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Social Security Contributions Distribution and Economic Activity☆

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Abstract

This paper studies the macroeconomic implications of the distribution of the social security tax between employees and employers using a general equilibrium framework. We calibrate a Dynamic General Equilibrium model for the average of OECD countries and find that increasing the share of social security contributions paid by employers has a positive effect on economic activity. Whereas raising the employer's share increases the labor cost for firms and reduces the equilibrium gross wage, conversely, workers' net labor income increases, increasing employment and output. The response of the economy to the change in the distribution of social security contributions between employees and employers depends on how the total labor tax wedge changes, which is also affected by the labor income tax and the consumption tax, as distortionary effects from one tax are not independent from the other taxes driving wages' purchasing power.

Keywords: Social Security Contributions; Employees Contributions; Employers Contributions; Dynamic General Equilibrium models.

JEL Classification: E20, H20, H22, H55.

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1. Introduction

Social security contributions to fund social security programs account for a large fraction of total taxation in most OECD countries, and in the last years they have become the most important source of fiscal revenues in a number of countries (OECD 2018). A common characteristic for these countries is that social security contributions are distributed between employers and employees. However, the proportion of the social security contributions levied on each of the two agents varies greatly across OECD countries. The employer's share of social security contributions ranges from 100% in Austria to about 25% in the Netherlands. The distribution of the social security tax has important implications for determining the labor cost to employers, introducing a gap between labor marginal productivity and the equilibrium gross wage, but it also affects the tax burden on employees, and it is argued that the employer contribution is borne by labor in the long run (Brittain 1971). However, distortionary effects of this tax can be different depending on the agent who has the statutory burden for the social security contribution (Fullerton and Metcalf 2002). As pointed out by Iturbe-Ormaetxe (2015), standard incidence analysis shows that social security contributions affect employment negatively, but it is irrelevant how they are divided between employers and employees when markets are competitive.[1] This paper shows that this is not the case in a standard neoclassical general equilibrium macroeconomic framework where the rest of taxes determining the total labor tax wedge are also taken into account.

In the literature on social security contributions, scholars have studied some key relevant issues, including the incidence of the tax as well as the relationship between the social security system and employment, hours worked, and economic growth. Given the distribution of the tax between the employee and the employer, a large branch of the literature has paid attention to the shifting effects (i.e., incidence analysis), that is, the difference between the impact incidence and the effective incidence, focusing on the question of who bears the burden of social security contributions (SSCs). According to the invariance of incidence principle hypothesis, the distribution of the SSCs between employers and employees should have no consequences for their economic incidence. The empirical literature has investigated the validity of that hypothesis, but results are mixed. Hamermesh (1993) reports no consensus in the empirical literature, but more recent empirical analysis using micro data supports the shifting of the social security burden to employees. Brittain (1971) indicates that firms

[1] See Salanié (2003) for a further discussion about the irrelevance of how the social security tax is distributed between employers and employees.

treat their social security tax like any other labor cost in their decision on output and price, and that in the long run employers avoid the burden of their contribution just by adjusting wages and salaries. In general, it is assumed that labor demand is more elastic than labor supply, and hence, the incidence of the social security tax should be borne mainly by workers (Hamermesh 1993). Gruber (1997) finds evidence for a total shifting of the burden of social security to employees in Chile. However, Saez, Matsaganis, and Tsakloglou (2012) show evidence against the invariance of the incidence principle for the case of Greece, concluding that the economic incidence of SSCs coincides with their statutory incidence. Melguizo and González-Paramo (2013) analyze the empirical literature on the economic implications of labor taxes and social security contributions using a meta-regression approach and find that workers bear between two-thirds and 90% of the tax burden. Iturbe-Ormaetxe (2015) fimds that employers' contributions have a stronger negative effect on employment than employees' contributions. He considers a competitive labor market in an environment in which workers perceive social security taxes paid as equivalent to deferred payment and in which they value contributions paid by themselves more than those paid by employers (salient effect). Additionally, he obtains that a reduction in the share of employers' contribution is positive for employment.

From a macroeconomic perspective, the focus has been placed on determining the effects of the tax system on labor decisions and output growth. The literature studying the role of taxes in accounting for cross-country differences in hours worked was initiated by Prescott (2004). Brauninger (2005) studied the relationship between social security and both unemployment and growth, with the social security system having a negative effect on both conditions. Similarly, Saint-Paul (1992) shows that a social security system reduces capital accumulation and the growth rate. Ohanian, Raffo, and Rogerson (2008) study the relationship between labor supply and taxes in OECD countries, arriving at the conclusion that difference in taxes explains much of the variation in hours worked both over time and across countries. Wallenius (2013) finds that differences in social security programs account for up to 80% of differences in employment rates of people aged 55-64, and 17-31% of the differences in aggregate hours worked between the US and Europe.

This paper contributes to the literature by studying the effects of the distribution of social security contributions between employers and employees in a standard neoclassical Dynamic General Equilibrium (DGE) model with taxes. The model includes four taxes: a consumption tax, a labor income tax, a capital income tax, and a social security tax that is divided into two parts. Distortionary effects of a particular tax can be different for households and firms, and thus the distribution of the social security tax between both agents can provoke different responses. In particular, we are interested in studying the general equilibrium effects of the distribution of the social security tax between employees and employers, as that distribution first affects labor cost for the firm and the equilibrium posted gross wage resulting from profit maximization, and it secondarily affects the net of the taxes equilibrium wage and the optimal labor supply.[2] The purpose of this paper is to estimate the size of these distortions depending on the distribution of the social security contributions between employers and employees, and the impact on equilibrium employment and economic activity. As in Barro and Sahasakul (1986) and Coenen, McAdam, and Straub (2008), we pay attention to the wedge between the effective consumption wage of households (the purchasing power of the after-tax wage) and the effective labor cost of firms, determined by the labor income tax, the social security tax (both employers' and employees'), and the consumption tax. The total labor tax wedge includes all tax components affecting the difference between the value of the marginal productivity of labor and the purchasing power of the salary. Importantly, the size of this labor tax wedge is affected by the distribution of the social security tax between employers and employees, which also influences labor-market distortions arising from the other taxes that also have an impact on the purchasing power of equilibrium gross wages. As we increase the employer's share of SSCs, the total labor tax wedge declines, compensating for the decline in the equilibrium gross wage, and resulting in an increase in the labor supply. What matters for firms is the total labor cost, including social security contributions paid by the firm. What matters for workers is the effective consumption wage. In our model, profit maximization implies that the total labor cost for the firm is equal to the marginal productivity of labor, and hence, the equilibrium gross wage is affected by the employer's social security tax and by the optimal labor supply by the workers which is a function of the purchasing power of the after-taxes wage.

We study the implications of social security tax policy reforms by calibrating the model for the average of OECD countries and find that the distribution of SSCs between employers and employees is not irrelevant for employment and output, and that there is no reason for sharing the social security contributions between employees and employers; instead, this particular tax should be levied on employers alone. Furthermore, we show that any social security tax reform must be evaluated jointly with distortions arising from labor income and consumption taxes. We perform four experiments, comparing steady-state values of

[2] Adam, Phillips, and Roantree (2019) find evidence that employees change their working hours in response to SSCs.

the relevant variables of the economy as a function of the distribution of SSCs. First, by reducing the share of the tax to employees and increasing the share of the tax to employers, output, consumption, investment, and employment gains are generated. This tax reform results in higher labor costs for the firm, which are fully offset by reducing the posted gross wage resulting from profits maximization, as it is assumed to be a competitive environment. However, we find that net labor income increases, with rising hours worked. This is the case where the policy reform is designed to keep constant the total social security tax (the sum of employers' and employees' social security taxes) or to keep constant the combined social security tax rate. The difference is that in the first case, social security fiscal revenues decrease, whereas in the second case social security fiscal revenues increase. Second, as the employer's share of SSCs increases, keeping constant either the total social security tax rate or the combined tax, total fiscal revenues decline by the reduction in labor income fiscal revenues, given that increasing the employer's share of SSCs reduces equilibrium gross wage. Overall, the effects of changes in SSCs depends on how the total labor wedge is affected, which also depends on the labor income and consumption tax rates. Therefore, to correctly assess the shifting effects of the distribution of SSCs between employers and employees, it is necessary to pay attention to all general equilibrium effects arising from the interactions among social security taxes and the rest of taxes affecting the purchasing power of the after-tax wage.

The rest of the paper is structured as follows. Section 2 uses a simple model to describe the relationships among social security taxes, the combined social security tax rate and the total labor tax wedge. Section 3 presents a simple DGE model where the tax menu is incorporated. Section 4 calibrates the model to the average of a set of OECD countries. Section 5 uses the calibrated model to perform some experiments, considering alternatives social security policy reforms as the distribution of SSCs between employers and employees changes. Finally, Section 6 presents some conclusions.

2. The combined social security tax and the labor tax wedge

We start from a simple static model without capital. The household utility function $U(\cdot)$, depends on consumption, C, and labor, L, i.e., $U(C, L)$. The budget constraint is $(1+\tau^c)C = (1-\tau^l-\tau^{ssw})WL$, where W is the real wage rate paid by the firm to workers (the posted gross earning), τ^c is a consumption tax, τ^l is a labor income tax, and τ^{ssw} is the social security contribution tax paid by workers, and where the price of consumption has been normalized to one. The households choose optimal consumption and labor, subject to the budget constraint, taking the posted wage and the taxes as given. The first-order condition for maximizing utility is the following:

$$\frac{-\frac{\partial U}{\partial L}}{\frac{\partial U}{\partial C}} = \frac{(1-\tau^{l}-\tau^{ssw})}{(1+\tau^{c})}W \tag{1}$$

which represents the real effective wage income of the household, that is, the purchasing power of the after-tax wage. For households, this is the relevant labor income driving the optimal consumption-leisure decision. However, social security contributions also have an impact on the determination of the posted gross wage, introducing a distinction between the gross wage received by the workers and the labor cost for the firm, denoted by W_F, where $W_F = (1+\tau^{sse})W$, and where τ^{sse} is the social security tax to be paid by the firm.

The firm's profit is defined as $\Pi = F(L) - (1+\tau^{sse})WL$, where L is labor and $F(L)$ is the production function. Maximization of profits implies that the labor marginal utility is:

$$\frac{\partial F}{\partial L} = W_F = (1+\tau^{sse})W \tag{2}$$

In this simple set-up, any change in τ^{sse} translates directly into a change in the posted gross wage. Substituting the real posted wage rate into the household's first-order condition, we obtain that:

$$\frac{-\frac{\partial U}{\partial L}}{\frac{\partial U}{\partial C}} = \frac{(1-\tau^{l}-\tau^{ssw})}{(1+\tau^{c})(1+\tau^{sse})}W_F \tag{3}$$

As we can observe, the tax system results in a positive wedge between the value of the marginal product of labor (equals to the labor cost for the firm) and the utility rate of substitution between consumption and leisure. The key issue here is that the distribution of the social security tax between employers and employees has an impact on the wedge between the value of the marginal productivity of labor and its purchasing power. Following Barro and Sahasakul (1986), we define the implicit tax as the overall effective marginal tax rate on labor's marginal productivity, given by:

$$\tau = 1 - \frac{(1-\tau^{l}-\tau^{ssw})}{(1+\tau^{c})(1+\tau^{sse})} = \frac{\tau^{c}+\tau^{l}+\tau^{ssw}+\tau^{sse}+\tau^{c}\tau^{sse}}{(1+\tau^{c})(1+\tau^{sse})} \tag{4}$$

which is a measure of the distortion affecting labor quantity. On the other hands, to isolate the implications of the social security tax system and following Saez *et al.* (2012) and Iturbe-Ormaetxe (2015), we define the pre-labor income taxes gross wage net of SSCs received by workers as:

$$W_N = \frac{1-\tau^{ssw}}{1+\tau^{sse}}W_F = \left[1 - \frac{\tau^{ssw}+\tau^{sse}}{1+\tau^{sse}}\right]W_F \tag{5}$$

and therefore, the combination of firm and worker social security taxes is equivalent to a combined payroll tax rate, denoted by τ^*:

$$\tau^* = \frac{\tau^{ss}}{1+\tau^{sse}} \tag{6}$$

where $\tau^{ss} = \tau^{ssw} + \tau^{sse}$ is the total social security tax rate. Notice that the combined social security tax rate, τ^*, is equal to the total social security tax rate, τ^{ss}, when all social security contributions are paid by workers, that is, $\tau^{sse} = 0$. This means that as we increase the employer's share of SSCs, keeping the total tax rate constant, both the combined tax rate and the overall effective marginal tax rate on labor's marginal productivity (the tax wedge hereafter) decreases. In the following section, we present a general equilibrium model where these taxes are incorporated which will be used to study how changes in SSCs affect labor decisions and other macroeconomic variables.

3. The model

We use a canonical Dynamic General Equilibrium model with taxes. In particular, the model includes four taxes: a consumption tax, a labor income tax, a capital income tax, and a social security tax that is split between households and firms. The government taxes private consumption goods, capital income, labor income, and social security contributions to finance an exogenous sequence of lump-sum transfers, $\{T_t\}_{t=0}^{\infty}$.

3.1. Households

The economy is inhabited by an infinitely lived, representative household that has time-separable preferences, represented by the following instantaneous utility function:

$$U(C_t, L_t) = \log C_t - \gamma \frac{L_t^{1+1/\upsilon}}{1+1/\upsilon} \tag{7}$$

where C_t is consumption of goods and services and L_t is hours worked. The parameter $\gamma > 0$ represents the willingness to work, where υ is the Frisch elasticity of labor supply.

The problem faced by the stand-in consumer is to maximize the value of her lifetime utility given by:

$$Max_{\{C_t,L_t\}_{t=0}^{\infty}} E_t \sum_{t=0}^{\infty} \beta^t \left(\log C_t - \gamma \frac{L_t^{1+1/\upsilon}}{1+1/\upsilon} \right) \tag{8}$$

where β $(0 < \beta < 1)$ is the discount factor and E_t is the expectation operator, subject to the budget constraint:

$$(1+\tau_t^c)C_t + I_t = (1-\tau_t^l - \tau_t^{ssw})W_t L_t + (1-\tau_t^k)R_t K_t + \tau_t^k \delta K_t + T_t \tag{9}$$

where I_t is gross investment, K_t is capital stock, W_t are compensations to employees (equilibrium gross wage posted by the firms), R_t is the rental rate, δ is the capital depreciation rate, modelled as tax deductible; and $\tau_t^c, \tau_t^l, \tau_t^k$, are a consumption tax, a labor income tax, and a capital income tax, respectively. τ_t^{ssw} is the social security tax levied on employees, and T_t are lump-sum transfers received by consumers from the government. Capital holdings evolve according to:

$$K_{t+1} = (1-\delta) K_t + I_t \tag{10}$$

From the first order conditions of the household's maximization problem, we derive the following equilibrium conditions:

$$C_t = \frac{(1-\tau_t^l-\tau_t^{ssw})}{(1+\tau_t^c)} \frac{W_t}{\gamma L_t^{1/\upsilon}} \tag{11}$$

$$\frac{E_t(1+\tau_{t+1}^c)C_{t+1}}{(1+\tau_t^c)C_t} = E_t\beta\left[(1-\tau_{t+1}^k)(R_{t+1}-\delta)+1\right] \tag{12}$$

Expression (11) is a equilibrium condition that equates the marginal disutility of additional hours of work with the marginal return on additional hours, representing optimal labor supply. Labor supply includes the overall tax rate that applies to gross earnings and results in the purchasing power of the after-tax wedge. Equation (12) is an intertemporal Euler equation that equates the marginal cost of additional capital with the return on investment, representing the optimal consumption path. Note that the intertemporal equation for investment is not affected by the consumption tax if constant over time.

3.2. The firms

For simplicity, we assume a competitive environment. The problem for the firm is to find optimal values for the utilization of labor and capital given the technology and the social security tax on employers. The production of final output, Y_t, requires labor services, L_t, and capital, K_t. The firm rents capital from entrepreneurs and hires labor from households and maximizes period-by-period profits, taking factor prices as given. The technology exhibits a constant return to scale; hence the profits are zero in equilibrium. The standard Cobb-Douglas technology used by the firm is:

$$Y_t = K_t^\alpha L_t^{1-\alpha} \tag{13}$$

where α is the capital share of output. The problem for the firm is to maximize period-by-period profits where social security contributions by the employer are part of labor cost:

$$\Pi_t = K_t^\alpha L_t^{1-\alpha} - (1+\tau_t^{sse})W_t L_t - R_t K_t \tag{14}$$

From the profit maximization problem we obtain the following two first order conditions:

$$(1+\tau_t^{sse})W_t = (1-\alpha)K_t^{\alpha}L_t^{-\alpha} \quad (15)$$

$$R_t^k = \alpha K_t^{\alpha-1}L_t^{1-\alpha} \quad (16)$$

where the firm's real effective wage cost (including social security contributions) equals the (value of) marginal product of labor.

3.3. The government

We assume that the government runs a balanced budget, period-by-period, by raising revenues through distortionary taxes that are fully expended as lump-sum transfers, T_t. Specifically, the effective average tax rates are: τ_t^c, τ_t^l, τ_t^k, τ_t^{ssw}, and τ_t^{sse}, as defined above, from which five sources of fiscal revenues are identified. The government budget in each period is given by

$$\tau_t^c C_t + (\tau_t^l + \tau_t^{ssw} + \tau_t^{sse})W_t L_t + \tau_t^k (R_t^k - \delta)K_t = T_t \quad (17)$$

Transfers to consumers are the counterpart of fiscal revenues.

3.4. Competitive equilibrium

The competitive equilibrium is defined by the following two conditions:

$$\gamma C_t L_t^{(1-\upsilon)/\upsilon} = \frac{(1-\tau_t^l-\tau_t^{ssw})}{(1+\tau_t^c)(1+\tau_t^{sse})}(1-\alpha)Y_t \quad (18)$$

$$\frac{E_t(1+\tau_{t+1}^c)C_{t+1}}{(1+\tau_t^c)C_t} = E_t\beta\left[(1-\tau_{t+1}^k)\alpha\frac{Y_{t+1}}{K_{t+1}} + 1 - \delta\tau_{t+1}^k\right] \quad (19)$$

In equilibrium, households' real after-tax consumption wage equals the marginal rate of substitution between consumption and leisure. The feasibility condition for this economy is given by

$$Y_t = C_t + I_t \quad (20)$$

Together with the first-order conditions of the firm, the budget constraint of the government (17), and the feasibility constraint of the economy (20), this characterizes a competitive equilibrium for the economy.

4. Data and calibration

To calibrate the parameters of the model, we use average data for the OECD countries. The parameters of the model are $\Omega = \{\alpha, \beta, \gamma, \upsilon, \delta, \tau_t^c, \tau_t^l, \tau_t^k, \tau_t^{ssw}, \tau_t^{sse}\}$, including preference and technological parameters, and five tax rates. We choose the parameters of the model in two steps. First, some parameters are calibrated according to the data and consistent with the literature. Second, we internally calibrate some parameters to match labor and fiscal revenues data moments.

Preference parameters $(\beta, \gamma, \upsilon)$: Preference parameters are the standard in the literature. We use a value of 0.97 for the intertemporal discount factor, considering an annual period basis. For the Frisch elasticity of labor supply, υ, we use a value of 0.72 as proposed by Heathcote, Storesletten, and Violante (2010). Finally, the parameter representing the willingness to work is chosen internally just to produce a value for working hours per year of 1,600 hours, corresponding to a fraction for working hours over total available discretionary time of 0.32. This results in an internally calibrated value for the parameter γ of 6.523.

Technological parameters (α, δ): The capital income share, α, is chosen using information about the fraction of compensation of employees over GDP for OECD countries. We use an average value for labor share in the year 2017 of $(1-\alpha) = 0.609$, and hence, $\alpha = 0.391$. The depreciation rate of physical capital, δ, is set to 0.06 for an annual basis.

Tax rates $(\tau_t^c, \tau_t^l, \tau_t^k, \tau_t^{ssw}, \tau_t^{sse})$: The model has five tax rates: a tax on consumption, labor and capital taxes on input incomes, and two social security taxes on employers and employees. Agents' decisions depend on marginal tax, and therefore effective marginal taxes should be used in the calibration of the model. However, marginal tax rates are hard to estimate and, as pointed out by Mendoza, Razin, and Tesar (1994), it is often impractical to do so given the limitations due to data availability and difficulties in dealing with the complexity of tax systems.[3]

Central to our calibration are the social security tax rates for employees and employers. In 2016, average OECD countries' tax revenues as a percentage of GDP were 34.0%, ranging

[3] Computational macroeconomic models of fiscal policy crucially depend on realistic measures of tax rates. Mendoza *et al.* (1994) propose a method for estimating effective average tax rates and show that they are within the range of marginal tax rates estimated in previous works and display very similar trends. On the other hand, these authors argue that their definition of effective average tax rates can be interpreted as an estimation of specific tax rates that a representative agent, in a general equilibrium context, takes into account.

from 16.6% for Mexico to 46.2% for Denmark. SSCs comprised 26.2% of total tax revenues, ranging from 0% for Australia and New Zealand (these two countries do not levy SSCs) to 43.5% in the Slovak Republic. OECD average SSCs represented about 31.1% of total fiscal revenues, being the most important source of fiscal revenues for most of the OECD countries. First, the taxes affecting labor income have been taken from the OECD Taxing Wages (OECD 2019) statistics, using figures for income taxes plus employee and employer social security contributions as a percentage of labor cost for the year 2018. Average values for the OECD countries for the median wage earners are a labor income tax rate of 0.1646, an employee social security tax rate of 0.0945, and an employer social security tax rate of 0.1589. To maintain data consistency, the other two taxes, on consumption and capital income, are also calibrated internally to match OECD average figures. In the year 2018, SSCs represented 27% of total fiscal revenues, personal income tax represented 23.9%, general consumption tax represented 32.53% of total fiscal revenues, corporate income tax (which we assume is equivalent to the capital income tax) represented 8.85%, and the rest, which correspond to other taxes, such as property taxes, are not included in the model. We redistribute these percentages into the four taxes included in the model, resulting in proportions of total fiscal revenues of 29.28% for SSCs, 25.93% for the labor income tax, 35.28% for the consumption tax, and 9.6% for the capital income tax. Estimated figures are a consumption tax rate of 0.1832 and a capital income tax rate of 0.2418.

For the baseline calibration to the average values for the OECD countries, we find that the total social contribution tax rate is 0.2534, which implies that 62.71% of the tax burden for SSCs is on employers. The corresponding combined social security tax rate for the baseline calibration is

$$\tau^* = \frac{\tau^{ss}}{1+\tau^{sse}} = \frac{0.2534}{1.1589} = 0.2187$$

whereas the baseline total labor tax wage, defined as the difference between labor marginal productivity and the purchasing power of the salary, is[4]

$$\tau = \frac{\tau^c + \tau^l + \tau^{ssw} + \tau^{sse} + \tau^c \tau^{sse}}{(1+\tau^c)(1+\tau^{sse})} = \frac{0.1832 + 0.1646 + 0.2534 + 0.1832 \times 0.1589}{1.1832 \times 1.1589} = 0.460$$

Table 1 shows the values of the calibrated parameters.

[4]This is different from the tax wage as defined by the OECD. The OECD calculates the tax by considering SSCs by employees and employers, and the labor income tax. Here, we follow Barro and Shahasakul (1986) and Coenen *et al.*, (2008), and also the consumption tax is considered for calculating the overall labor tax wedge, as stated by the equilibrium condition (18).

Table 1: Calibrated parameters

Parameter	Definition	Value
α	Output-capital elasticity	0.391
β	Discount factor	0.975
γ	Willingness to work	6.523
υ	Frisch labor elasticity	0.720
δ	Physical capital depreciation rate	0.060
τ_t^c	Consumption tax rate	0.1832
τ_t^l	Labor income tax rate	0.1646
τ_t^k	Capital income tax rate	0.2418
τ_t^{ssw}	Employee's social security tax rate	0.0945
τ_t^{sse}	Employer's social security tax rate	0.1589

5. Employee versus employer social security tax

Using the calibrated model, we consider changes in τ_t^{ssw} and τ_t^{sse}, under alternative social security fiscal policy reforms, and we study how those changes affect the macroeconomic equilibrium. In particular, we consider four alternative scenarios: keeping the total social security tax constant, keeping the combined social security tax constant, keeping social security revenues constant, and keeping total fiscal revenues constant. For each scenario we compute the steady state of the model economy for the employer's share of SSCs from 0 to 1.

5.1. Experiment 1: Keeping the total tax rate constant, τ^{ss}

First, we consider the case of a simple redistribution of social security contributions between employers and employees, keeping the aggregate social security tax rate constant (that is, $\Delta\tau^{sse} = -\Delta\tau^{ssw}$, $\Delta\tau^{ss} = 0$). This fiscal policy reform results in a decrease in the combined social security tax rate as the share of the employer's SSCs increases. Figure 1 plots the total social security tax rate, the combined social security tax rate, and the total labor tax wedge as a function of the employer's share of SSCs. As indicated above, for the benchmark calibration the total social security rate is 0.2534, where the employee's tax rate is 0.0945 and the employer's tax rate is 0.1589, represented by a circle in Figure 1 at the baseline employer's share of SSCs. The corresponding combined social security tax to the benchmark calibration is 0.2187. Both tax rates are equal when all SSCs are paid by the employees. The total social security tax rate is a constant in this scenario, but the combined

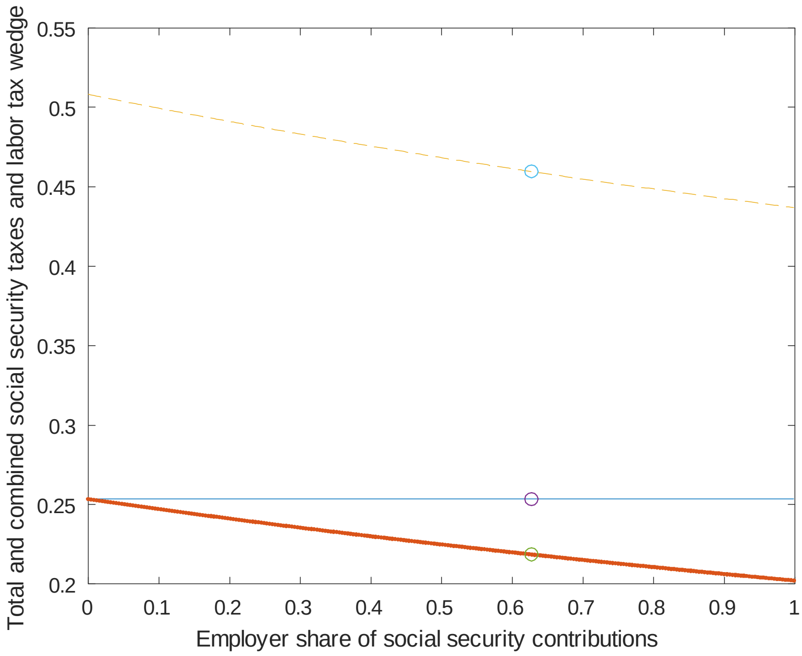

Figure 1: Experiment 1. Total and combined social security tax rates and labor tax wedge. Solid line (blue): Total social security tax rate. Dot line (red): Combined social security tax rate. Dash line (orange): Labor tax wedge. Circles: values of the baseline calibration.

tax rate is decreasing in the employer's share. The combined tax rate is in a range between 0.2534 (that is, equal to the total tax rate when all SSCs are paid by workers), and 0.2022 (when all SSCs are paid by the firms). As the combined tax rate is reduced while keeping the total tax rate constant, we also reduce the difference between labor cost for the firm and the gross salary (net of SSCs) received by the worker. Figure 1 also shows that the total labor tax wedge decreases as the employer's share increases. When all SSCs are paid by employees, the labor tax wedge reaches a maximum of 0.5081, declining to 0.4368 when all SSCs are paid by the employers. This means that the combination of a reduction the employee social security tax and an increase in the employer social security tax, reduces the labor tax wedge, which positively affects the labor supply by households.

Given the distribution of SSCs between employees and employers, next we compute steady states of the economy for a range of employer's share of SSCs from 0 to 1. Results are shown in Figures 2 (for the main macroeconomic variables) and 3 (for the different components of fiscal revenues), where the steady state value of each variable is plotted as a function of the employer's share of SSCs. We find that all variables, except the equilibrium gross wage, increase as the employer's share of SSCs increases. As expected, the adjustment in the total labor cost for firms is done via a change in equilibrium posted gross wages, which also depends on the changes in labor supply. Therefore, this policy reform induces two general equilibrium opposite effects of increasing the employer's share of SSCs. First, profit maximization leads to a reduction in equilibrium posted gross wages in response to the rise in labor cost. Labor cost for the firm is defined as $W_{F,t}L_t = (1-\alpha)Y_t = (1+\tau_t^{sse})W_tL_t$ depending on the SSCs levied on employers, where $W_{F,t}$ is the total labor cost per unit of time for the firm, and W_t is the equilibrium gross posted wage that the firm pays to the workers, once the employer SSCs have been taken into account. The value of social security contributions paid by the firm is $\tau_t^{sse}W_tL_t$. How labor cost will respond to a change in τ_t^{sse} will depend on how wages and hours worked will react to the change in the distribution of the total SSCs rate between employees and employers. Social security contributions paid by workers is $\tau_t^{ssw}W_tL_t$, and the pre-labor income tax net wage received by workers is $W_t^* = (1-\tau_t^{ssw})W_t$. Therefore, pre-labor income tax net of SSCs labor income by workers can be defined as:

$$W_t^*L_t = \frac{(1-\tau_t^{ssw})}{(1+\tau_t^{sse})}W_{F,t}L_t = (1-\tau_t^*)W_{F,t}L_t = (1-\tau_t^*)(1-\alpha)Y_t \tag{21}$$

where the labor social security tax wedge depends on the combined tax and not on the total social security tax. Therefore, in this scenario, the observed reduction in the social security combined tax will increase the pre-labor income tax net of SSCs labor income. The final effect depends on how employment reacts to this tax reform.

Second, labor productivity and the equilibrium posted gross wage depend on equilibrium employment. Equilibrium employment is a function of the total labor tax wedge, once not only SSCs but also labor income tax and consumption tax are taken into account, as this is the relevant information that households use to make labor supply decisions. In this scenario, the positive response on main macroeconomic variables to the rise in the employer's share of SSCs is explained by the rise in labor supply as a consequence of the reduction in the total labor wage wedge provoked by the reduction in the social contribution rate paid by employees; this overcomes the reduction in the equilibrium gross posted wage provoked by the rise in the social security contribution paid by the employers. Indeed, the equilibrium wage goes down but this also implies that less labor income taxes have to be paid by workers, resulting in an increase in the net labor income.

In sum, increasing the employer share of SSCs has a clear positive effect on economic activity. Output, consumption, investment, and capital stock all increase as we move the

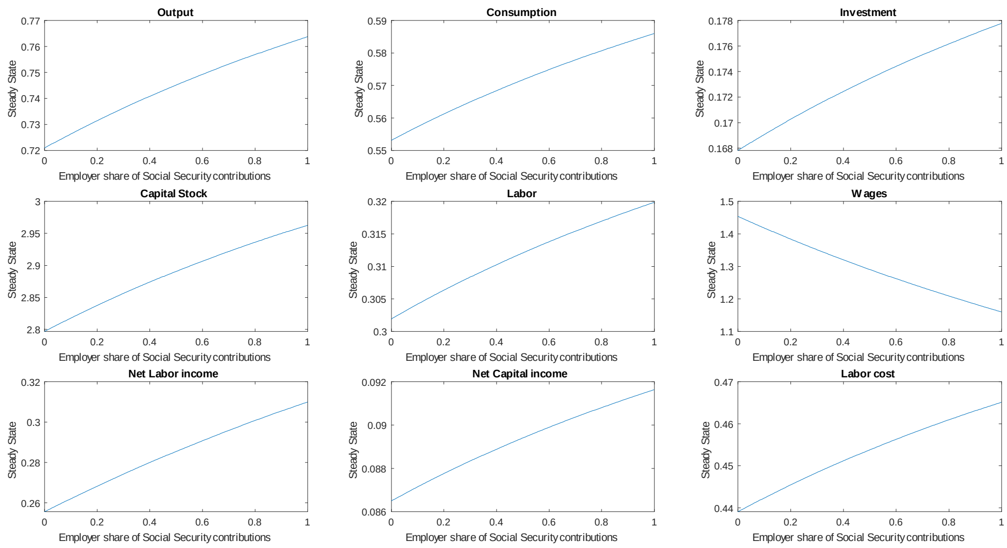

Figure 2: Experiment 1. Steady state values for the main macroeconomic variables as a function of the SSCs employer's share.

tax from employees to employers. Output increases by a 5.93%, moving from an employer's share of 0 to a share of 1 while keeping the total social security tax constant. All these effects follow from the positive response of working hours. It is worth noting that in this experiment, whereas the equilibrium gross labor income decreases by 20.19%, and gross labor income decreases by 15.46%, the net (of taxes) labor income increases by 21.29%, leading the positive response of the economy to this fiscal policy change. The decline in the equilibrium gross wage not only is the consequence of the increase in SSCs to employers but also is driven by the decline in labor marginal productivity resulting from the increase in labor.

Figure 3 plots steady state fiscal revenues (total and for each tax) as a function of the employer share of SSCs. Given the structure of the model, we can disaggregate fiscal revenues from five sources: consumption tax, capital income tax, labor income tax, social security contributions by employees, and social security contributions by employers. First, total revenues from SSCs decrease as we increase the employer share of the tax, keeping the total social security tax rate constant. This is a direct consequence of the reduction in the equilibrium gross salary (the relevant salary for social security taxation). As noted above, in the profits maximization process firms equal the total labor cost, including SSCs, to the

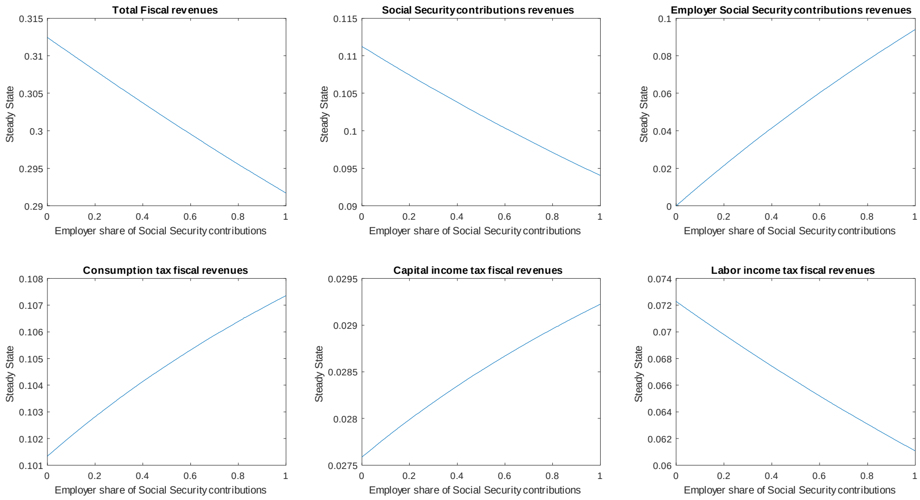

Figure 3: Experiment 1. Fiscal revenues in steady state as a function of the SSCs employer's share.

labor productivity. Even when labor productivity remains constant (no change in labor supply), the rise in the social security tax levied on the employers has to be accompanied by an equivalent decrease in the equilibrium gross wage. However, the reduction in total revenues from SSCs is not caused by a loss of revenues from employers but by the reduction in the revenues from employees, as the social security tax levied on workers tends to zero. Therefore, by increasing the employer share of SSCs, fiscal revenues from employers increase, but simultaneously, fiscal revenues from employees are reduced, with the second effect prevailing over the first, leading to a reduction in total social security fiscal revenues.

Second, revenues from consumption and capital income taxes rise as the employer share of SSCs increases. This is a consequence of the rise in output, consumption and investment. The rise in the purchasing power of the salary increases both consumption and investment, increasing capital and labor. However, fiscal revenues from labor income tax is reduced as a direct consequence of the reduction in total labor income (lower equilibrium wages but higher employment). Finally, this tax policy change leads to a reduction in total fiscal revenues. Social security fiscal revenues fall by 15.46%, whereas the reduction in total fiscal revenues is 6.63%.

5.2. Experiment 2: Keeping the combined tax rate constant, τ^*

Second, we consider the case of a change in the distribution of SSCs, keeping the combined social security tax rate constant ($\Delta\tau^* = 0$). In the previous experiment, the combined tax

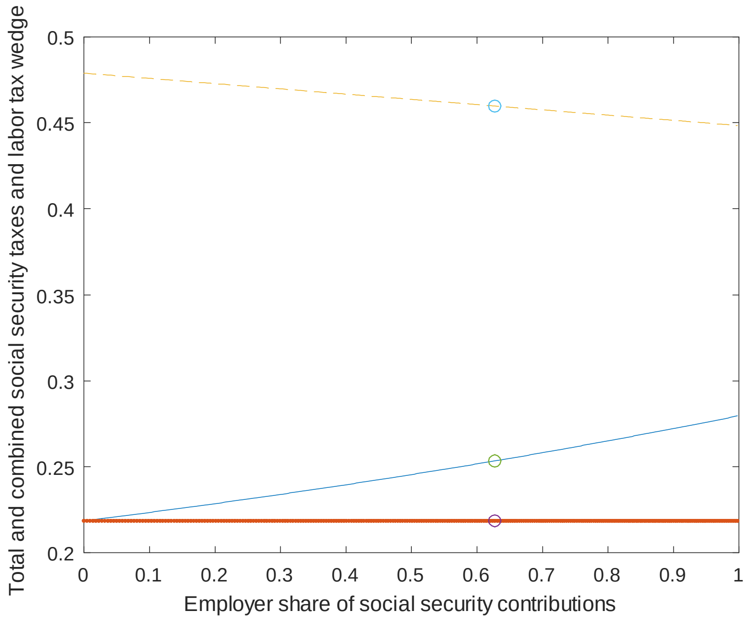

Figure 4: Experiment 2. Total and combined social security tax rates and labor tax wedge. Solid line (blue): Total social security tax rate. Dot line (red): Combined social security tax rate. Dash line (orange): Labor tax wedge. Circles: values of the baseline calibration.

rate decreases as the employer's share of SSCs increases, with a policy reform in which the total social security tax rate was assumed to be constant. In this second experiment, we assume a constant social security combined tax rate for any distribution of SSCs between employers and employees, which will result in an increasing total social security tax rate ($\Delta\tau^{ss} > 0$), as the rise in the employer's tax rate is higher than in the employee's tax rate ($\Delta\tau^{sse} > -\Delta\tau^{ssw}$). For this experiment, we compute for each distribution of the SSCs the corresponding values for employer and employee social security taxes that are compatible with a constant combined social security tax equals to the benchmark rate. Notice that this policy reform is neutral in terms of the social security labor tax wedge, but the distribution of the SCCs will change the overall labor tax wedge.

Figure 4 plots the total and combined social security tax rates, as well as the total labor tax wedge for this policy reform. Given the baseline calibration of the model, the value for the combined tax rate in this experiment is fixed at 0.2187 for any distribution of the social security tax between employees and employers. In this scenario, as the employer's share of SSCs increases, the total social security tax rate also increases. The total tax rate is always above the combined tax rate except when all SSCs are paid by the workers when both taxes

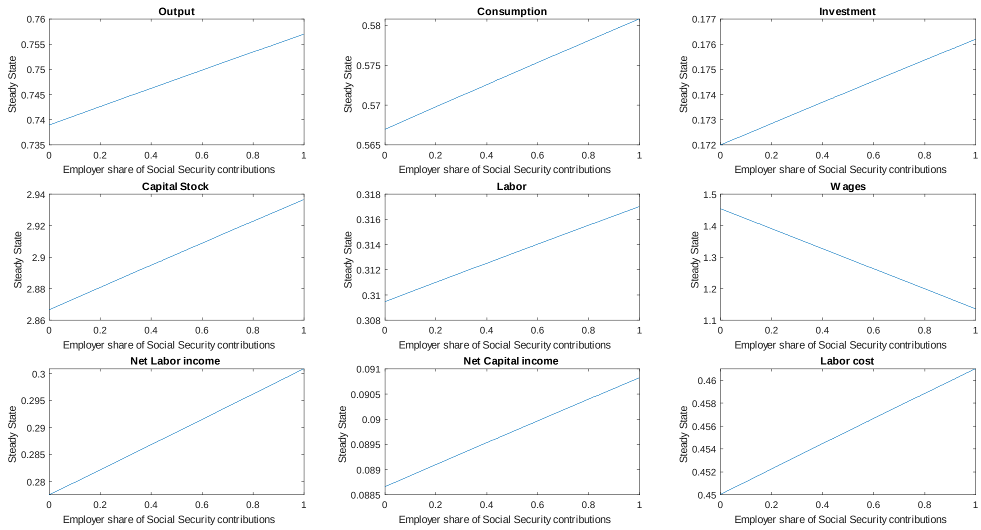

Figure 5: Experiment 2. Steady state values for main macroeconomics variables as a function of the SSCs employer's share.

are equal. As we reduce the employees social security tax rate, keeping the combined tax rate constant requires a more than proportional increases in the employers social security tax rate, leading to a rise in the total social security tax rate. In our experiment, the maximum total social security tax rate is 0.2797 when all SSCs are paid by the employer. In this scenario, the net of SSCs equilibrium gross wage does not change but the difference between labor marginal productivity and labor income net of payroll and labor income taxes is reduced as the employer's share of SSCs increases. Additionally, the overall effective marginal tax rate on labor's marginal productivity, once consumption taxes are taken into account, also falls as the employer's share of SSCs increases. For an employer's share of SSCs that is zero, the overall effective tax rate is 0.4797, declining to a rate of 0.4184 for an employer's SSCs share of 1.

Figures 5 and 6 plot the steady state values for the relevant variables. Qualitatively, the effects are similar to the previous experiment, except for social security fiscal revenues, but the quantitative response changes. The rise in the total social security tax reduces the positive effects of increasing the employer's share of SSCs on the economy, but still we find a positive response in output and employment. All variables show a steady state positive relationship with the employer's share of SSCs, except the equilibrium gross wage, which falls in response to the rise in the tax component of the labor cost. Changing the employer's

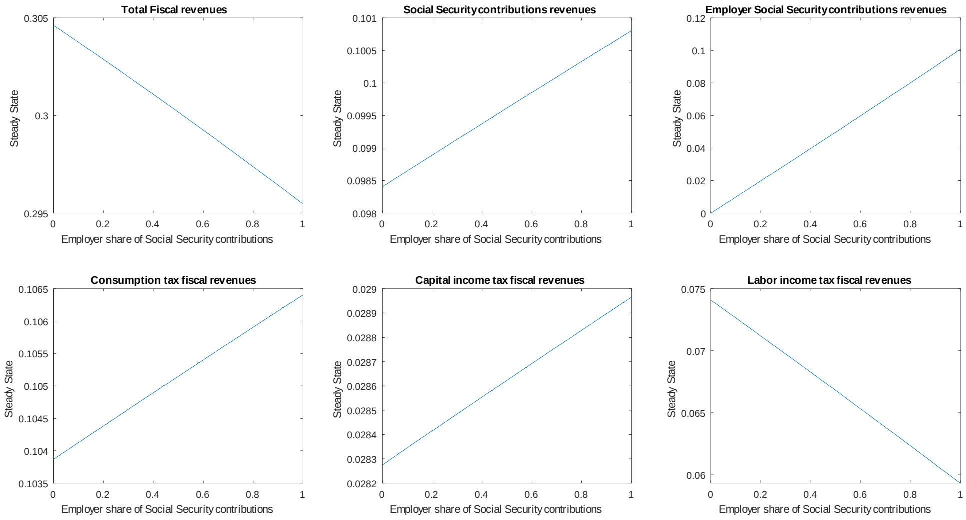

Figure 6: Experiment 2. Fiscal revenues in steady state as a function of the SSCs employer's share.

share of SSCs from 0 to 1, the equilibrium gross wage is reduced by 21.81%. Again, two general equilibrium forces are in place. First, the reduction of the net of SSCs equilibrium wage reduces labor income taxes but at the same time it increases the net of payroll and labor income tax wage. Second, working hours increases. The combination of both effects, together with the decline in the SSCs of employees, results in a rise in net labor income. For the full range of the SSCs distribution, the net labor income increases by 8.40%.

To observe the effects of a change in the combined social security tax on labor income net of payroll and labor income taxes, $W_{N,t}L_t$, it is convenient to write:

$$W_{N,t}L_t = (1-\tau_t^l-\tau_t^{ssw})W_tL_t = \frac{(1-\tau_t^l-\tau_t^{ssw})}{(1+\tau_t^{sse})}W_{F,t}L_t = \left[1-\tau_t^*-\frac{\tau_t^l}{(1+\tau_t^{sse})}\right]W_{F,t}L_t \quad (22)$$

where the payroll and labor income tax wedge depends not only on the value of the social security combined tax but also on the labor income tax and the social security tax of employers. From the expression above it is clear that as the employer's share of SSCs increases, the payroll and labor income tax wedge is reduced. This is because the implicit payroll tax falls, given that τ_t^* is a constant but the other component $\tau_t^l/(1+\tau_t^{sse})$ is lower as τ_t^{sse} increases for a given τ_t^l. Therefore, even in the case that the gap between labor productivity and the equilibrium wage net of SSCs remains constant, the payroll and labor income implicit tax falls, increasing net labor income. Compared to the previous experiment, here output increases by 2.44%, a lower figure than the previous one as the increase in the combined social security tax rate reduces the positive impact of increasing the employer's share of SSCs.

Figure 6 plots the steady state fiscal revenues as a function of the employer's share of SSCs. This policy reform results in a rise in social security fiscal revenues, as keeping the social security combined tax constant implies a rise in social security total tax, offsetting the negative effects on the equilibrium gross wage. The rise in social security fiscal revenues is 2.44%, similar to the increase in output because with this policy reform the social security tax over compensation to employees is a constant for any distribution of the SSCs. Again, the consumption tax and capital income tax fiscal revenues increase, whereas fiscal revenues from labor income decline. The reduction in total fiscal revenues is 3.00% as the loss of labor income tax revenues is partially compensated by the rise in social security fiscal revenues. Finally, the labor income fiscal revenues decline by 19.91%.

5.3. Experiment 3: Keeping social security revenues constant

Next, we study the combination of employee and employer social security tax rates required for keeping social security fiscal revenues constant, $\tau_t^{ss} W_t L_t$, for each distribution of the social security tax between employees and employers. Based on previous results, this will require changes in both the social security total tax rate and the combined social security tax rate. Experiments 1 and 2 reveal that increasing the employer's SSCs while keeping the total social security tax constant reduces social security fiscal revenues, but social security fiscal revenues increase when keeping the combined social security tax constant. In this experiment, we compute the steady states for a grid of values of social security tax rates for both employees and employes, and we select the combination that generates the same level of social security fiscal revenues as in the benchmark calibration. Figure 7 plots the resulting total and combined social securities tax rates as well as the total labor tax wedge for each distribution of SSCs. To keep social security fiscal revenues constant, as we increase the employer's share, the total social security tax rate must increase, but the combined tax rate is reduced. The reduction in the combined social security tax rate is a direct consequence of the difference between the total labor cost for the firm and the equilibrium net of SSCs wage for workers, which must be reduced. Finally, this tax policy reform also implies a lower total tax wedge as the employer's share of SSCs increases.

In sum, the response of the economy to this tax reform is a combination of the previous two experiments, where all steady state macroeconomic variables increase, except the equilibrium gross wage, as the employer's share of SSCs increases. In this experiment, the

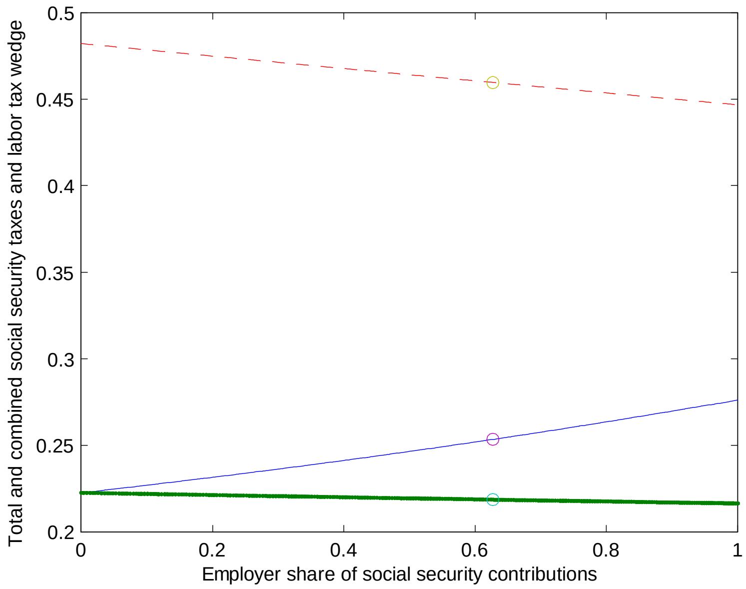

Figure 7: Experiment 3. Total and combined social security tax rates and labor tax wedge. Solid line (blue): Total social security tax rate. Dot line (green): Combined social security tax rate. Dash line (red): Labor tax wedge. Circles: values of the baseline calibration.

estimated expansion of output is 2.82%, whereas total fiscal revenues decline by 3.47% and labor income revenues decline by 19.41%. The conclusion is that even a social security tax reform for distributing SSCs between employers and employees, designed to keep social security fiscal revenues constant, has effects on fiscal income from other taxes, resulting in a change in total fiscal revenues. This is of particular importance in the case of the labor income fiscal revenues, as both taxes burden labor income. Any fiscal policy that changes social security taxes has implications for labor costs, resulting in a change in the equilibrium gross wage, which constitutes the tax base for both SSCs and the labor income tax. In fact, our experiments reveal that labor income fiscal revenues are very sensitive to any change in the social security tax menu.

5.4. Experiment 4: Keeping total fiscal revenues constant

Finally, we consider the case where both the employee and the employer social security tax rates are chosen just to keep total fiscal revenues constant for any employer's share of SSCs. The objective of this exercise is to have an estimation of how the change in the distribution of SSCs between employees and employers must change the social security tax

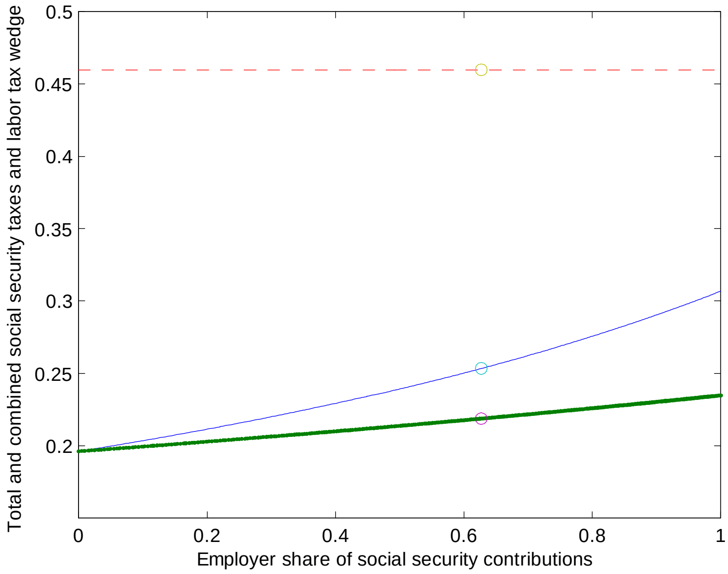

Figure 8: Experiment 4. Total and combined social security tax rates and labor tax wedge. Solid line (blue): Total social security tax rate. Dot line (green): Combined social security tax rate. Dash line (red): Labor tax wedge. Circles: values of the baseline calibration.

rates. In this scenario, we compute all steady states corresponding to an employer's share of SSCs between 0 and 1, and the corresponding employee and employer social security tax rates such as total fiscal revenues remain constant and equal to the baseline calibration. From previous experiments, one of the consequences of the change in the employer's share of SSCs is that total fiscal revenues decline, mainly by a decline in fiscal revenues from labor income taxation. In this new experiment, social security tax rates for any distribution of SSCs are calculated such that no change in fiscal revenues is produced. This implies that the total labor tax wedge must be constant for any distribution of SSCs.

Figure 8 shows that both the total and the combined social security taxes must be increasing with the employer's share in order to keep total fiscal revenues constant, and the new employee and employer social security tax rates (Figure 9) must be chosen such that the total labor tax wedge remains constant. For any distribution of the SSCs, the total labor tax wedge takes the value of the baseline calibration ($\tau = 0.46$). For the case in which all SSCs are paid by the employers, the total tax is 0.3067 and the combined tax is 0.2347, and where the minimum value for both taxes, when the employer's share of SSCs is zero is 0.1961.

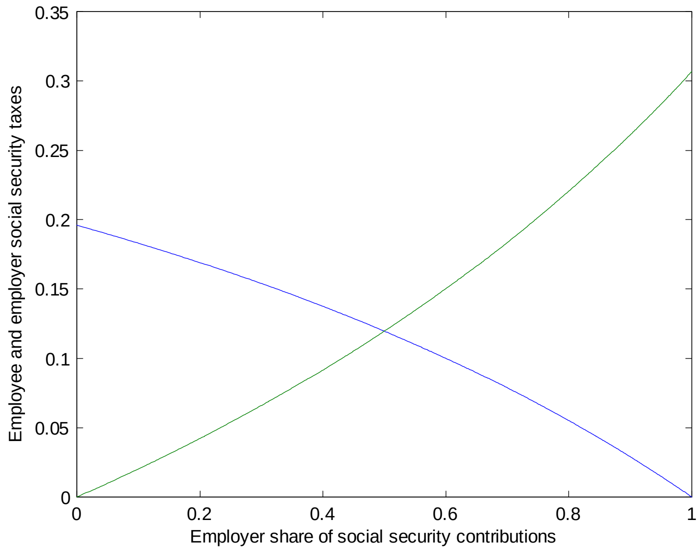

Figure 9: Experiment 4: Employee and employer social security tax as a function of the SSCs employer's share to keep constant total fiscal revenues. Blue line: Employee tax rate. Green line: Employer tax rate.

Steady state values for the main macroeconomic variables as a function of the distribution of SSCs all remain constant except the equilibrium gross wage. With this policy, the total labor fiscal burden remains constant across any distribution of social security contributions between employees and employers, and as a consequence, no change in the optimal response by households is obtained because the purchasing power of the net salary received by workers does not change. In keeping total fiscal revenues constant, both the total tax rate and the combined social security tax rate increase as the employer's share increases. By contrast, this policy would require a combination of employer and employee social security tax rates such that the labor tax wedge remains constant. The change in the equilibrium gross wage from changing the employer's share from 0 to 1 is 23.47%. This is the necessary change in the equilibrium gross wage to simultaneously constant the net wage constant.

Given that no macroeconomic variable reacts to this policy reform, except the equilibrium gross wage, total fiscal revenues remain constant. Also consumption tax and capital income tax remain constant. However, both social security fiscal revenues and labor income fiscal revenues changes. Social security fiscal revenues increase by 19.70%, whereas labor income fiscal revenues decline by 23.47% (see Figure 10). This reduction in the equilibrium gross wage as the employer's share of SSCs increases is fully compensated by the reduction in the social security tax paid by employees and all other taxation (labor income tax and

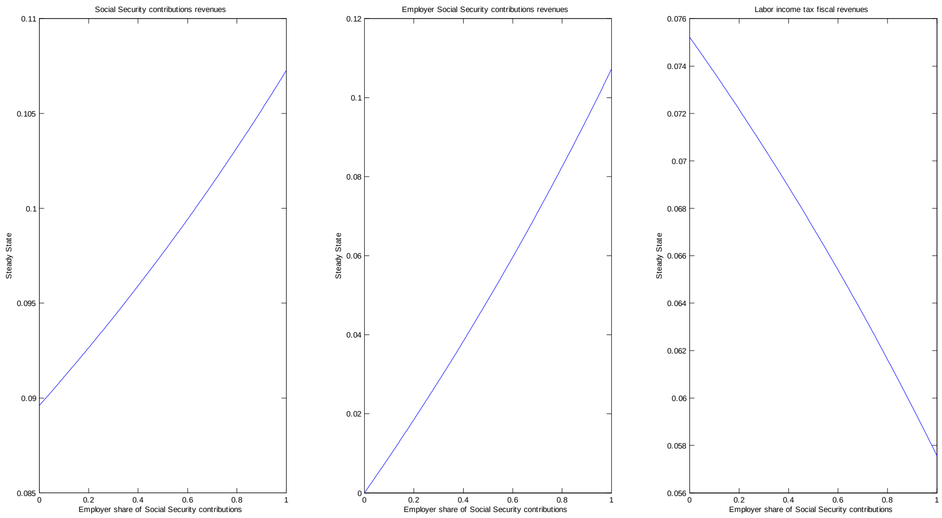

Figure 10: Experiment 4. Changes in fiscal revenues.

consumption tax), resulting in a constant consumption power labor income. This is also the case for social security fiscal revenues, given that the reduction in the equilibrium gross wage is compensated by an equivalent increase in the combined social security tax rate just to keep social security fiscal revenues constant. In sum, this tax policy reform implies no change in the optimal decision by households, and the only visible effect is a reduction in the equilibrium gross wage in response to the rise in labor cost for firms.

6. Concluding remarks

This paper provides a quantitative measure of the effects on the distribution of the social security tax between employees and employers at an aggregate level in a standard general equilibrium framework. Incidence analysis of social security contributions have been extensively studied in the literature from a microeconomic perspective. According to the invariance of incidence principle hypothesis, the distribution of the social security contributions between employers and employees should have no consequences for their economic incidence. However, recent theoretical and empirical contributions show that this is not the case, and that the distribution of the social security tax has effects on employment and economic activity.

This paper shows that increasing the employer's share of social security tax while keeping the total social security tax constant has a positive impact on economic activity, as this is equivalent to a reduction in the combined social security tax. This policy increases the labor cost for the firms but at the same time increases the net salary received by workers, increasing labor supply. Even implementing a fiscal policy reform, keeping the combined social security tax rate constant, results in a positive effect on economic activity. This is a consequence of the positive response of employment to the reduction in the total tax labor wedge, which also includes labor income and consumption taxation. However, these policy reforms lead to a reduction in total fiscal revenues, as the reduction in the equilibrium gross wage results in lower labor income fiscal revenues. Finally, we estimate the social security taxes for each distribution of the total tax between employers and employees that lead to no change in total fiscal revenues. This tax policy reform implies that both the total social security tax rate and the combined tax rate must be increasing in the employer's share of SSCs just to keep constant the overall effective marginal tax rate on labor's marginal productivity.

Our analysis provides evidence that any tax policy reform in the social security system implies important effects for fiscal revenues from other taxes. Labor income fiscal revenues are linked to the distribution of SSCs between employees and employers. Hence, any social security tax reform must be designed jointly with the rest of the tax menu, and in particular, with labor income taxation.

The results presented in this paper are obtained under the assumption of a perfect competitive environment. The question remains open to how the economy responds to the redistribution of SSCs between employers and employees under imperfect competition. This is an important issue worth noting and yet to be studied, as in a competitive environment total labor cost is equals to the marginal cost, driving the response of employment to the fiscal policy change, where this is not the case in an imperfect competitive environment.

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