Reducing social contributions on unskilled labour as a way of fighting unemployment: An empirical evaluation for the case of Spain*

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Abstract

In this paper we provide an empirical evaluation of the effects of a cut in social security contributions (i) for all types of labour, and (ii) only for unskilled labour, within a computable general equilibrium model simulated for the Spanish economy. The model allows firms to follow a non-competitive price rule, and incorporates an equal yield assumption, which means that the reduction in social security contributions is compensated with an increase in value-added tax rates, so that the public sector deficit is not affected. In addition, the labour market is assumed to follow a matching unemployment rule, which allows to model in a simple way any frictions present in that market.

Key words: Computable general equilibrium, unemployment, unskilled labour, social contributions.

JEL classification: D58, H20.

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1 Introduction

Despite their recent decrease, the still high unemployment rates in most European countries are a problem of deep concern for these economies. In addition, a particularly noticeable feature of the high unemployment rates in Europe would be given by its relatively greater concentration among low-skilled workers. This is illustrated in Table 1, which shows the total unemployment rates, together with their distribution according to the attained level of education, for the OECD countries in 1998. Notice that the data on educational levels refer to people aged 25-64 years, unlike unemployment rates that refer to people aged 15-64 years. This fact explains why in some countries (Greece, Italy, Portugal, Spain, and Turkey) the total unemployment rate is greater than in any of the educational levels considered, and the difference would be explained by unemployment among young people (i. e., people aged 15-24 years).

The main message from Table 1 would be that, for all the countries in the table (with the exceptions of Greece, Portugal, and Turkey) unemployment rates are higher in the lowest educational levels. In particular, this is the case of Spain, where the highest unemployment rate is that of the lowest educated workers; and the even higher total unemployment rate is due to the importance of youth unemployment, presumably less educated.

This situation has led to a debate in policy circles on the role of social security contributions, since these taxes might be considered as a disincentive for labour demand; see OECD (1995) for a broad overview of the issue. In particular, some authors have proposed to reduce or even eliminate social security contributions falling on low wage earners, as a way to fight against unemployment among low-skilled workers; see, e. g., Drèze and Malinvaud (1994) or Alogoskoufis *et al.* (1995).

The justification of such a proposal would be the following (Nickell and Bell, 1997). In principle, if wages are flexible, there should be no relation between the level of social security contributions and the level of unemployment since, in the long run, non-wage costs would be borne by the employees. But it can be presumed that wages at the bottom end of the pay distribution are not flexible because of the wage floor generated by minimum wage laws, unions, the benefit system, and so on. In this way, reducing social security contributions for low wage earners (basically, the unskilled) may have a significant effect on employment in the long run, since payroll taxes would not be borne by labour for this type of workers. However, as noticed by Nickell and Bell (1997), a potential disadvantage of this policy would be that it may reduce the incentive for the unskilled to acquire training.

In this paper we provide an empirical evaluation of such a proposal for the case of Spain, a medium-size economy whose labour market is characterized by a substantial unemployment rate, higher than the European average, and with a very high component of unskilled unemployment. We will analyze this issue by means of a computable general equilibrium (CGE) model, simulated for the Spanish economy. Since these models trace the consequences of changes in a particular variable throughout the entire economy modelled, this general equilibrium framework provides a more complete analysis than partial equilibrium models (Scarf and Shoven, 1984).

On the other hand, the empirical implementation through CGE models of the kind of policy measures analyzed in this paper, has been hardly made. An exception is Sørensen (1997), who analyzes the effects of shifting the tax burden away from low-skilled labour and away from the production of consumer services in a CGE model simulated for the Danish economy. However, the possibility of imperfect competition in the output market is not contemplated in the model, an important feature that we address in this paper (see below). Also, our model incorporates a higher sectoral and household disaggregation; and we take more realistic values, different among sectors, for the Armington elasticities of substitution, as compared to the extremely low values, equal for all sectors, used by Sørensen.

The model in this paper embodies three relevant features. First, in addition to the more common assumption in the literature of perfectly competitive firms under constant returns to scale, our model is also able to incorporate increasing returns to scale and a non-competitive price rule. The availability of recent, high-quality data for all (i. e., manufacturing and non-manufacturing) sectors of the Spanish economy allows us to incorporate sectoral concentration measures in the non-competitive version of the model.

Second, neutrality of tax reforms on public revenue is a key issue both for the analysis of welfare effects, and for the evaluation of their feedback effects on other variables. If social contribution rates are lowered, other taxes (usually the value-added tax) should be increased, leading to a restrictive effect that partial equilibrium models do not reflect. Also, in recent years, governments are increasingly concerned with the fact that fiscal reforms should not affect the public sector deficit. We modify the typical neutrality assumption to incorporate this additional constraint.

Third, we analyze the effects of two different fiscal reforms, namely, a cut in social contribution rates, for all types of labour, and only for unskilled labour. To this end, we provide a disaggregation of households that allows us to evaluate the different effects according to the skill level of each household. The labour market is modelled following a matching unemployment rule.

Therefore, in this paper we will use a CGE model in order to analyze the effects of a fiscal policy reform aimed to employment creation by decreasing social security contributions, and how different scenarios might influence the results, both at the aggregate and sectoral levels. The setup of the model is presented in section 2, the empirical analysis and results are discussed in section 3, and section 4 concludes.

2 The model

The model of this paper is static, and describes a single open economy disaggregated in eleven production sectors, with eleven consumption goods, twelve households, and a public sector. The model is a derivation of Gómez (1999).

As a general rule, the notation is as follows: endogenous variables are denoted by capital letters, exogenous variables by capital letters with a bar, and parameters by small Latin and Greek letters. There are n $(i, j = 1, \ldots, n)$ production sectors. The goods produced by these n sectors are transformed into m $(k = 1, \ldots, m)$ consumption goods, of which good m is public final consumption, and good $m-1$ is the residents' consumption abroad. There are r $(h = 1, \ldots, r)$ private households.

To solve the model, we use Rutherford's (1999) method, based on Mathiesen (1985), who proposes solving general equilibrium models as mixed complementarity problems. Hence, there are two types of equations in the CGE model: those representing that firms just break even, and those representing goods and factor market clearing. All of them are numbered below, with some additional equations referring to constraints to the system.

2.1 Production

Domestic producers are subject to a technology characterised by a three-level nesting and constant returns to scale. So, for each sector i, the first nesting level is a Leontief production function where output X_i comes from a composite of primary inputs VA_i, and n composites of intermediate inputs $II_{1i}, \ldots, II_{ni}$. The second nesting level refers to the composite of primary inputs VA_i, which is a CES function of labour L_i, and capital K_i. And the third nesting level is a Cobb-Douglas composite of labour inputs L_i, made of skilled labour L_i^s, and unskilled labour L_i^{us}.

To obtain the zero-profit equations, we have estimated the corresponding cost functions, which come from:

$$min \quad PX_i X_i \ = PVA_i VA_i + \sum_{j=1}^{n} PO_j II_{ji}$$

$$s. \quad t. \quad X_i \ = min\left(\frac{VA_i}{c_{0i}}, \frac{II_{1i}}{c_{1i}}, \ldots, \frac{II_{ni}}{c_{ni}}\right)$$

where PX_i is the unit price of output; PVA_i and PO_{ji} are the prices of composites VA_i and II_{ji}, respectively; and c_{0i}, c_{1i},..., c_{ni} are Leontief coefficients[1].

The cost functions for the second nesting level come from the next problem:

$$min \quad PVA_i VA_i \ = PL_i L_i + R\, K_i$$

[1]The assumption of fixed coefficients is frequently used in CGE models (see Dixon *et al.* (1992), pp. 211-219). This can be justified since many empirical studies do not find an effect of changes in the relative prices of inputs on changes in their relative quantities.

$$s.\quad t.\quad VA_i = \alpha_i \left(a_i L_i^{\frac{\sigma_i^{LK}-1}{\sigma_i^{LK}}} + (1-a_i) K_i^{\frac{\sigma_i^{LK}-1}{\sigma_i^{LK}}} \right)^{\frac{\sigma_i^{LK}}{\sigma_i^{LK}-1}}$$

where PL_i is the average labour cost, R is the capital rent, α_i is a scale parameter, a_i is a share parameter, and σ_i^{LK} is the elasticity of substitution between labour and capital.

Finally, the third nesting level involves the next problem:

$$min \quad PL_i L_i = W^s(1 + socce_i + soccw_i)L_i^s + W^{us}(1 + socce_i + soccw_i)L_i^{us}$$

$$s.\quad t.\quad L_i = \beta_i \left(b_i (L_i^s)^{\frac{\sigma_i^{LL}-1}{\sigma_i^{LL}}} + (1-b_i)(L_i^{us})^{\frac{\sigma_i^{LL}-1}{\sigma_i^{LL}}} \right)^{\frac{\sigma_i^{LL}}{\sigma_i^{LL}-1}}$$

where W^s and W^{us} are the reservation wages for skilled and unskilled labour, respectively; $socce_i$ and $soccw_i$ are the effective tax rates of social contributions paid by employers and employees, respectively; β_i is a scale parameter; b_i is a share parameter; and σ_i^{LL} is the elasticity of substitution between skilled and unskilled labour.

The solution of the three above optimization problems gives us the cost functions, which are used to get the zero-profit conditions[2]. From the first problem we have:

$$\Pi_i^X = PX_i - c_{0i} PVA_i - \sum_{j=1}^{n} c_{ji} PO_j = 0 \tag{1}$$

for the second problem:

$$\Pi_i^{LK} = PVA_i - \frac{1}{\alpha_i} \left(a_i^{\sigma_i^{LK}} PL_i^{1-\sigma_i^{LK}} + (1-a_i)^{\sigma_i^{LK}} R^{1-\sigma_i^{LK}} \right)^{\frac{1}{1-\sigma_i^{LK}}} = 0 \tag{2}$$

and for the third problem:

$$\Pi_i^L = PL_i - \frac{1}{\beta_i} \left(\frac{W^s(1 + socce_i + soccw_i)}{b_i} \right)^{b_i} \left(\frac{W^{us}(1 + socce_i + soccw_i)}{1-b_i} \right)^{1-b_i} = 0 \tag{3}$$

where Π_i^X, Π_i^{LK}, and Π_i^L are unit profits at the first, second, and third nesting level, respectively.

The next step is to estimate the market clearing conditions. Derived demand functions are obtained using Shepard's lemma on cost functions, which is equivalent to apply Shepard's lemma to the above zero-profit conditions with negative sign. Hence, the market clearing conditions apply when[3]:

[2] In all the optimization problems we use Green's (1964) theorem on price and quantity homogenous indices. Note the duality between production functions (quantity indices) and cost functions (price indices).

[3] As a general rule, in market clearing equations we present supply in the left-hand side, and demand in the right-hand side.

$$VA_i = X_i\left(-\frac{\partial \Pi_i^X}{\partial PVA_i}\right) \tag{4}$$

$$II_{ji} = X_i\left(-\frac{\partial \Pi_i^X}{\partial PO_j}\right) \tag{5}$$

The equilibrium conditions in factor markets are shown in section 2.6.

The estimated production is X_i, which corresponds to effective production. However, data availability (see section 3.1) obliges us to convert effective production into distributed production using a fixed coefficients matrix, as in Ballard *et al.* (1985, pp. 76-77):

$$\begin{pmatrix} q_{11} & q_{12} & \dots & q_{1n} \\ q_{21} & q_{22} & \dots & q_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ q_{n1} & q_{n2} & \dots & q_{nn} \end{pmatrix} \times \begin{pmatrix} X_1 \\ X_2 \\ \vdots \\ X_n \end{pmatrix} = \begin{pmatrix} DIST_1 \\ DIST_2 \\ \vdots \\ DIST_n \end{pmatrix} \tag{6}$$

where X_i is effective production, $DIST_i$ is distributed production, and q_{ij} are fixed coefficients. Distributed production is then used to get the total supply of goods in the economy, which is composed of domestic production and imports; and these goods have two possible destinations: domestic and foreign markets. Next, we are going to introduce zero-profit conditions for this supply.

Total supply is modelled by means of the following CES Armington[4] aggregate A_i, from domestic output and imports, for each sector i:

$$A_i = \left(e_i DIST_i^{\frac{\sigma_i^A-1}{\sigma_i^A}} + (1-e_i) IMP_i^{\frac{\sigma_i^A-1}{\sigma_i^A}}\right)^{\frac{\sigma_i^A}{\sigma_i^A-1}}$$

where A_i is the total amount of goods supplied, composed by distributed production $DIST_i$, and imports IMP_i; e_i is a share parameter; and σ_i^A is the Armington elasticity of substitution.

This aggregate shows that producers choose the optimal mix between domestic goods and imports. Hence, producers minimize their costs, subject to the technological restriction assumed in the Armington aggregate, that is:

$$\begin{aligned} min \quad PA_i A_i = {} & PDIST_i(1+npt_i)(1+vatdist_i)DIST_i \\ & + \overline{PFX}FC(1+it_i)(1+vatimp_i)IMP_i \end{aligned}$$

$$s. \quad t. \quad A_i = \left(e_i DIST_i^{\frac{\sigma_i^A-1}{\sigma_i^A}} + (1-e_i) IMP_i^{\frac{\sigma_i^A-1}{\sigma_i^A}}\right)^{\frac{\sigma_i^A}{\sigma_i^A-1}}$$

[4]In essence, Armington's (1969) assumption amounts to assume that goods with different geographical origins are taken as close but not perfect substitutes.

where PA_i is the unit price of the supplied good; $PDIST_i$ is the unit price of distributed production; $\overline{PFX}FC$ are world prices multiplied by a conversion factor to local currency; and npt_i, it_i, $vatdist_i$, and $vatimp_i$ are effective tax rates denoting, respectively, net production taxes, import tariffs, value-added tax on distributed production, and value-added tax on imports.

The cost function is obtained by solving the optimization problem in the usual way, so that the zero-profit condition can be written as:

$$\begin{aligned} \Pi_i^A = PA_i - \Big(& e_i^{\sigma_i^A} (PDIST_i(1+npt_i)(1+vatdist_i))^{1-\sigma_i^A} \\ & + (1-e_i)^{\sigma_i^A} (\overline{PFX}FC(1+it_i)(1+vatimp_i))^{1-\sigma_i^A} \Big)^{\frac{1}{1-\sigma_i^A}} \\ = 0 & \end{aligned} \tag{7}$$

where Π_i^A are unit profits. Market-clearing equations are:

$$DIST_i = A_i \left(-\frac{\partial \Pi_i^A}{\partial PDIST_i} \right) \tag{8}$$

$$IMP_i = A_i \left(-\frac{\partial \Pi_i^A}{\partial FC} \right) \tag{9}$$

The next set of equations refers to the producers' decision on the market of destination for their goods. As suppliers, producers maximize their revenue subject to a constant elasticity of transformation (CET) function, nested in two levels[5]: at the first level, producers decide on the destination of their goods between domestic and foreign markets; and, at second level, they decide the use given to goods destined to the domestic market.

Hence, the problem for the first nesting level is:

$$\begin{aligned} max \quad PA_i A_i &= PO_i O_i + \overline{PFX}FC\ EXP_i \\ s. \quad t. \quad A_i &= \zeta_i \left(d_i O_i^{\frac{\epsilon_i+1}{\epsilon_i}} + (1-d_i) EXP_i^{\frac{\epsilon_i+1}{\epsilon_i}} \right)^{\frac{\epsilon_i}{\epsilon_i+1}} \end{aligned}$$

where PO_i and $\overline{PFX}$ are the prices of the goods sold in the domestic market, and the goods' world price, respectively; O_i and EXP_i are the amounts sold in the domestic market and abroad, respectively; ζ_i is a scale parameter; d_i is a share parameter; and ϵ_i is the elasticity of transformation. After solving the optimization problem we get the cost function, so that the zero-profit condition would be:

$$\begin{aligned} \Pi_i^{CET} &= PA_i - \frac{1}{\zeta_i} \Big(d_i^{-\epsilon_i} PO_i^{\epsilon_i+1} + (1-d_i)^{-\epsilon_i} (\overline{PFX}FC)^{\epsilon_i+1} \Big)^{\frac{1}{\epsilon_i+1}} \\ &= 0 \end{aligned} \tag{10}$$

[5]See Powell and Gruen (1968) for an analytic description of CET functions. Notice that CET functions involve a certain degree of substitution among goods assigned to different markets or uses.

where Π_i^{CET} are unit profits; and, from here, market-clearing conditions are:

$$O_i = A_i\left(-\frac{\partial \Pi_i^{CET}}{\partial PO_i}\right) \quad (11)$$

$$EXP_i = A_i\left(-\frac{\partial \Pi_i^{CET}}{\partial FC}\right) \quad (12)$$

The second nesting level involves the distribution of O_i. We assume that its components are perfect substitutes, so there is an infinite elasticity of substitution. In this case the optimization problem is:

$$max \quad PO_iO_i = PO_iI_i + \sum_{j=1}^{n} PO_iII_{ij} + PO_iCF_i$$

$$s. \quad t. \quad O_i = I_i + \sum_{j=1}^{n} II_{ij} + CF_i$$

where I_i are goods destined to gross capital formation; II_{ij} are goods produced in sector i destined to intermediate use in sector j; and CF_i are goods destined to final consumption. Now, we don't need to write a specific zero-profit condition since profits are zero by assumption. The equilibrium in this case would be:

$$O_i = I_i + \sum_{j=1}^{n} II_{ij} + CF_i \quad (13)$$

To end this section, and following Ballard *et al.* (1985, pp. 76-77), the goods destined to final consumption are transformed into consumption of residents and consumption of non-residents by means of a fixed coefficients matrix:

$$\begin{pmatrix} o_{11} & o_{12} & \ldots & o_{1n} \\ o_{21} & o_{22} & \ldots & o_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ o_{m1} & o_{m2} & \ldots & o_{mn} \end{pmatrix} \times \begin{pmatrix} CF_1 \\ CF_2 \\ \vdots \\ CF_n \end{pmatrix} = \begin{pmatrix} \sum_{h=1}^{r} Q_1^h + \overline{CFNR_1} \\ \sum_{h=1}^{r} Q_2^h + \overline{CFNR_2} \\ \vdots \\ \sum_{h=1}^{r} Q_m^h \end{pmatrix} \quad (14)$$

where $Q_1^h, Q_2^h, \ldots, Q_{m-2}^h, Q_m^h$ is the consumption of household h; $\overline{CFNR}_1$, $\overline{CFNR}_2$, ..., $\overline{CFNR}_{m-2}$ is the consumption of non-residents; and o_{ik} are fixed coefficients

2.2 Consumption

Private consumers are divided into twelve households, according to the main householder's socioeconomic characteristics. Each household h maximizes a Cobb-Douglas utility function V_h subject to a budget constraint. and is endowed with fixed amounts of capital $\overline{K_h}$, skilled labour $\overline{L_h^s}$, and unskilled labour $\overline{L_h^{us}}$. The fixed amounts of skilled and unskilled labour should be interpreted as a maximum supply of labour although we also consider the existence of leisure and unemployment.

Decisions on savings, leisure and final consumption follow from the consumer's problem for each household h:

$$max \quad V_h = (Q^h_{sav})^{\tau^h_{sav}} (Q^h)^{1-\tau^h_{sav}}$$

$$s. \quad t. \quad Y_h = \sum_{k=1}^{m-1} P_k Q^h_k + P_{sav} Q^h_{sav} + W^s Q^h_{ls} + W^{us} Q^h_{lus}$$

where Q^h_{sav} are savings, and Q^h is an aggregate of leisure Q^h_l and final consumption of goods Q^h_k $(k = 1, \ldots, m-1)$:

$$Q^h = \left(e_h (Q^h_l)^{\frac{\sigma^{LQ}_h - 1}{\sigma^{LQ}_h}} + (1 - e_h) \left(\prod_{k=1}^{m-1} (Q^h_k)^{\tau^h_k} \right)^{\frac{\sigma^{LQ}_h - 1}{\sigma^{LQ}_h}} \right)^{\frac{\sigma^{LQ}_h}{\sigma^{LQ}_h - 1}}$$

with

$$Q^h_l = \left(f_h (Q^h_{ls})^{\frac{\sigma^{LEI}_h - 1}{\sigma^{LEI}_h}} + (1 - f_h)(Q^h_{lus})^{\frac{\sigma^{LEI}_h - 1}{\sigma^{LEI}_h}} \right)^{\frac{\sigma^{LEI}_h}{\sigma^{LEI}_h - 1}}$$

so that Y_h is disposable income; P_k and P_{sav} are prices of good k and savings, respectively; W^s and W^{us} are wages for skilled and unskilled labour, used to value leisure; Q^h_k is final consumption of good k; Q^h_{ls} and Q^h_{lus} are leisure for skilled and unskilled labour; τ^h_{sav}, e_h, f_h, and τ^h_k are share parameters; σ^{LQ}_h are elasticities of substitution between leisure and final consumption; and σ^{LEI}_h are the elasticities of substitution between leisure for the skilled and leisure for the unskilled.

Household h's disposable income is given by:

$$\begin{aligned} Y_h \quad = \quad & W^s(\overline{L^s_h} - Q^h_{ls})(1 - U_s) + W^{us}(\overline{L^{us}_h} - Q^h_{lus})(1 - U_{us}) + \\ & + R\overline{K_h} + \overline{NTPS_h} + \overline{NTROW_h}FC - \overline{INC_h} \end{aligned} \tag{15}$$

where the first and second terms correspond to labour rents (adjusted by leisure and unemployment rates U_s and U_{us}, for skilled and unskilled labour, respectively); the third term is the rent of capital; $\overline{NTPS_h}$ and $\overline{NTROW_h}FC$ are net transfers received from the public sector and the rest of the world, respectively; and $\overline{INC_h}$ are income taxes.

¿From the above optimization problem we can get the demand functions, so that market equilibrium would be given by:

$$Q^h_k = \frac{\tau^h_k Y_h}{P_k} \tag{16}$$

$$Q^h_{sav} = \frac{\tau^h_{sav} Y_h}{P_{sav}} \tag{17}$$

$$
\begin{aligned}
Q_{ls}^{h} &= f_h \left(\frac{Y_h}{W^s}\right)^{\sigma^{LEI}} &(18)\\
Q_{lus}^{h} &= (1-f_h)\left(\frac{Y_h}{W^{us}}\right)^{\sigma^{LEI}} &(19)
\end{aligned}
$$

2.3 Public sector

The starting point when modelling the public sector is the Musgravian notion of differential incidence, which refers to the effects of substitution among taxes, holding constant public revenues and expenditure. In a broader sense, we could say that this notion would involve keeping unchanged the size of the public sector after a fiscal policy change. Following Shoven and Whalley (1977), a debate among applied general equilibrium modellers has developed on the meaning of *keeping unchanged the size of the public sector*, that is, the *equal yield* assumption[6]. In order to avoid ambiguous welfare results, we assume that a constant size of the public sector involves *keeping unchanged the level of public consumption* following the fiscal policy change.

A fixed welfare level from final public consumption does not mean that its determinants are going to remain constant after the simulation exercise. For example, due to the general equilibrium structure, endogenous variables are expected to change, although the welfare level from final public consumption will recover its initial level. Assume that public expenditure is one of the endogenous variables that are modified. Since we take as a restriction the level of public deficit, then an increase (or decrease) in public expenditure must be offset by an equivalent increase (or decrease) in public revenues (i. e., changing other tax rates). In the end, the solution will involve an exogenous and constant public deficit (or surplus), and keeping unchanged the level of welfare from public consumption; public expenditure and revenues will undergone an equivalent change.

Public sector income Y^G is given by:

$$
\begin{aligned}
Y^G = R\overline{K^G} &+ \sum_{i=1}^{n}(SOCCE_i + SOCCW_i) + \sum_{i=1}^{n} VAT_i + \sum_{i=1}^{n} IT_i \\
&+ \sum_{i=1}^{n} NPT_i + \sum_{h=1}^{r} \overline{INC_h} - \sum_{h=1}^{r} \overline{NTPS_h} + \overline{NTROW^G}FC
\end{aligned}
\quad (20)
$$

where $R\overline{K^G}$ is the public sector's capital rent; $SOCCE_i$ and $SOCCW_i$ are the social contributions paid by employers and employees, respectively; VAT_i are the revenues from the value-added tax; IT_i are the revenues from import tariffs; NPT_i are the revenues from taxes on production; $\overline{INC_h}$ are the (exogenous) revenues from the income tax; $\overline{NTPS_h}$ and $\overline{NTROW^G}FC$ are (exogenous) net transfers paid to households, and received from the rest of the world, respectively; and the following taxes are modelled as effective *ad valorem* rates, estimated from benchmark data (see section 3.1):

[6] See Pereira (1995) for an overview of the different concepts of *equal yield*.

$$
\begin{aligned}
SOCCE_i &= socce_i W^s \; L_i \left(-\frac{\partial \Pi_i^L}{\partial W^s}\right) + socce_i W^{us} \; L_i \left(-\frac{\partial \Pi_i^L}{\partial W^{us}}\right) \\
SOCCW_i &= soccw_i W^s \; L_i \left(-\frac{\partial \Pi_i^L}{\partial W^s}\right) + soccw_i W^{us} \; L_i \left(-\frac{\partial \Pi_i^L}{\partial W^{us}}\right) \\
VAT_i &= \overline{PFX} FC \; A_i \left(-\frac{\partial \Pi_i^A}{\partial FC}\right) (1 + it_i) vatimp_i + \\
&\quad + PDIST_i A_i \left(-\frac{\partial \Pi_i^A}{\partial PDIST_i}\right) (1 + npt_i) vatdist_i \\
IT_i &= \overline{PFX} FC \; A_i \left(-\frac{\partial \Pi_i^A}{\partial FC}\right) it_i \\
NPT_i &= PDIST_i A_i \left(-\frac{\partial \Pi_i^A}{\partial PDIST_i}\right) npt_i
\end{aligned}
$$

The macro closure for the public sector includes an identity and an equation. Both public investment $\overline{INVPUB}$ and public surplus (or deficit) $\overline{BALPUB}$ are taken as exogenous, so public savings $\overline{SAVPUB}$ are also exogenous:

$$\overline{BALPUB} = \overline{SAVPUB} - \overline{INVPUB} \tag{21}$$

Recall that we are imposing into the model a restriction of constant public surplus (or deficit). Lastly, final public consumption $CPUB$ would be given by:

$$CPUB = P_m Q_m = Y^G - \overline{SAVPUB} \tag{22}$$

where good m is public final consumption.

2.4 Investment and savings

Investment should affect the economy's productive capacity in subsequent periods of time but, in our static framework investment exerts its influence on the economy as a component of final demand.

Following Dervis *et al.* (1981), total investment $INVTOTAL$ is splitted into sectoral gross capital formation I_i through a fixed coefficients Leontief structure. The minimization cost problem would be:

$$min \quad PINV\overline{INVTOTAL} = \sum_{i=1}^{n} PO_i I_i$$

$$s. \quad t. \quad \overline{INVTOTAL} = min\left(\frac{I_1}{l_1}, \ldots, \frac{I_n}{l_n}\right)$$

where $PINV$ is the price of investment, and l_i are fixed coefficients; and the equation for the derived unit profit Π^I would be:

$$\Pi^I = PINV - \sum_{i=1}^{n} l_i PO_i = 0 \tag{23}$$

The second equation for the macro closure of the model relates to the identity between savings and investment. Investment has been described above, and national savings are the aggregation of private and public savings, with $\overline{NLB}$ denoting the net lending/borrowing of the economy:

$$P_{sav} \sum_{h=1}^{r} Q_{sav}^h + \overline{SAVPUB} - PINV\overline{INVTOTAL} = \overline{NLB}FC \tag{24}$$

2.5 Foreign sector

When modelling the rest of the world, we assume that the economy analyzed is small. This implies that the country faces exogenous world prices, and hence perfectly elastic functions for both exports demand and imports supply.

We need to include in the model an equation for the balance of payments, which is the third equation for macro closure, and shows that the difference between receipts and payments with the rest of the world is the net lending/borrowing of the economy:

$$\begin{aligned} &\sum_{i=1}^{n} \overline{PFX}EXP_i + \sum_{h=1}^{s} \overline{NTROW_h} + \overline{NTROW^G} + \\ &+ \frac{\sum_{k=1}^{m-2} P_k \overline{CFNR_k}}{FC} - \sum_{i=1}^{n} \overline{PFX}IMP_i - \sum_{h=1}^{r} \overline{PFX}Q_{m-1}^h = \\ &= \overline{NLB} \end{aligned} \tag{25}$$

where, together with trade flows, EXP_i and IMP_i, the equation includes the net transfers received by households, $\overline{NTROW_h}$, and the public sector, $\overline{NTROW^G}$; the final consumption of non residents within the economy's borders, $CFNR_k$; and the consumption of domestic households abroad, Q_{m-1}^h.

Our foreign sector closure follows de Melo and Tarr (1992). An equation like (25) avoids, for example, the possibility of a high increase in exports with no change in imports, which would be unreliable on leading to a continuous capital outflow. This problem can be avoided by taking as exogenous the net lending/borrowing.

2.6 Factor markets

Capital, skilled labour, and unskilled labour are the primary factors in the model, and their derived demands can be obtained by applying Shepard's lemma to equations

(2) and (3). Now we will present the factor supplies and market clearing conditions for each market.

Households and the public sector have a fixed endowment of capital $\overline{K_h}$ and $\overline{K^G}$, respectively, so that the supply of capital is inelastic. The capital rent adjusts to clear the market. Capital is internationally immobile, and perfectly mobile across domestic sectors. The equilibrium condition in the capital market is:

$$\sum_{h=1}^{r} \overline{K_h} + \overline{K^G} = \sum_{i=1}^{n} VA_i \left(-\frac{\partial \Pi_i^{LK}}{\partial R} \right) \tag{26}$$

Each household h is endowed with a fixed amount of skilled and unskilled labour, but, due to the existence of leisure, supply functions can be elastic. Labour supply also depends on unemployment, since we assume a case of equilibrium unemployment, according to a matching unemployment specification. This approach has the advantage of allowing the researcher to model frictions in otherwise conventional models, with a minimum of additional complexity; see Petrongolo and Pissarides (2001) for a recent survey of the matching function in macroeconomics.

According to this framework, firms and workers have to spend some resources before job creation and production can take place. We will assume that there is a matching function that gives the number of jobs created, following the approach of Balistreri (2002), based on Markusen (1990). In this way, we define wages W_0^s and W_0^{us} as reservation wages W^s and W^{us} including a premium that represents search costs, denoted by $\frac{1}{H^s}$ and $\frac{1}{H^{us}}$, respectively:

$$W_0^s = W^s \frac{1}{H^s} \tag{27}$$

$$W_0^{us} = W^{us} \frac{1}{H^{us}} \tag{28}$$

being

$$H^s = (1 - \overline{U_s}) \left(\frac{\sum_{i=1}^n L_i \left(-\frac{\partial \Pi_i^L}{\partial W^s} \right)}{\sum_{i=1}^n \overline{L_i} \left(-\frac{\partial \Pi_i^L}{\partial W^s} \right)} \right)^{\eta_0} \left(\frac{U_s}{\overline{\overline{U_s}}} \right)^{\eta_1} \tag{29}$$

$$H^{us} = (1 - \overline{U_{us}}) \left(\frac{\sum_{i=1}^n L_i \left(-\frac{\partial \Pi_i^L}{\partial W^{us}} \right)}{\sum_{i=1}^n \overline{L_i} \left(-\frac{\partial \Pi_i^L}{\partial W^{us}} \right)} \right)^{\eta_0} \left(\frac{U_{us}}{\overline{\overline{U_{us}}}} \right)^{\eta_1} \tag{30}$$

where $\overline{U_s}$ and $\overline{U_{us}}$ are the unemployment rates in the base year (in our case, 10 per cent for skilled labour, and 20 per cent for unskilled labour); $\overline{L_i}$ is the benchmark aggregate employment; and η_0 and η_1 represent externalities from labour supply and unemployment, respectively. Like capital, labour is internationally immobile, but mobile across sectors. Equilibrium in the skilled labour market is determined by the above equations and:

$$\sum_{h=1}^{r}(\overline{L_h^s} - Q_{ls}^h)(1-U_s) = \sum_{i=1}^{n} L_i\left(-\frac{\partial \Pi_i^L}{\partial W^s}\right) \tag{31}$$

$$\sum_{h=1}^{r}(\overline{L_h^{us}} - Q_{lus}^h)(1-U_{us}) = \sum_{i=1}^{n} L_i\left(-\frac{\partial \Pi_i^L}{\partial W^{us}}\right) \tag{32}$$

2.7 Increasing returns to scale and imperfect competition

There are many well-known ways of modelling competition among firms according to several alternative assumptions. However, a trade-off between theoretical complexity and empirical data availability is always present, since the lack of data usually prevents implementing many imperfect competition specifications, or even leads to use inadequate data (aggregated figures, old data, data belonging to another country, ...), which has been a common critique to deterministic CGE models. For these reasons, we have chosen to represent competition among firms in our model in the following way.

The constant returns to scale version of the model would be characterized by a competitive price rule (see section 2.1). An alternative version embodying a non-competitive price rule and increasing returns to scale, due to the existence of some fixed labour and capital requirements, is developed in this section. The presence of fixed costs means that average costs are higher than marginal costs, so that firms set prices by charging a markup on marginal costs. This price rule is based on the idea that firms face demand functions with a negative slope and compete *à la Cournot*. There is free entry and exit of firms in each sector, so that in equilibrium firms just break even.

This version of the model involves both replacing and including several equations. First, the unit profit function Π_i^X in equation (1) must be replaced by the following one, which includes fixed costs:

$$\Pi_i^X = PX_i - \frac{\left(R\overline{KF_i} + W^s\overline{LF_i^s} + W^{us}\overline{LF_i^{us}}\right)E_i}{X_i} - c_{0i}PVA_i - \sum_{j=1}^{n} c_{ji}PO_j \tag{33}$$
$$= 0$$

where $\overline{LF_i^s}$, $\overline{LF_i^{us}}$, and $\overline{KF_i}$ are, respectively, the fixed requirements of skilled labour, unskilled labour, and capital for each firm; and E_i is the number of firms operating in sector i.

Given these fixed factor requirements, the equilibrium conditions in factor markets shown in section 2.6 must be replaced by:

$$\sum_{h=1}^{r}\overline{K_h} + \overline{K^G} = \sum_{i=1}^{n} E_i\overline{KF_i} + \sum_{i=1}^{n} VA_i\left(-\frac{\partial \Pi_i^{LK}}{\partial R}\right) \tag{34}$$

$$\sum_{h=1}^{r}(\overline{L_h^s} - Q_{ls}^h)(1 - U_s) = \sum_{i=1}^{n} E_i\overline{LF_i^s} + \sum_{i=1}^{n} L_i\left(-\frac{\partial \Pi_i^L}{\partial W^s}\right) \quad (35)$$

$$\sum_{h=1}^{r}(\overline{L_h^{us}} - Q_{lus}^h)(1 - U_{us}) = \sum_{i=1}^{n} E_i\overline{LF_i^{us}} + \sum_{i=1}^{n} L_i\left(-\frac{\partial \Pi_i^L}{\partial W^{us}}\right) \quad (36)$$

Finally, from the first-order condition of profit maximization we can derive the non-competitive price rule:

$$MARKUP_i = \frac{\Omega_i}{E_i \kappa_i^d} \quad (37)$$

where $MARKUP$ is the price-cost margin or Lerner index; $\Omega_i = 1$ are Cournot conjectural variations for each sector i; κ_i^d is the perceived elasticity of demand for each firm; and the inverse of the number of firms in each sector $1/E_i$ can be approximated by the Herfindahl concentration index, since firms are assumed to be symmetric. As can be seen in equation (37), when the concentration index is very low, the sectoral price rule approaches the competitive one.

3 Empirical analysis

3.1 Calibration and data

The model has been calibrated using the social accounting matrix MCS-90 (see Uriel *et al.* (1997) and Gómez (2001)), which represents the benchmark equilibrium of the model.

When calibrating the scale and share parameters we make use of Rutherford's (1999) method, implemented with GAMS/MPSGE. The method starts with the balanced equilibrium for the social accounting matrix as the reference equilibrium, with a set of elasticities taken from the available empirical evidence.

Calibration is made in three steps. In the first step, the matrix collects the quantities appearing in the equations, which means a first reference point in the isoquant of the calibrated function. In the second step, relative prices in that year fix the slope of the isoquant in that point. Since matrix data do not distinguish between prices and quantities, only showing values, we follow Harberger's (1972) assumption and choose the quantity units for goods and factors so that we can have unit prices in the chosen numerary. The last step in calibration uses elasticities, which show the curvature of the isoquant. To sum up, we have the slope and curvature for any point in each isoquant, and from here all the unknown parameters are calibrated using Rutherford's method.

In addition to the data from the MCS-90, taxes have been further disaggregated using Spanish National Accounts. The data on imperfect competition are taken from Bajo and Salas (1998), who compute concentration indices using data on sales for more than two million firms, obtained from official VAT returns.

In turn, regarding elasticities, the elasticities of substitution between labour and capital σ_i^{LK}, as well as Armington elasticities σ_i^A for the CES functions, are taken from GTAP (Hertel, 1997). As for the elasticities of substitution between skilled and unskilled labour σ_i^{LL}, the available evidence shows quite different figures, which may range from more than 5 to (small) negative values; see Hamermesh (1993), Chapter 3. Since our results could be presumed to be highly dependent on the value of this elasticity, the simulations have been performed using two alternative values, constant across sectors: a "low" value of 1, which would agree with the recent estimates of Biscourp and Gianella (2001) for French manufacturing; and a "high" value of 4, more in line witth older studies (e.g., Dougherty, 1972).

On the other hand, the elasticities of substitution between leisure and consumption σ_h^{LQ} have been obtained using the procedure of Ballard *et al.* (1985), from the uncompensated elasticity of labour supply estimated in García and Molina (1998)[7]; a total of 40 hours worked per week, out of a potential 70, has been assumed. We have no data available on the elasticities of substitution between leisure for the skilled and leisure for the unskilled σ_h^{LEI}, so we assume they take a constant value across households of 0.5; such a value has been carefully checked in the sensitivity analysis (see section 3.4). Finally, the remaining elasticities of substitution are either zero (for Leontief functions) or one (for Cobb-Douglas functions), whereas elasticities of transformation ϵ_i come from de Melo and Tarr (1992).

The definitions of households and sectors are presented in Table 2, and the Herfindahl concentration indices and the different elasticities are shown in Table 3.

3.2 Scenarios and simulation

The simulation performed consists of a decrease in social contribution rates compensated with an increase of 6.25 per cent in value-added tax rates (which amounts to an increase of one percentage point), where the decrease in social contributions is endogenously computed by the model, subject to the restrictions on public sector behaviour examined in section 2.3. Other alternative simulations (not shown here, but available from the authors upon request) have been also performed, but the results are roughly similar.

It is worth to stress that our general equilibrium framework allows us to study the restrictive role of the value-added tax in this policy analysis, which is often neglected in partial equilibrium models. As we will see, the feedback effect of an increase in the value-added tax will be quite relevant for the results.

The model developed in section 2 is available in two versions: a first one where firms set prices in a competitive way and technology exhibits constant returns to scale,

[7]These authors estimate the elasticity of labour supply with respect to the own wage, for both men and women, from different functional forms. Since they find no evidence against the null that these elasticities are zero, we use this value as starting point when computing σ_h^{LQ}.

and a second one with a non-competitive price rule under a technology of increasing returns to scale. Due to space reasons, only the results from the latter will be those shown below. The simulations from the alternative version led to slightly weaker effects on the main variables, and are available from the authors upon request.

On the other hand, the simulation results are presented under four scenarios, depending on whether the decrease in social contributions is made either for both types of labour, or only for unskilled labour; and on the value taken by the elasticity of substitution between skilled and unskilled labour σ_i^{LL}:

1. **Scenario BOTH-1**. Social contributions decrease for both skilled and unskilled labour, and the elasticity of substitution between them is 1.

2. **Scenario BOTH-4**. Social contributions decrease for both skilled and unskilled labour, and the elasticity of substitution between them is 4.

3. **Scenario UNSK-1**. Social contributions decrease only for unskilled labour, and the elasticity of substitution between them is 1.

4. **Scenario UNSK-4**. Social contributions decrease only for unskilled labour, and the elasticity of substitution between them is 4.

The equilibrium of the competitive version of the model involves the resolution of three sets of equations:

- *Zero-profit conditions* (equations 1 to 3, 7, 10, and 23).

- *Market clearing in goods markets* (equations 4 and 5, 8, 9, 11 to 13, and 16 to 19) *and in factor markets* (equations 26, 31, and 32).

- *Restrictions on disposable income* (equations 15 and 20), *equilibrium unemployment* (equations 27 to 30), *transformation of goods* (equations 6 and 14), *and macro closure* (equations 21, 22, 24, and 25).

In turn, in the equilibrium of the non-competitive version equation (33) replaces (1), and equations (34), (35) and (36) replace (26), (31) and (32), respectively. Finally, equation (37) should be also added.

3.3 Results

The results from the above simulations appear in tables 4 through 8, for our four scenarios. Table 4 shows the effects on several aggregate variables: employment, prices (measured by the consumption price index), real wage, premium on the reservation wage, real capital rent, and unemployment rate. In turn, tables 5 to 8 show the effects on some selected variables (labour costs, employment, leisure, and welfare, respectively), disaggregated according to the sectors or households included in our model.

Beginning with the effects on aggregate variables in Table 4, and summarising the main conclusions, we can see that, first, discriminating when cutting labour taxes in favour of unskilled labour would have a clear positive effect on the employment of that segment of workers. Second, a higher elasticity of substitution between skilled and unskilled labour leads to stronger effects on most variables, but only when social contributions are cut just for the latter. Third, increases in value-added tax rates, in order to keep unchanged public sector deficit, do matter in a general equilibrium framework. And lastly, the quantitatively small effect on all variables of this fiscal reform would be evident.

Employment slightly increases for skilled and unskilled workers when social contributions fall for both types of labour; however, when contributions are decreased only for unskilled workers, total job creation would be higher, although employment for skilled workers would decrease. Overall, total employment increases in all cases, reaching the highest effects when tax cuts are addressed just on unskilled labour, and for the "high" value of σ_i^{LL} (i.e., in the scenario UNSK-4). To give a rough quantitative flavour of these results, we have applied the figures in the first three rows of Table 4 for the UNSK scenarios, to Spanish employment data for the last available year, 2000. We found that total employment would increase by 19,912 people (27,556 unskilled minus 7,644 skilled), and by 24,113 people (34,975 unskilled minus 10,862 skilled), following the implementation of a cut in social contributions in scenarios UNSK-1 and UNSK-4, respectively.

As expected, since value-added tax rates are increased, prices go up around 0.20 per cent in all the scenarios. Although capital rents fall in all cases, the change in real wages depend on the scenario. When social contributions are decreased for all types of labour, the higher labour demand leads to an increase in real wages for both skilled and unskilled workers. However, when labour taxes decrease only for unskilled workers, there is an asymmetric effect, with real wages falling for skilled labour and rising for unskilled labour. Also as expected, the opposite happens for the premium on reservation wages: since this premium covers the costs associated with finding a job, when the probability of becoming unemployed falls the premium should also fall.

Regarding the unemployment rate, it always falls except for skilled labour in the UNSK scenarios. This means that the simulated policy would work for unskilled workers, despite the increase in their real wages and the reduction in their leisure (see Table 7 below), so that the job creation effect prevails. The fall in the total rate of unemployment, however, turns to be very small, and is again higher when social contributions are reduced just for unskilled labour, and for the "high" value of σ_i^{LL}. If we apply now the figures in the last three rows of Table 4 for the UNSK scenarios, to the Spanish data on unemployment rates in 2000, the total unemployment rate would decrease by just 0.04 percentage points (corresponding to a decrease of 0.08 for the unskilled and an increase of 0.09 for the skilled), and also by 0.04 percentage points (corresponding to a decrease of 0.10 for the unskilled and an increase of 0.13 for the skilled), in scenarios UNSK-1 and UNSK-4, respectively. Notice that the effects on unemployment rates are even lower than those on employment, which would be explained by the decrease in leisure (see Table 7 below), especially for unskilled labour due to the increase in real wages for this type of labour.

Table 5 shows the effects on sectoral labour costs. In general, labour costs decrease in all sectors, with a more homogenous pattern regarding both types of labour in the BOTH scenarios; on the contrary, in the UNSK scenarios the fall in labour costs is significantly higher for unskilled labour, as expected. Differences in the elasticity of substitution between skilled and unskilled labour only matter in the UNSK scenarios, with the "high" value of σ_i^{LL} leading to stronger effects in the case of skilled labour. Regarding particular sectors, those more affected by the fiscal policy change are the services activities (with the exception of Other services), and the less affected, Agriculture, and Other services. In the case of Agriculture, this can be related to the lower social contributions rates in this sector as compared to others, due to its special fiscal regime; whereas Other services includes the public sector, which has been constrained in the model due to the equal yield assumption.

Turning now to the effects on sectoral employment, we see in Table 6 some asymmetries among sectors, despite a similar decrease in labour costs for most of them. This can be explained since capital is in fact the only fixed factor, because leisure and matching unemployment allow for some flexibility in the case of labour. So, if capital flows into any sector, it should flow out from other sectors, and a general equilibrium framework allows to represent this fact. As can be seen in Table 6, this effect is relatively small in all sectors, except for the negative effect on Energy and water (a sector that is not intensive in unskilled labour, and with a very low ratio of social security contributions to value added), and the positive effect on Metal and machinery (the most unskilled labour-intensive sector, and with a high ratio of social security contributions to value added). In both cases capital drives the effect on employment, unlike the rest of sectors (in particular, services activities), where the decrease in labour costs would be the main force behind changes in employment.

At the sectoral level, when social contributions are decreased for both types of labour, most of the increase in employment (both skilled and unskilled) occurs in Metal and machinery, House renting, and, at a lower extent, Finance and insurance. However, when the fiscal policy change is addressed only to unskilled labour, there is a generalized fall in employment for skilled workers, with the exception of Agriculture (for the "high" value of σ_i^{LL}), and Metal and machinery. On the other hand, unskilled employment rises in all sectors, except for Agriculture, and Energy and water (in this case, only for the "low" value of σ_i^{LL}); with the highest increases occurring in Metal and machinery, House renting, and Finance and insurance. The effects on both skilled and unskilled employment are normally stronger for the "high" value of σ_i^{LL}, but only in the UNSK scenarios.

As noticed above, leisure and matching unemployment allow for a certain flexibility on the side of labour supply. Leisure effects (see Table 7) show in general small variations, but in most of cases we can confirm that decreasing social contributions would involve a decrease in leisure, especially for unskilled labour. Households would prefer to work or to try to find a job, following a cut in social contribution rates.

Finally, the welfare results (measured as Hicksian equivalent variations) presented in Table 8, show some asymmetries among households, due to the difference in their income sources (see Table 9). In any case, if we compare the BOTH and UNSK scenarios ("low" or "high" values of σ_i^{LL}do not lead to significantly different results), the most benefited are households 1 and 7, whereas household 6 is the most damaged. As can be seen in Table 9, households 1 and 7 (i. e., Rural, employed; and Urban, employed, non graduate, respectively) would have a majority of unskilled workers, unlike household 6 (i. e., Urban, employed, graduate), with a majority of skilled workers. On the other hand, the main income source for the rest of households would be capital, so that, as capital rental rates decrease, the welfare levels of those households would also be reduced.

3.4 Sensitivity analysis

A sensitivity analysis on several key variables and parameters of the model has been carried out. The main results (available from the authors upon request) are as follows:

- The simulations performed above assumed that capital endowments were fixed. When the simulations were redone assuming an exogenous increase in capital endowments, we found that the sectoral pattern of the variation in labour employment was roughly unchanged.

- Regarding the elasticities of substitution, the results were rather insensitive to the values of the elasticity of substitution between capital and labour. On the other hand, in the case of the elasticity of substitution between leisure for the skilled and leisure for the unskilled, the effects were quantitatively higher the higher the value of that elasticity. The same result applied to the elasticity of substitution between savings and consumption, even though the degree of sensitivity was quite low in this case.

- Finally, the signs of the effects were robust to the values of the parameters measuring externalities (from labour supply and unemployment) in the matching function.

4 Concluding remarks

The still high unemployment rates in most European countries, heavily concentrated among low-skilled workers, has led several authors to advocate in favour of selective tax cuts on social security contributions for low wage earners. This measure is justified on the grounds that the (currently assumed) high level of social contributions could be a disincentive for labour demand regarding low-skilled workers.

In this paper we provide an empirical evaluation of such a proposal for the case of Spain, a medium-size economy whose labour market is characterized by a substantial unemployment rate, higher than the European average, and with a very high component of unskilled unemployment. We simulate the effects of a cut in social contribution rates (i) for all types of labour, and (ii) only for unskilled labour, within a CGE model, calibrated for the Spanish economy. The model allows firms to follow a non-competitive price rule under increasing returns to scale, and incorporates an equal yield assumption, so that public consumption is kept unchanged following the fiscal policy change. This involves that the reduction in social security contributions is compensated with an increase in value-added tax rates amounting to one percentage point. In addition, the labour market is assumed to follow a matching unemployment rule, which allows to model in a simple way any frictions present in that market. Finally, the simulations are performed under two alternative values of the elasticity of substitution between skilled and unskilled labour.

The results of the simulations show a small positive effect on the employment of unskilled workers following a selective reduction in social contributions only for this type of labour, accompanied by a negative effect on the employment of skilled workers, which leads to an almost negligible positive effect on total employment. The overall effect on employment, however, is higher than in the case of a general reduction in social contributions for all types of labour. Although the total unemployment rate falls, this effect would be even lower than in the case of employment, due to the decrease in leisure, especially for unskilled labour, following the increase in real wages for this type of labour. On the other hand, the higher the elasticity of substitution between skilled and unskilled labour, the stronger the effects on unskilled employment and unemployment, but only when social contributions are reduced just for the unskilled. Finally, the effects would be asymmetric among households and sectors, being stronger for those households and sectors where the share of unskilled labour is higher.

To conclude, notice the importance for our results of the equal yield assumption in a general equilibrium setting, leading to the crucial feedback effect of the increase in indirect tax rates (aimed to compensate the fall in social security contributions), which is neglected in partial equilibrium analyses. In this way, even though a policy measure such as that evaluated in this paper would provide some room to reduce unskilled unemployment, the initial positive effect would be later offset to a great extent, so that the total result would turn to be rather modest.

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Table 1: Unemployment rates according to educational levels in 1998 (% on active population)

Country	Unemployment rate, total (a)	Less than secondary (b)	Secondary (b)	Higher than secondary (b)
Australia	7.9	9.0	5.8	3.3
Austria	5.5	6.7	3.4	2.5
Belgium	9.4	13.1	7.4	3.2
Canada	8.4	12.2	7.8	5.2
Denmark	5.1	7.0	4.6	3.3
Finland	11.6	15.6	11.9	6.5
France	11.9	14.9	9.5	6.6
Germany	9.3	16.6	10.8	5.6
Greece	11.0	6.5	9.6	7.3
Ireland	7.9	11.6	4.5	3.0
Italy	12.3	10.8	8.7	7.0
Netherlands	4.4	6.2	3.2	2.3
New Zealand	7.6	10.4	4.6	4.3
Norway	3.2	4.0	3.1	1.7
Portugal	5.2	4.3	4.3	2.6
Spain	18.8	17.0	15.3	13.1
Sweden	8.4	10.4	7.2	3.6
Switzerland	3.7	5.6	2.8	2.8
Turkey	6.6	4.0	6.2	4.3
United Kingdom	6.2	10.5	5.0	2.6
United States	4.5	8.5	4.4	2.1
European Union	10.0	10.6	9.1	6.0
OECD	6.9	8.3	6.1	3.5

a. 15-64 years of age.

b. 25-64 years of age.

Source: OECD (2000, pp. 216, and 228-230).

Table 2: Classification of households and sectors

Households
1 - Rural, employed
2 - Rural, self-employed, non agricultural
3 - Rural, self-employed, agricultural
4 - Rural, other incomes, males
5 - Rural, other incomes, females
6 - Urban, employed, graduate
7 - Urban, employed, non graduate
8 - Urban, self-employed
9 - Urban, other incomes, males, under 65
10 - Urban, other incomes, females, under 65
11 - Urban, other incomes, males, over 65
12 - Urban, other incomes, females, over 65

Sectors
1 - Agriculture
2 - Energy and water
3 - Nonenergy minerals, chemicals
4 - Metal and machinery
5 - Other manufacturing
6 - Construction
7 - Commerce and hotel trade
8 - Transport and communications
9 - Finance and insurance
10 - House renting
11 - Other services

Table 3: Concentration indices and elasticities

Sectors	Herfindahl index $1/E_i$ (a)	Elasticity of substitution labour-capital σ_i^{LK} (b)	Armington elasticity σ_i^A (c)	Elasticity of transformation ϵ_i (d)
1	0.00154	0.56	4.4	3.9
2	0.13939	1.26	5.2	2.9
3	0.03533	1.26	3.8	2.9
4	0.04666	1.26	10.4	2.9
5	0.01404	1.26	5.6	2.9
6	0.00572	1.40	3.8	0.7
7	0.01790	1.26	3.8	0.7
8	0.24310	1.68	3.8	0.7
9	0.03855	1.26	3.8	0.7
10	0.00799	1.26	3.8	0.7
11	0.00111	1.26	3.8	0.7

Households	Elasticity of substitution leisure-consumption σ_h^{LQ} (e)
1	0.428
2	0.057
3	0.037
4	0.060
5	0.038
6	0.304
7	0.402
8	0.048
9	0.087
10	0.059
11	0.062
12	0.019

Source: Elaborated from:
(a) Bajo and Salas (1998)
(b) and (c) Hertel (1997)
(d) de Melo and Tarr (1992)
(e) Ballard *et al.* (1985) and García and Molina (1998).

Table 4: Simulation results: Effects on aggregate variables (% change from base year)

Variable		**BOTH-1**	**BOTH-4**	**UNSK-1**	**UNSK-4**
Employment	Skilled	0.05	0.05	-0.19	-0.27
	Unskilled	0.06	0.06	0.26	0.33
	Total	0.06	0.06	0.17	0.21
Prices		0.21	0.21	0.20	0.21
Real wage	Skilled	0.41	0.43	-0.10	-0.29
	Unskilled	0.44	0.42	0.80	0.95
Wage premium	Skilled	-0.02	-0.02	0.08	0.12
	Unskilled	-0.03	-0.03	-0.13	-0.17
Real capital rent		-0.39	-0.39	-0.38	-0.38
Unemployment rate	Skilled	-0.21	-0.20	0.74	1.09
	Unskilled	-0.11	-0.12	-0.54	-0.69
	Total	-0.11	-0.13	-0.30	-0.36

Table 5: Simulation results: Effects on sectoral labour costs (% change from base year)

	Skilled labour			
Sectors	**BOTH-1**	**BOTH-4**	**UNSK-1**	**UNSK-4**
1	-0.02	-0.03	-0.12	-0.34
2	-0.67	-0.68	-0.15	-0.42
3	-0.49	-0.50	-0.14	-0.40
4	-0.49	-0.50	-0.14	-0.40
5	-0.48	-0.49	-0.14	-0.40
6	-0.49	-0.51	-0.14	-0.40
7	-0.59	-0.60	-0.15	-0.41
8	-0.76	-0.77	-0.15	-0.44
9	-0.88	-0.89	-0.16	-0.45
10	-0.84	-0.85	-0.16	-0.45
11	-0.37	-0.38	-0.14	-0.39

	Unskilled labour			
Sectors	**BOTH-1**	**BOTH-4**	**UNSK-1**	**UNSK-4**
1	-0.05	-0.04	0.01	0.17
2	-0.70	-0.69	-1.11	-0.94
3	-0.52	-0.51	-0.80	-0.63
4	-0.52	-0.51	-0.80	-0.63
5	-0.51	-0.50	-0.78	-0.61
6	-0.53	-0.52	-0.81	-0.64
7	-0.62	-0.62	-0.98	-0.80
8	-0.79	-0.78	-1.27	-1.09
9	-0.91	-0.90	-1.47	-1.29
10	-0.88	-0.87	-1.41	-1.23
11	-0.40	-0.39	-0.59	-0.42

Table 6: Simulation results: Effects on sectoral employment (% change from base year)

	Skilled labour			
Sectors	**BOTH-1**	**BOTH-4**	**UNSK-1**	**UNSK-4**
1	-0.19	-0.20	-0.05	1.39
2	-0.33	-0.34	-0.68	-1.10
3	-0.02	-0.02	-0.26	-0.37
4	0.49	0.49	0.23	0.15
5	-0.02	-0.03	-0.27	-0.42
6	-0.01	-0.02	-0.31	-0.49
7	0.0	-0.01	-0.31	-0.70
8	0.08	0.08	-0.31	-0.84
9	0.15	0.15	-0.22	-0.50
10	0.31	0.31	-0.17	-0.54
11	-0.02	-0.02	-0.16	-0.04

	Unskilled labour			
Sectors	**BOTH-1**	**BOTH-4**	**UNSK-1**	**UNSK-4**
1	-0.17	-0.17	-0.16	-0.35
2	-0.31	-0.31	-0.03	0.30
3	0.01	0.01	0.21	0.29
4	0.52	0.52	0.71	0.81
5	0.01	0.01	0.20	0.19
6	0.01	0.01	0.17	0.19
7	0.03	0.03	0.28	0.39
8	0.10	0.11	0.43	0.89
9	0.18	0.19	0.63	1.68
10	0.33	0.34	0.65	1.51
11	0.01	0.01	0.18	0.06

	Capital			
Sectors	**BOTH-1**	**BOTH-4**	**UNSK-1**	**UNSK-4**
1	0.03	0.03	0.06	0.05
2	-0.41	-0.41	-0.42	-0.41
3	0.03	0.03	0.02	0.02
4	0.53	0.53	0.51	0.53
5	0.04	0.04	-0.00	0.02
6	0.03	0.03	-0.06	-0.02
7	-0.03	-0.03	-0.06	-0.04
8	-0.12	-0.12	-0.11	-0.12
9	-0.07	-0.07	0.07	0.01
10	0.13	0.13	0.13	0.14
11	0.13	0.12	0.16	0.11

Table 7: Simulation results: Effects on leisure (% change from base year)

	Skilled labour			
Households	**BOTH-1**	**BOTH-4**	**UNSK-1**	**UNSK-4**
1	-0.05	-0.05	0.38	0.53
2	-0.35	-0.35	-0.08	0.02
3	-0.35	-0.35	0.07	0.22
4	-0.21	-0.21	0.24	0.40
5	-0.22	-0.22	0.21	0.35
6	-0.02	-0.02	-0.13	-0.17
7	-0.04	-0.03	0.37	0.52
8	-0.37	-0.37	-0.09	0.01
9	-0.23	-0.22	0.12	0.24
10	-0.20	-0.20	0.12	0.23
11	-0.19	-0.18	0.07	0.15
12	-0.20	-0.19	0.10	0.20

	Unskilled labour			
Households	**BOTH-1**	**BOTH-4**	**UNSK-1**	**UNSK-4**
1	-0.04	-0.05	-0.18	-0.23
2	-0.34	-0.35	-0.64	-0.74
3	-0.35	-0.35	-0.49	-0.54
4	-0.20	-0.21	-0.31	-0.36
5	-0.21	-0.22	-0.35	-0.41
6	-0.01	-0.02	-0.69	-0.93
7	-0.02	-0.03	-0.19	-0.24
8	-0.36	-0.37	-0.65	-0.75
9	-0.22	-0.22	-0.44	-0.52
10	-0.19	-0.20	-0.44	-0.53
11	-0.18	-0.18	-0.49	-0.61
12	-0.19	-0.19	-0.46	-0.56

Table 8: Simulation results: Effects on welfare (% change from base year)

Households	BOTH-1	BOTH-4	UNSK-1	UNSK-4
1	0.10	0.10	0.18	0.21
2	-0.32	-0.32	-0.32	-0.32
3	-0.33	-0.33	-0.31	-0.31
4	-0.18	-0.18	-0.15	-0.15
5	-0.21	-0.21	-0.18	-0.18
6	0.09	0.09	-0.18	-0.28
7	0.10	0.11	0.17	0.20
8	-0.35	-0.35	-0.35	-0.34
9	-0.19	-0.19	-0.17	-0.17
10	-0.17	-0.17	-0.16	-0.16
11	-0.16	-0.16	-0.16	-0.16
12	-0.19	-0.19	-0.18	-0.19

Table 9: Sources of the factor incomes (%)

Households	Unskilled labour	Skilled labour	Capital
1	45.87	17.70	36.43
2	3.93	3.95	92.12
3	4.27	1.38	94.35
4	20.50	5.01	74.49
5	11.79	3.74	84.48
6	1.49	55.05	43.46
7	42.68	19.56	37.75
8	3.11	2.90	93.99
9	14.06	8.61	77.32
10	14.45	10.81	74.74
11	16.25	19.48	64.27
12	7.01	6.20	86.79