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Double Dividend Hypothesis: Can it be Validated by Carbon Taxation Swap With Payroll Taxes?

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This paper is concerned with the proficiency assessment of the environmental tax reform to tackle the pollution and simultaneously decrease the tax burden of pre-existent labor taxation. In comparison with mainstream literature, we focus exclusively on the reduction of the tax distortions that affect labor demand, using the revenues generated by environmental levies. Our starting point is the double dividend hypothesis with respect to the environmental taxation. The main objective of this paper is to validate the second dividend hypothesis, hence testing the carbon taxation ability to reduce harmful effects of taxes on inputs such as labor. Following the trajectory of the double dividend hypothesis, the paper examines the potential of carbon taxation enactment accompanied by the payroll tax cuts in order to lower the efficiency costs of these pre-existent distortionary taxes. The feasibility of tax swap mechanism between environmental and payroll taxation is verified through estimating and comparing their efficiency costs. The results obtained from empirical analysis confirm that there is a high potential of swapping these taxes and implementing offsetting measures, where the efficiency costs of payroll taxation are considerably larger than of environmental taxation. Hence, we conclude that there is "enough room" for this tax swap mechanism to take place which would have a two-folded outcome – environment protection improvement and decreasing the efficiency costs of the fiscal system. Given the fact that the efficiency costs of environmental taxes are considerably lower (both in absolute and percentage values), than payroll taxation in the EU, it is possible to apply payroll tax cuts and consequently increase the ratio of environmental taxation.

Keywords**:** *carbon taxation, environmental levies, social security contribution, efficiency costs, tax swap, double dividend hypothesis.*

Introduction

Since Pigou's proposal to tackle negative externalities through taxation, economists have appraised the possible outcome of environmentally related taxes. One of the most debated issues of environmental taxation is the double dividend hypothesis. This hypothesis sustains that environmental levies could have a double outcome if associated with offsetting measures. In this particular context, environmental taxes would not only decrease pollution but will also increase the efficiency of fiscal system. As mentioned by (Pavel & Vitek, 2012), when designing the system of environmental taxation, it is necessary not to take into account just the primary objective – elimination of the negative externality, but also carry out the analysis of the costs connected with the implementation. Our focus is directed to the particular issue of efficiency cost associated with carbon taxation and how the burden of this environmental tax can be offset by operating tax cuts into pre-existent distortionary taxes such as employer's social security contribution. The link between analyzing the excess burden of environmental and payroll taxation lies into the size of efficiency costs of both taxes and the possibility to offset social security excess burden through gradual decreases accompanied by gradual increases into less-distortionary environmental taxation. The aim of the paper is to validate the second outcome of the double dividend hypothesis - i.e. the research of possibility of the swap mechanism between environmental and payroll taxation and its verification through estimation of the efficiency costs.

One supporting argument of a tax swap between these two levies is given by the revenues recycling potential which accompanies the environmentally related taxation. In comparison with previous studies done by (Bovenberg & de Mooj, 1994; Goulder & Metcalf, 1998; Oates, 1995; Fullerton & Metcalf, 1997), we change the angle of analysis, leaving behind the root concern of previous papers such as the tax interaction between environmental taxes and income tax that affects the labor supply. The current paper differs from earlier papers which stress the topic of tax swap such as (Metcalf, 2007a, 2007b; Rauch & Reilly, 2012), for there is analyzed the potential of tax swap mechanism between carbon tax and employer's social security contribution by comparing their efficiency costs. Consequently, this paper analyses the distortions that affect labor demand - payroll taxation and efficiency cost of a new carbon tax, aiming to find those useful connections between these two levies in order to research if there is "enough place" to implement a tax swap mechanism that would result into a "win-win" outcome, which would support the double dividend hypothesis.

This paper relies on both theoretical and empirical analysis. In the first section we review the theory underlying the deadweight loss of taxation and impact of the employer's social contribution on labor demand. This approach allows us to establish the assumption on which our empirical analysis will be performed. In the second part of the paper we calculate both taxes efficiency costs and compare their size in order to determine the feasibility of the tax swap mechanism respecting the revenue neutrality condition.

Theoretical Background

(Auerbach, 1995) states that the deadweight loss (hereinafter as DWL) from a tax system is the amount lost in excess of what government collects. Taking the case of payroll taxes supported by a company and their impact on labor demand, there are two effects associated with this tax: substitution and scale effect. Referring to (Auerbach, 1995) assertion, (Lind & Granqvist, 2010) consider that the impact of income tax over the working hours is indeterminate due to the contradictory signs of substitution and income effect. The measuring of welfare changes due to the tax imposition has two different approaches: equivalent and compensatory variation. (Harberger, 1964) follows the paper of (Little, 1951) considering that there are no differences between an excise duty and income tax with respect to their distortionary effect. Like in the case of an excise duty, the efficiency cost inflicted "artificially" by an income tax can be seen as an excise duty that strikes all commodities with an equal percentage rate. Adopting the example given by (Little, 1951) in an economy with only three goods, the impact of income tax on labor, as an unique factor of production, (Harberger, 1964) sustains that there is no "qualitative" difference between the nature of effect of direct against indirect taxation. There are distortions present in both cases produced by indirect and direct taxes alike. Therefore, the author concludes that the welfare cost of taxation could be lowered by introducing widely different rates of taxation on different goods and services against the equal rates by income taxation.

The DWL of environmental taxes and employer's social contribution are calculated using Harberger's method in measuring the excess burden of an excise tax, which can be summarized intro following explanation – when a tax of good X of T_x per unit is the only distortion present, the welfare cost of that tax can be measured by:

$$-\frac{1}{2}T_x\Delta X \tag{1}$$

Where: ΔX = is the change of consumption of X induced by the tax;

$t_x = \frac{T_x}{P_{x0}} => t_x =$ the percentage change;

$\Delta X = \eta_{xx}Xt_x$; where η_{xx} is own-price elasticity for product demand. Deriving $\Delta X = \eta_{xx}Xt_x$ and substituting ΔX with $\eta_{xx}Xt_x$, and $P_{xo}t_x$ for T_x the author obtains an alternative formula to measure excess burden:

$$-\frac{1}{2}XP_{xo}\eta_{xx}t^2 \tag{2}$$

However in order to simplify the calculation, and considering that $XP_{xo}t_x$ represents the tax yield R_x then the formula above can be rewritten:

$$-\frac{1}{2}R_x\eta_{xx}t_x \tag{3}$$

Where R_x represents the tax revenues therefore simplifies the determination of deadweight loss, because tax yield (R_x) and tax rate (t_x) usually are published, the only element left to estimate is the own-price elasticity of the good X. In our case, to calculate deadweight loss (hereinafter DWL), η_{xx} is the own price elasticity of demand for fossil fuels.

Feldstein (1995a) contribute to the economics of excess burden of income tax measurement by adopting a different method to calculate the deadweight loss. Instead of using traditional labor supply responsiveness to wage rate proposed by (Harberger, 1964), the author uses taxable income response to changes into marginal tax rates. Following the paper of (Lindsey, 1987b), Feldstein estimates the elasticity of taxable income with respect to the marginal net-of-tax rate. Using this alternative measurement, (Feldstein, 1995b) considers that the traditional method proposed by Harberger to analyze the distortionary effect of income tax greatly underestimates the total deadweight loss.

Therefore, in order to change the angle of approach we choose to analyze the distortionary effect of the payroll taxes with respect to labor demand. According to the law of demand, the demand curve for labor is a downward-sloping function of the wage rate. As consequence policies that increase the labor costs of the employer's will have the undesirable side effect of reducing the employment opportunities.

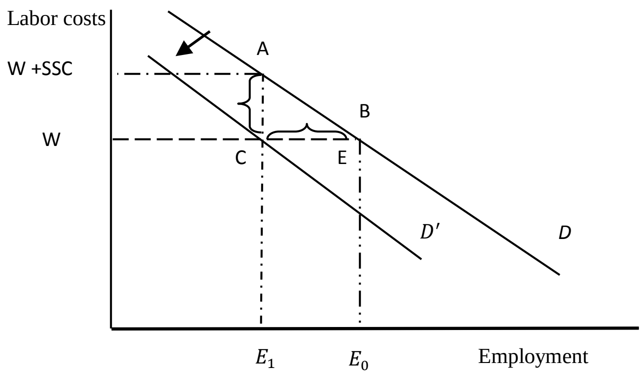

Figure 1. The diagrammatic representation of labor demand responsiveness to payroll taxation distortions (employer's social security contribution)

Where: AC = social security contributions of the employer; CE = the reduction in Labor Demand due to this tax; D = Labor Demand curve and ABC is the DWL triangle with respect to the payroll taxes paid by the employer for each of its employees.

Therefore the formula to calculate the DWL will be:

$$\frac{1}{2}\eta ssc^2 wL \tag{4}$$

Where: η = compensated (using the Feldstein, 1995; Lindsey, 1984; Hamermesh, 1986)) elasticity of the Labor Demand with respect to the wage rate, holding the output constant; ssc^2 = is the square of the social security contributions of the employer rate and wL = represent earnings of labor gross of income tax (i.e. gross income).

Because $ssc * wL = SSCyield$ (payroll tax yield), then the final formula to calculate DWL of social security paid by the employer is:

$$\frac{1}{2}esscSSCyield \quad (5)$$

According to the (Ramskov & Munskgaard, 2001) e represents the compensated elasticity of labor demand with respect to the wage rate can be calculated as the traditional, uncompensated Marshalian elasticity (E) from which is extracted the scale effect (holding output constant), meaning the formula is:

$$-E(1-e_i) \quad (6)$$

Where e_i is the proportion of the expences for good (our case labor proportion in total costs). This estimate represents the Unit Labor Costs (e_i). The data regarding unit labor costs are reported by the Eurostat, as well as the other necessary data to calculate the DWL of the payroll tax.

Examining the issue of Harberger's Triangle (ABC triangle in Figure 1), (Hines, 2004) considers that the same as an excise duty effect over the consumption of a given good, payroll tax drives a wedge between marginal benefits and marginal cost of labor – considered as an input. Accordingly to (Ehrenberg, 2006) the presence of payroll taxes create distortions in such manner that employees are constricted to accept a lower wage rates and the employers are constricted to choose a lower level of employment. The conclusion that can be drawn is that payroll taxes artificially increase the labor costs faced by a company, where these costs are shared between her and its employees. The amount in what each actor shares the burden of payroll taxation depends strictly on the elasticity of both labor demand and supply to the wage rate. However the employer cannot fully shift the burden of payroll taxation on the employees because the wage rate will fall in such manner that it will become harder for the company to hire additional employees. In order to estimate the efficiency cost of payroll taxation, a key element of the analysis is to calculate the own-price elasticity of the labor demand.

The elasticity of labor demand with respect to its wage rate is governed by two effects: firstly if the increase of wage rate increases the labor costs then the employer is forced to use less labor by replacing it with other cheaper inputs - the substitution effect. Secondly, when the increase in wage rate leads to the increase in the marginal cost of production, the employer increases prices, which would reduce the output creating the scale effect. Therefore the sensitivity of labor demand to wage rate fluctuations can be divided in two components: the substitution and the scale effect.

The scale effect expressed as elasticity can be defined as the percentage change into employment associated with a change into wage rate, holding production technology constant, in other words the labor demand response without substitution effect. Accordingly, the substitution effect manifests more in the long-run and is expressed as elasticity in the labor demand response to a change in wage rate holding output constant.

(Allen, 1938) defines the elasticity of substitution between the capital and labor services as an effect of change in relative factor prices on relative inputs of the two factors, holding output constant.

$$\sigma = \frac{dln(K/L)}{dln(w/r)} \quad (7)$$

Therefore the own-wage elasticity of labor demand according to (Hijzen & Swaim, 2008) at a constant output and constant r is:

$$\eta_{LL} = -(1-s)\sigma < 0 \quad (8)$$

Where s is the share of labor in total costs production. In here the constant output elasticity of the labor demand is smaller (highly inelastic) for a given technology, where labor's share is greater because there is relatively less capital toward which the company can substitute labor when labor costs rise. The scale effect or the elasticity of scale strictly depends on the absolute value of the product demand elasticity η, and the share of labor in total production costs:

$$\eta'_{LL}=-[1-s]\sigma - s\eta \quad (9)$$

In the formula (6) the first element captures the substitution effect, which shows the extent to which a firm substitutes away from labor when is face with a wage rate increase, for a given level of output. The second element of the above formula captures the scale effect, which shows the reduction in employment due to the reduction in output as a response to the higher cost of labor, leading to higher output prices and therefore lowers sales. For a given cost share of labor in total production costs, the scale and the substitution effect due to the change in wage rate are both negative.

In analyzing the own price elasticity of labor demand, (Hamermesh, 1986) dismisses the simple choice of measurement such as total employment and total hours. Only when workers are homogenous this measure can be used, but in case where employees are heterogeneous along the dimension of hours worked per time period using total employment will lead to biased results if hours per worker are correlated with factor price or output. Therefore the author recommends that total hours worked to be used instead of total employment. On the other hand the measure of the price of labor, according to (Hamermesh, 1986) should be average hourly earnings instead of average wage rate. The analysis performed by (Feldstein, 1995; Lindsey, 1986) regarding the DWL of income tax and social security contribution of the employee is based on the supply side of economics. Our interest, particularly for this paper is to move our attention towards the demand side of labor, in order to analyze the impact of payroll taxes, such as social and health contribution paid by the employer for its employees over the demand for labor and thus to calculate the DWL of such taxes.

Data and Empirical Methodology

In order to calculate the deadweight loss of environmental taxation already enacted in the European Union member countries, we incorporate the traditional Harberger proposed formula (3), where three different types of raw statistic data will be used: the environmental tax revenues, the environmental tax rates and the own-price elasticity of demand for fossil fuels. First set of data is available on the Eurostat Database, but the last two sets of data are missing and require a difficult procedure of determining. In order to simplify the analysis, we will use the meta-analysis provided by (Dahl, 2011) and use their average estimates on own-price elasticities for fossil fuels demand, which is considered as highly inelastic, estimates ranging between -0,2 and -0,4. The third set of data involves a messy aggregation of dispersed and irregular taxation of fossil fuel consumption across the EU member states. Therefore, we choose another approach of calculating the tax ratio of environmental levies in the EU. We use available data for the EU member states, due to the presence of both environmental and payroll taxation. The main reason of this country selection is due to the absence of a tax swap mechanism that targets corrective levies increases accompanied with gradual reduction of taxes that affect labor demand.

Taking the data provided by the U.S. Energy Information Administration (U.S. IEA), we choose the Energy Intensity data, from which we use the Total Primary Energy Consumption per Dollar of GDP – meaning how much energy had a country used in one year to produce 1 U.S. Dollar worth of gross domestic product. This energy consumption is expressed in the British Thermal Units – Btu's. On the other hand we used the data provided by the World Bank Database – World Development Indicators where is specified the Fossil Fuel Consumption of Energy in percentage out of total energy consumed in analyzed countries. Going forward we calculated the Real GDP using the GDP deflator and calculating the Deflator for 2000–2011 period, with the base year being 2005 (2005=100). After determining the Real GDP, we calculated the total energy consumed produced burning fossil fuels by using data provided from the World Bank and the US IEA. Having total fossil fuel energy consumed per year expressed in the US dollars and also the total environmental taxation revenues reported by the OECD Statistics also in the US dollars, we were able to determine the effective environmental tax rate in the EU countries.

After determining the effective environmental tax rate we calculate the DWL of the environmental taxation using the traditional (Harberger's, 1964) formula (3). Following the previous described methodology to calculate the deadweight loss for environmental taxation and payroll taxes, we intend to compare the net loses between both taxes. We expect that the deadweight loss of payroll taxation will be much higher compared to the indirect taxation such as environmental taxes in the European Union. This comparison will enable us to propose a tax swap between payroll and environmental taxation in order to decrease the efficiency costs of the former and increase the less-costly environmental tax rates. This swap could represent one of the most important premises to satisfy the double dividend hypothesis with respect to carbon taxation theory.

Enacting carbon taxation accompanied by payroll taxation cuts will not only decrease pollution but also will increase the efficiency of the tax system and enhance economic growth. Therefore for comparative reasons we estimate both types of elasticities – uncompensated and compensated with respect to labor demand for wage rate. In case of the environmental taxation deadweight loss calculation we will rely on the results obtained by (Dahl, 1993, 2011) from where the average own-price elasticity for fossil fuels demand will be used in order to calculate the deadweight loss of environmental taxation enacted in the European Union countries. For comparative reasons, we will use an upper (-0,4) and a lower (-0,2) level of fossil fuels elasticity of demand.

The calculation of labor demand elasticity with respect to the wage rate uses the Marshalian uncompensated formula and also Hicksian compensated own-price elasticity of labor demand. The uncompensated own-price elasticity of labor demand with respect to wage rate formula is:

$$\eta_{w,L} = \frac{\%\Delta L}{\%\Delta w} = \frac{\delta L}{\delta w} x \frac{w}{L} \tag{1.1}$$

And respectively:

$$\eta^*_{LL} = -(1-s)\sigma \tag{1.2}$$

Where σ represents the substitution effect and s is the labor cost share in total costs of production; $-(1-s)$ represents the weights or the output elasticity with respect to the capital (capital cost share if factor markets are competitive). Therefore the compensated Hicksian own-price elasticity of demand takes into account only the substitution effect holding the output constant.

In the first case we assume the Cobb-Douglas production function, where the elasticity of substitution is equal with 1. In case of uncompensated elasticity – (1.1), Labor L is a function of L=f(W,R), but in case of compensated elasticity labor L is a function of L=f (W, R, Y), meaning it measures how much does the demand changes if wage rate varies and the holding output fixed.

The compensated elasticity of labor demand with respect to wage rate (1.2) measures how much the demand for labor changes as a response to the wage rate changes but the output level is kept constant. The conditional elasticity reflects the possibility of factor substitution and scale effect. The calculation of compensated elasticity is based on holding the output constant and the result obtained exhibits only the substitution effect from a change in wage rate.

Because the raw statistic data used are available on an aggregated level for the European Union countries, we will assume that there are constant returns to scale and capital and labor as inputs are close to perfect substitutes, consequently we will approach the issue of compensated elasticity from a Cobb-Douglas production function perspective. In this manner we assume that the effect of substitution is σ =1.

Results

In order to achieve relevant outcome from the empirical analysis we follow the assumptions established into previous sections. Firstly, we calculate separately the efficiency costs for environmental taxation and employer's social contribution. Secondly we compare the size of deadweight losses from the selected levies. The results obtained for the Environmental taxation deadweight loss calculation are presented in Table 1. The DWL of the environmental levies is determined using a lower and upper level of own-price elasticity of demand for fossil fuels according to the primary studies of (Dahl, 1991, 2011).

The data displayed are in averages for the period of 2000–2011, where the DWL were calculated for 15 European Union member states. First set of results, DWL1 was obtained using a lower level of elasticity, were we assume that own-price elasticity of demand for fossil fuels is highly inelastic using as an average estimate of -0,2. Therefore the DWL1 for a highly inelastic demand has a significantly small size, both in absolute and in percentage. The efficiency loss amounts from a minimum level of 0,2 % up to 0,6 % out of total revenues from environmental taxation in the EU countries. Increasing the elasticity of demand for fossil fuels give us the second set of results regarding the deadweight loss of the environmental levies – the DWL2, where we use an average estimate of -0,4. Even if the demand for fossil fuel is still considered as inelastic, the efficiency cost (DWL2) for this level of elasticity ranges from 0,6 % up to 1,6 % with respect to Environmental tax revenues in the EU member states between 2000–2011.

On the other side, in order to determine the DWL of employer's social security contribution (hereinafter as SSC) supported for its employees we used the data provided by the OECD Statistics regarding the employer's annual average social security contribution rate, for the period of 2000–2011 in the European Union member countries. In order to calculate the own-price elasticity of labor demand with respect to wage rate we used both (1,1) and (1,2) formulas for uncompensated and compensated own-price elasticity of demand for labor. Another particularity in calculating both types of elasticities, we choose to use annual average working hours and average annual hourly earnings instead of using the traditional total employment and annual average wage rate to determine the own-price elasticity of demand for labor, data that was provided by the OECD Statistics.

Table 1

Deadweight loss of environmental taxation for 2000-2011 period, in the EU member countries

	***Environmental tax revenues Mil. US $**	***Effective Environmental tax rate %**	***DWL1 (ε =-0.2) Mil. US $**	***DWL1 %**	***DWL2 (ε =-0,4) Mil. US $**	***DWL2 %**
Austria	5113,487	3,585	-18,339	-0,358	-36,679	-0,717
Belgium	4749,366	3,249	-15,403	-0,325	-30,806	-0,650
Czech Rep.	245,273	0,032	-0,056	-0,032	-0,901	-0,609
Denmark	11847,091	5,536	-65,710	-0,554	-131,420	-1,107
Finland	4952,307	6,042	-29,733	-0,604	-59,466	-1,208
France	27512,384	3,922	-107,097	-0,392	-214,194	-0,784
Germany	66886,955	2,934	-195,551	-0,293	-391,102	-0,587
Hungary	3073,117	0,037	-0,115	-0,004	-0,230	-0,007
Netherlands	24060,953	4,003	-96,750	-0,400	-193,499	-0,801
Norway	8533,399	4,702	-39,009	-0,470	-78,018	-0,940
Poland	6874,172	2,103	-14,563	-0,210	-29,126	-0,421
Portugal	5077,512	3,377	-17,179	-0,338	-34,357	-0,675
Slovakia	1382,173	3,696	-4,871	-0,370	-9,741	-0,739
Spain	20830,284	2,420	-48,948	-0,240	-97,897	-0,479
Sweden	10480,094	8,129	-85,125	-0,813	-170,251	-1,626
UK	53794,795	2,894	-154,412	-0,289	-308,823	-0,579

Source: *Own calculations; *the results represent averages for 2000–2011 period.*

The results regarding the efficiency cost of employer's social security contribution across the EU member states is presented in Table 2. Similarly, to the environmental tax deadweight loss calculations, we estimated also two sets of DWL for employer's SSC, using traditional Marshalian uncompensated elasticity of labor demand to calculate DWL (1,1) and Hicksian compensated own-price elasticity of labor demand to estimate the DWL (1,2). The results regarding compensated own-price elasticity of labor demand (See the Appendix, Tables 1,1–1,5) are consistent with those obtained by (Lichter *et al.*, 2013). The first set of results regarding DWL (1,1) has considerable differences across the EU countries, ranging from an average of 0,8 % out of total employer's SSC revenues and rising up to 3,6 % with respect to SSC revenues collected. In comparison with these results, the second set of estimates for DWL (1,2) is significantly higher, where the efficiency cost of employer's SSC both in the absolute and in the percentage value ranging from a minimum of 1,5 % up to 7,6 % out of total revenues from social security contributions. Comparing the efficiency costs between the environmental taxation and employer's social security contribution, using only the percentage values, we observe a significant difference where the DWL of employer's SSC dominates the DWL of environmental levies enacted across the EU countries. While the excess burden of environmental taxation expressed as percentage with respect to amount collected stays at a sub unitary level, the DWL of SSC is considerably higher, rising up to an average of 3,5 % out of employer's social security contributions.

Therefore if we choose to evaluate the efficiency costs with respect to both types of taxation, weighting one tax against another we can support the idea that a tax swap between analyzed direct and indirect taxes is feasible. Carbon taxation introduction can be accompanied by an employer's social security gradual reduction, in order to decrease the distortionary effect of SSC on labor costs by offsetting with less distortionary, indirect-wise environmental levy such as carbon taxation. The substantial differences between the efficiency cost of both types of taxes stays into the responsiveness of demand curve for each taxed item – labor in case of SSC and fossil fuels in case of the environmental taxes.

Table 2

Deadweight loss of Employer's Social Security Contribution, in the EU member countries for 2000-2011 period

	SSC Revenues Mil. Euro	Unit Labor Cost (ULC)	SSC Rate %	**Uncompensated** Elasticity Of Labor Demand	Compensated Elasticity Of Labor Demand	DWL (1.1) Mil. Euro	DWL (1.1) %	DWL (1.2) Mil. Euro	DWL (1.2) %
Austria	26936,13	0,69	24,30	-0,364	-0,311	-993,59	-3,604	-1007,37	-3,736
Belgium	37948,22	0,69	30,76	-0,004	-0,306	-11,83	-0,087	-1771,93	-4,722
Czech Rep	10219,04	0,59	34,67	-0,085	-0,415	-138,18	-0,149	-725,27	-7,194
Denmark	7809,75	0,66	20,00	-0,036	-0,337	-41,16	-0,365	-253,84	-3,370
Finland	17951,34	0,66	23,72	-0,091	-0,344	-191,50	-1,094	-727,81	-4,106
France	239030,28	0,69	43,53	-0,104	-0,314	-4996,70	-2,226	-16227,80	-6,837
Germany	250229,57	0,69	20,16	-0,362	-0,311	-9109,18	-3,619	-7847,54	-3,138
Hungary	7652,74	0,63	34,98	-0,031	-0,372	-43,03	-0,569	-500,47	-6,651
Netherlands	55761,46	0,68	10,29	-0,146	-0,318	-414,22	-0,756	-903,45	-1,642
Norway	19593,22	0,57	12,91	-0,062	-0,430	-50,55	-0,394	-519,53	-2,776
Poland	20930,96	0,57	16,12	-0,092	-0,427	-162,49	-0,699	-711,87	-3,453
Portugal	12194,69	0,68	23,75	-0,209	-0,324	-295,61	-2,477	-464,91	-3,842
Slovakia	3308,65	0,50	30,07	-0,053	-0,499	-33,86	-0,970	-246,35	-7,612
Sweden	39943,10	0,68	32,33	-0,025	-0,316	-105,59	-0,445	-2041,53	-5,112
UK	157652,37	0,70	10,52	-0,205	-0,296	-1766,75	-1,090	-2395,74	-1,549

Source: *Own calculations; All data represent averages for 2000–2011 period.*

Another pertinent explanation of the feasibility of this tax swap mechanism stays into the fact that employer's SSC "artificially" increases the labor costs driving a wedge between marginal cost and marginal product of labor. This means that employer's social security contribution targets one of the fundamental inputs of production – labor, compared with environmentally oriented taxes which target general commodities which can be considered as outputs.

On the other side, the differences between both the absolute and percentage values of both DWL's are intimately determined by the degree of own-price elasticity. Therefore it is important to take into consideration the inverse rule proposed by Ramsey (1957), where the author recommends a large tax base targeting those commodities with a highly inelastic demand, as carbon taxation does, and in return the distortions of production (supply) and consumption (demand) will be kept at a minimum efficiency costs.

Discussion

Aiming to deepen our analysis we choose to run a series of simulations, where we build two type of scenarios, where we operate 30 % and 50 % reductions into payroll taxation (social security contribution of the employer) and consecutively operating the modifications such as increases into the environmental tax rates and the tax revenues respecting the revenue neutrality condition, in order to compare the fluctuations of DWL in both types of taxation.

According to the Table 3 we simulated a decrease of employer's SSC rate and revenues and implicitly an increase of the environmental tax rate and the revenues, adding the lost revenues from SSC to the environmental tax. This procedure was followed by a recalculation of now modified environmental tax rate and also the recalculation of both taxes efficiency costs. Therefore, if we take the example of Germany, using initial reported average of SSC and the environmental tax results, we operate firstly a 30 % reduction of SSC rate and also a 30 % reduction in SSC revenues. That means that employer's SSC rate will decrease from an initial level of 20,16 % to a level of 14,11 %. These artificially operated SSC rate cuts will also decrease the revenues from an initial value of 250 billion Euro to 175,1 billion Euro. Adding the 30 % loss or revenues to the Environmental tax revenues in order to fulfill the condition of the revenue neutrality, the initial revenues of the Environmental taxation will increase from 56 billion Euro up to 131,9 billion Euro. Recalculating the environmental tax rate that will collect this amount of the revenues (131,9 billion Euro), we obtained that the environmental tax rate should rise from the initial value of 2,93 % up to 6,19 %, meaning that the decrease of 30 % of employer's SSC rate equals an 118% increase of the environmental tax rate in order to respect the condition of revenue neutrality.

A decrease of SSC rate with 50 % meaning that employer's SSC rate will decrease from 20,16 % to 10,08 % implies that the environmental tax rate should increase from 2,93 % up to 9,33 %, in order to collect the revenues lost from SSC decrease. Therefore, a 50 % decrease of SSC rate equals a 215 % increase in the environmental tax rate.

Table 3

Two scenarios simulations for Germany, applying gradual reductions of employer's SSC and increasing the environmental taxation

Germany	Initial	30% (+/-)	50% (+/-)
SSC Revenues Mil. Euro	250229,57	(-)175160,70	(-)125114,78
SSC rate %	20,16	(-)14,11	(-)10,08
ENV Revenues Mil. Euro	56853,91	(+)131922,78	(+)181968,69
ENV Rate %	2,93	(+)6,19	(+)9,33
DWL SSC Mil. Euro	-7847,54	-4438,57	-2282,69
DWL SSC %	-3,14	-2,53	-1,82
DWL ENV Mil. Euro	-195,55	-791,54	-1637,72
DWL ENV %	-0,29	-0,60	-0,90

Source: *Own calculations. The environmental revenues are transformed from US dollar to Euro using an average exchange rate for 2000–2011 of 0,85. The (+)/(-) represent additional information to indicate where increases and respectively decreases have been operated.*

Once we have these new estimates regarding both tax rates and revenues, we recalculated the DWL of employer's SSC and environmental taxation. Firstly, in case of SSC, the efficiency cost sensibly decreases along the simulated tax rate cuts, while the DWL of the environmental taxation has a sluggish increase compared with a steep decrease of the efficiency cost in case of the employer's social security contribution. In the both sets of simulation, the DWL of SSC decreases sharply from a 3,14 % from SSC revenues to 1,82 % of SSC revenues, while due to the gradual increases of environmental tax rate and revenues, the DWL of this tax rises from 0,2 % up to 0,90 % with respect to the environmental tax revenues.

The additional distortions that result from the environmental related levies tends to encourage capital outflow and industry relocations to other "pollution heaven" countries. In that connection is necessary to stress that some of the energy-intensive industries cannot be easily relocated due to the nature of their economic activities and physical distance from marketplace. Nevertheless, one can argue that industries relocate also due to the low corporate income tax and the cheap labor. Therefore, even if the analyzed tax swap tries to combine two different taxes that *prima facie* have no connection, each being dependent on different underlying factors and having incompatible purposes as (Murphy, 2012) sustains, one can easily exploit the advantages of the environmental tax if the efficiency cost of this tax is lower than the one of employer's payroll taxation. Low payroll tax rate will decrease the price of labor for companies, consequently the labor demand will increase boosting investments, production and consumption. Payroll tax cuts followed by the introduction of carbon tax can be seen as a tax shift in a positive manner between companies and households, meaning that trough this mechanism the resulted labor cost decrease can be passed partially to employees through the higher wage rate or increasing demand for new employees.

It is important to underline also the methodological limitation of the study, which is caused by the assumptions on which we based our analysis, such as examining the efficiency costs of both forms of taxation in a framework where the presence of other distortionary taxes is excluded. Ignoring the tax interaction effect tends to lower the accuracy of the results obtained. We estimate that the deadweight loss of both environmental and payroll taxes is considerably higher if other distortionary effects are included. On the other hand, using the assumption that the effect of substitution σ =1, where labor and capital as inputs are near-perfect substitutes, in order to simplify the calculation of the compensated own-price elasticity of labor demand, can be also questioned. There are several studies see (Chirinko, 2002; Stern, 2008) on this particular issue where the opinions differ on the value of the effect of substitution σ, demonstrating that σ is not always equal to 1. There are cases where the effect of substitution is σ<1 or even $\sigma < 0$. However, the most important contribution of this paper lies in an innovative approach, where we choose to analyze the distortions of labor demand due to the payroll taxes and compare with the DWL of environmental levies.

The main reason of this direction of the research is the assumption that the companies represent the core of every market economy and their reaction to the exogenous distortions triggers and intimately influences the trajectory of economic growth and environmental protection. Therefore, the responsiveness of the labor demand (employer's choice with respect to employment level) to the burden of taxation, particularly to payroll taxes that artificially increase the cost of labor requires a special attention. Our approach towards a tax swap is different with the one proposed by mainstream economics such as (Fullerton & Metcalf, 1997; Goulder, 1991, 1995; Metcalf, 1998; Poterba, 1991; Jorgenson & Wilcoxen, 1990; Bovenberg & de Mooij, 1994) and others. This tax swap mechanism aims to operate income tax cuts accompanied by carbon taxation enactment, respecting the condition of revenue neutrality. Although the income tax cuts might be appealing, this mechanism risks to become a hidden subsidy from the state to individuals. Leaving the real net income unaffected after price increases, due to the income tax cuts via environmental taxation introduction, this mechanism unintendedly further allows the individuals to buy now more expensive "dirty goods", leaving the consumption patterns unchanged. Making a tax-rebate, through income tax cuts, it could turn into a reverse of carbon taxes increasing the consumption of carbon intensive products. This means that the state, through the income tax cuts subsidizes the consumption of the same goods that previously have been taxed (for its amount of carbon emissions resulted in the production process). This reversal of abatement policy does not improve the environment and certainly does not reduce the pollution. Therefore, applying income tax cuts leaves the real income unaffected (identical budget constraint curve), which means that the impact over the "dirty goods" is unchanged and the pollution will not decrease significantly. In this particular setting, with an inelastic demand for fossil fuels, where the prices rise through carbon taxation and real income increases due to the income tax cuts, will produce only a shift of the supply to the left, without substantially affecting the consumption pattern. Our results are similar with those obtained by (Shackleton *et al.*, 1993) where the authors stress that revenues used to reduce taxes on labor income tend to stimulate consumption but not investment, therefore in this case the adverse economic impact of carbon tax is only slightly offset by this mechanism.

Combining the issue of distortionary impact of payroll taxes with the issue of efficiency costs of environmental taxation, we examine the potential of an offsetting mechanism that aims a double outcome through tax swap – decrease pollution and the excess burden of pre-existent taxes. As a consequence, the results obtained, even if at an aggregate level, have provided the strong evidence that there is a substantial potential of swapping these taxes.

Conclusion

The aim of this paper was to validate the second outcome of double dividend hypothesis. We started with the question whether the carbon taxation swap with payroll tax cuts can decrease the excess burden. In order to meet our research question, we firstly deploy a brief review of the literature underlying both issues pursued in this paper: measuring the deadweight loss of taxation and establishing the impact of payroll taxation on labor demand. Once we outline the theoretical background on which our empirical analysis will be performed, we proceeded to determine the efficiency costs of both – the environmental taxation and employer's social contribution in the selected countries. The results obtained from the empirical assessment demonstrate that there is a considerable difference in absolute and percentage value between the efficiency costs of environmental levies and the payroll taxation, where the former has a significantly lower size than the latter. Furthermore, we run a series of simulations in order to prove the feasibility of a tax swap between selected taxes, using as country of choice Germany. In this case we run two stages of simultaneous employer's social contribution reduction and respective environmental taxation increases. The research revealed that the efficiency costs of the latter does not increase significantly due to this mechanism, while the employer's social contribution deadweight loss is substantially decreased. It is important to specify that this tax swap mechanism was considered under the condition of the revenue neutrality.

Therefore, the results obtained for the selected EU member states confirm that there is "enough room" to implement a gradual tax swap mechanism. Given the fact that the efficiency costs of environmental taxes are considerably lower (both in absolute and percentage values), than the payroll taxation in the EU, it is possible to apply payroll tax cuts and consequently increase the ratio of environmental taxation. Nevertheless, this tax swap should be done in a framework where revenue neutrality condition is fulfilled. Therefore taking into consideration the feasibility of this mechanism, we can conclude that in this particular setting we can validate the double dividend hypothesis.

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