contribution in the third column is 0.247.

Finally, I use the results from Table 3 to perform a simple exercise. Suppose that we start from a situation in which $\tau_F = 15.18$ and $\tau_W = 8.65$. This situation corresponds to the mean of the 30 OECD countries. The mean value of the logarithm of employment is 4.2477. Now we reduce τ_F in one percentage point while increasing in that amount τ_W. The new situation is, therefore, $\tau'_F = 14.18$ and $\tau'_W = 9.65$. According to the estimated values of Table 3, the change in the logarithm of employment rate is:

$$d \ln L = -0.0062(-1) - 0.0039(1) = +0.0023. \tag{14}$$

This means that the logarithm of the employment rate goes from 4.2477 to 4.25. That is, the employment rate rises to 70.1054. This represents an increase on the employment rate of 0.16 percentage points.

5 Conclusions

In this paper I find that, contrary to the prediction of standard economic theory, the way in which social security contributions are split between employers and employees affects the level of employment. In particular, I find that contributions paid by firms are more harmful for employment than contributions paid by workers. To obtain this result I need two conditions. First, workers must attach some value to social security contributions. Second, workers must value more their own contributions than those paid by employers. Additionally, under these conditions, a reduction of employers' contributions that goes together with a corresponding increase of employees' contributions, leaving unchanged total contributions, is also positive for employment. Finally, I also find that making more visible the contributions paid by employers is always beneficial for employment.

There are several potential drawbacks of my approach. One is that I am considering just one representative individual. In a model with heterogeneous individuals the results could be potentially different, since different

individuals may suffer from different degrees of myopia.

Another criticism is that I am assuming a competitive labor market and this does not seem very realistic for many countries, in particular for most European countries. However, in the Appendix of the paper I present an standard right-to-manage model in which a representative firm and a representative union bargain over wages, while the level of employment is fixed by the firm. I find that the result of Section 2 extends easily to this setup.

Appendix: A Right-to-manage model

Here I build a very simple right-to-manage model. This model was originally developed by Nickell and Andrews (1983).[11] The main idea is that unions have market power and they bargain over wages with firms. Taken wages as given, firms choose optimally the amount of labor. Since wages are higher than in a competitive market, the employment level is lower and unemployment arises.

As is standard in the literature, I assume that the outcome of the model is the solution of a maximization problem corresponding to an asymmetric Nash bargaining problem as follows:

$$\max_{w} \ [u - \overline{u}]^{\beta} [\pi - \overline{\pi}]^{1-\beta}, \tag{15}$$

where u is the utility function that maximizes the union, π is the profit of the firm, β represents the relative bargaining power of the union, and $(\overline{u}, \overline{\pi})$ is the disagreement point. This point corresponds to the situation when the union and the firm do not reach an agreement. Next I define the profit of the firm and the utility of the union.

There is one firm that uses labor as the unique input to produce. The output market is perfectly competitive and I normalize output price to 1.[12] In particular, the production function is:

$$q(L) = \frac{\delta L}{1-\sigma}^{1-\sigma}, \tag{16}$$

where $\delta > 0$ and $0 < \sigma < 1$. The firm gets profits:

$$\pi(L) = \frac{\delta L}{1-\sigma}^{1-\sigma} - w(1+\tau_F)L. \tag{17}$$

Since the firm chooses L, the demand of labor will be:

$$D(w) = \left[\frac{\delta}{w(1+\tau_F)}\right]^{\frac{1}{\sigma}}. \tag{18}$$

[11] See also Layard, Nickell and Jackman (1991) and Boeri and Van Ours (2008).

[12] This can be easily generalized by introducing another parameter that captures output elasticity. Here I am implicitly assuming that this elasticity is $-\infty$.

Note that the elasticity of labor demand (in absolute value) is $\varepsilon_D = \frac{1}{\sigma}$. Normalizing total labor force to 1, the rate of unemployment is $U = 1 - L$. In case of disagreement I assume that the firm has no profit, then $\overline{\pi} = 0$.

Regarding the union, I assume that union members are risk neutral and their objective is to maximize the expected revenue of workers. In case of disagreement, they get b that can be seen as the wage workers earn in another sector or as the unemployment benefit. Utility is:

$$u(w, L) = \alpha w L + bU. \tag{19}$$

Here αw is as defined in Section 2. Since in case of disagreement workers get b, net utility for the union is:

$$u - \overline{u} = (\alpha w - b)L. \tag{20}$$

Collecting all terms, the solution to the model will be the solution of:

$$\max_w \ [(\alpha w - b)L]^\beta \left[\frac{\delta L}{1-\sigma}^{1-\sigma} - w(1+\tau_F)L \right]^{1-\beta}, \tag{21}$$

under the restriction that $L = D(w)$. Solving this problem we obtain that the equilibrium wage is:

$$w^* = \frac{1 - \sigma + \beta\sigma}{(1-\sigma)\alpha} b. \tag{22}$$

The equilibrium wage increases with β, σ, and b and falls with α. I get the level of employment by substituting w^* into the labor demand function:

$$L^* = \left(\frac{\alpha\delta(1-\sigma)}{(1+\tau_F)(1-\sigma(1-\beta))b} \right)^{1/\sigma}. \tag{23}$$

When β is 1, the union has all the bargaining power. The wage and the level of employment correspond to the monopoly union model. In particular, when $\beta = 1$ I get:

$$w^* = \frac{b}{(1-\sigma)\alpha} \quad \text{and} \quad L^* = \left(\frac{\alpha\delta(1-\sigma)}{(1+\tau_F)b} \right)^{1/\sigma}. \tag{24}$$

In the other extreme case in which $\beta = 0$, I get:

$$w^* = \frac{b}{\alpha} \quad \text{and} \quad L^* = \left(\frac{\alpha\delta}{(1+\tau_F)b} \right)^{1/\sigma}.$$

I am interested on the effect of the split of social security contributions between the firm and the worker. Using Equation (23) above and noting that $\tau_W = \tau - \tau_F$, I can write the equilibrium employment level as a function of τ_F only. Computing the derivative of L^* with respect to τ_F I get that this derivative is negative as long as the term $\delta(-1+\theta-\tau)+\tau$ is negative. It is immediate to check that this is exactly Condition (8) from Section 2.

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Figure A.1: Social security contributions, OECD countries 2008