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A Simulation Method to Measure the Tax Burden on Highly Skilled Manpower[1]

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Abstract

A model is presented for simulating the tax burden on highly skilled manpower. The effective average tax rate, defined as the relative wedge between employment costs and disposable income, is computed. Income and payroll taxes and social security contributions not yielding an equivalent benefit are taken into account. The compensation package consists of cash payments and old-age provision. To integrate retirement benefits and their tax treatment, an intertemporal approach is used. The results indicate a wide dispersion of tax rates across Europe and the US. Slovakia, Switzerland and the US tax highly skilled manpower low. Scandinavian countries, Belgium and Slovenia turn out to be high tax countries.

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1. Introduction

International comparisons of business locations emphasise the importance of taxation. For example, the European Commission has funded several comparative studies on the effective tax burden of companies in the European Union (see European Commission (1992) and (2002)). This kind of research is focussed upon the tax burden on capital investment. However, since qualified workers become increasingly mobile internationally, companies should also pay attention to the tax burden imposed on the production factor labour at the firm's location – an issue so far largely neglected by research. The present paper aims at filling this gap by analysing the tax burden on highly skilled labour. We use the effective average tax rate as a measure for the relative additional amount that has to be paid by the company if it wants to remunerate a highly qualified employee with a predetermined disposable income.

Our approach is characterised by four distinctive features. Firstly, we treat the tax burden on highly skilled employees from the perspective of the company. Secondly, we take into account all direct taxes and social security contributions but also benefits procured by public pensions. Thirdly, our approach allows for old-age provision as part of the compensation package, taking account of the resulting benefits and tax liabilities in an explicit intertemporal model. Fourthly, the final purpose of our research being international comparisons, we apply the model to the tax and social security systems in Europe and selected US states and discuss the results.

The method presented here was firstly applied in a study by Elschner/Schwager (2005). In the current paper, we especially focus on a precise description of the methodology, and on illustrating the way the tax burden reacts to changes of parameters such as the share of old-age provision in employment costs. Finally, compared to the mentioned study we extend the geographical coverage of the analysis and provide updated figures.

The results show that the effective tax burden on highly skilled manpower may differ substantially from the effective tax burden of companies as analysed by the European Commission (2002). Thus, in contrast to the company tax burden, the tax burden on qualified labour in some US states is about as low as in Switzerland. Also Germany and France, which are high-tax countries with respect to company taxation, indicate moderate tax burdens if one looks on the taxation of highly skilled manpower. The Scandinavian countries with low company taxation rank last in our analysis.

The composition of the compensation package typically has a minor influence on the tax burden if one compares old-age provision with a hypothetical investment yielding tax free interest. If such interest income is taxed at the employee's marginal tax rate applicable to interest

income, however, the EATR usually can be reduced substantially by increasing the share of occupational pension plans in the compensation package.

The remainder of the paper is organised as follows. In the next section we take up the defining characteristics of our approach and relate them to other concepts of effective tax burdens on labour. Section 3 describes the formal model. In section 4 we apply the model to 22 locations across the United States and Europe and present the results. Finally, section 5 puts the results in perspective and discusses some future lines of research.

2. Outline of the Approach and Comparison with Other Concepts

Highly qualified specialists or managerial staff are typically mobile across jurisdictional boundaries. Figures provided by the OECD (2005) indicate that in the United States and in Sweden approximately 25% of the total stock of the PhD titles is held by foreign-born persons. In Canada and Australia, the proportions are even higher. Becker et al. (2003) show evidence of the increasing international mobility of Italian college graduates during the 1990s'. An analysis of the migration between eastern and western Germany by Hunt (2002) confirms that the mobility of skilled employees is driven, among other factors, by wage differences.[1] These facts suggest that qualified labour is highly, if not perfectly, mobile.

An internationally mobile employee thus will evaluate different employment opportunities on the basis of the disposable income he receives after taxes. Our international comparison is based on the assumption that the employee obtains a fixed disposable income which he can earn at all locations. This however implies that the tax to be paid on an employee's income is shifted onto the company. Thus, taxes and social security contributions payable by the employee increase labour costs as perceived by the firm. Adding labour related charges paid by the employer results in the employment costs which the company has to spend so as to be able to hire the employee.

To express it from the perspective of regional politics, the higher the taxes shifted onto the employer, the less attractive is a country for companies employing highly qualified employees. When assessing the attractiveness of regions for highly skilled labour in this way, it should be stressed that we do not intend to provide a comprehensive theory of migration. More modestly, our methodology aims at isolating the tax burden as one important factor for the attractiveness of locations. Thus, we do not question the importance of other factors influencing a job decision, such as job satisfaction, cost of living, local schools, or environmental amenities. In order to clearly display international differences in taxation, we purposefully abstract from these factors.

[1] Wildasin (2000) and Hunt (2004) give an overview on further empirical literature and migration trends.

Our aim is to quantify the tax burden on the income generated by working during one period. However, the compensation of highly qualified employees typically does not only consist of cash compensation. In particular, contributions to old-age provision are a prominent feature of a typical highly skilled's compensation package. This form of compensation induces benefits and tax liabilities during retirement. For this reason, we explicitly account for the timing of income, tax and social security payments induced by cash compensation and old-age provision.

In line with established methods to measure the effective tax burden of companies (King/Fullerton 1984, Devereux/Griffith 1998), we define the difference between the company's employment costs and the disposable income as the tax wedge. The tax wedge is composed of all direct taxes and charges paid by employer or employee in connection with the employment costs. This obviously includes income taxes and surcharges, as well as payroll taxes levied on aggregate salaries or wages. Concerning the various branches of social security, our leading principle is to take into account both contributions and benefits. For simplicity, with the exception of pensions, we do this by assuming that the contribution either does not provide any benefit, or that the benefit is exactly equivalent to the contribution. We assume that the first is the case for unemployment and accident insurance premiums since competition for the mobile employee rules out unemployment and since we do not think of high risk manual work. Contrary to that, we abstract from redistributive elements in health care systems and do not consider those premiums to be tax-like.

Since mandatory public pension schemes differ widely among countries regarding both contributions and benefits it would neither be satisfactory simply to add these contributions to the tax burden nor simply to ignore them. Instead, we carefully account for the benefits provided by such schemes according to the regulations currently in force in each country. By using this approach, we take account of the fact that payments into a public pension scheme can at least partially be considered as insurance premium even if the benefit provided is typically not actuarially fair.

We do not include indirect taxes in our measure of the tax burden on labour. At first glance, this may not seem satisfactory since in general equilibrium, a sales tax is equivalent to a tax on wages, pure profits, and existing wealth (see for example Gravelle, 1991 and Gaube and Schwager, 2003). The present model, however, is a partial equilibrium approach aiming at isolating the taxes triggered directly by the employment decision. Integrating taxes levied on the spending side of the employee's budget, such as sales or property taxes, would require assumptions about consumption and saving patterns. Since this is likely to obscure the interaction of compensation structure and direct taxes we focus on, we prefer to disregard indirect taxes, even at the cost of missing some general equilibrium reactions. In that respect, leaving sales and other consumption taxes out of the simulation is in line with disregarding the cost of living and other location factors.

Personnel costs are deductible from the company's tax base. The higher the costs for employing the highly skilled worker, the lower are the company's tax base and thus the company taxes payable. Allowing for this would require the simulation of a whole company model including assumptions on the production function. Although such an approach might yield a more complete picture of the company's overall tax burden, we do not follow it. The reason is that the resulting figures would be jointly determined by the taxation of the employee and the corporate income tax. With such numbers, it would be very hard to isolate the taxes which are triggered directly by the employment from the general tax burden of the firm.

The tax burden on labour has been quantified by several alternative approaches. Mendoza et al. (1994) present effective average tax rates on labour income. These measures are computed by dividing aggregate taxes on labour income by a macroeconomic measure of such income. Microsimulation models, e.g. the approach of the EUROMOD research consortium (Sutherland, 2001), are another important field of measures of labour tax burdens. In these models, the tax and social security contributions as well as welfare entitlements are simulated for a representative sample of the population. The focus lies on a microfoundation of aggregate policy analysis. Fenge and Werding (2004) present an international comparison of public pensions based on an inter-temporal simulation model which is similar to our treatment, without however analysing income taxes.

In its publication series on "taxing wages" described by Heady (2004), the OECD takes an approach which is comparable to ours in several respects (OECD, 2005). Also there, the taxes and social security contributions of several types of workers are assessed in a casuistic simulation. An effective average tax rate is then calculated by dividing the resulting tax wedge by total labour costs. As in our approach, income and payroll taxes are considered whereas consumption taxes are disregarded essentially for the reasons mentioned above. However, there are two major differences between our model and the OECD approach. Firstly, unlike the OECD we do not treat social security contributions as a whole as taxes. Instead, we take resulting benefits into account. Secondly, both approaches consider different types of employees. While the OECD concentrates on the average production worker, our study is explicitly focussed on highly qualified employees considering as well different types and times of compensation.

3. The Model

The two key economic variables in the model are the employment costs E^* and the disposable income E. Employment costs are the amount the company has to pay in order to obtain the employee's labour supply for one year. Disposable income is the amount the employee obtains in exchange for this labour supply. Dividing the tax wedge E^*-E by employment costs we obtain the effective average tax rate

$$EATR = \frac{E^* - E}{E^*} \tag{1}$$

This is the measure of effective tax burden proposed in this paper.

The employee's working life covers the periods $t = 0,1, \ldots t_0, \ldots, t_p\text{-}1$. The retirement phase extends over periods $t = t_p, t_p+1, \ldots, t_p+P\text{-}1$. Period t_0 is called the remuneration period, and the disposable income received by the employee in this period is denoted by E_0. In addition to E_0, the remuneration earned by working in t_0 generates retirement income represented by a constant flow of disposable incomes E_p in t_p and each of the subsequent P-1 years.

This flow is evaluated by a constant interest rate $\bar{r}$ which is the individual rate of return the employee obtains for his savings, possibly net of income taxes levied on interest income. The disposable income E is then obtained by computing the present value of this flow at time t_0 plus the disposable income E_0 in the remuneration period:

$$E = E_0 + \sum_{t=t_p}^{t_p+P-1} \frac{E_p}{(1+\bar{r})^{t-t_0}} \tag{2}$$

Our simulation has to find a value of E^* which, given the tax and social security regulations in force in the country under consideration, leads to the exogenously fixed E according to equation (2). This is done by an iterative procedure where, starting from varying levels of E^*, disposable incomes E_0 and E_p are determined from tax and social security regulations until the desired E is reached.

Tax and social security legislation usually does not refer to the economic concepts of employment costs and disposable income. Instead, the assessment base is a legally defined quantity called taxable income, which we denote by e^t, or gross income, denoted by e^g. The tax schedule $T(e^t, x)$ determines the income tax due after deduction of any tax credit. In addition to taxable income, it may depend on a vector of personal characteristics, denoted by x, such as family status.

Contributions to the systems of social security applying to the employer are designated with a hat (^) and those applying to the employee with a bar (¯). We distinguish between contribu-

tions to the first pillar of old-age insurance, with contribution rate[2] ω, and other contributions, with a rate γ. Thus we have $\omega e^g = \overline{\omega} e^g + \hat{\omega} e^g$ and $\gamma e^g = \overline{\gamma} e^g + \hat{\gamma} e^g$ for all e^g. We denote by $\gamma_\tau e^g$ those contributions, contained in γe^g, which in our evaluation are considered as tax-like without an equivalent benefit. Finally, payroll taxes depend on gross income, and are denoted by θe^g.

The shares of the two compensation components in employment costs are fixed and denoted by f_c for cash and f_p for old-age provision, with $f_c + f_p = 1$. The compensation component old-age provision is itself composed of two parts. Firstly, there are contributions to occupational pension plans, denoted by C, with the shares of C contributed by the employee and the employer being β and $(1 - \beta)$ respectively. Secondly, compulsory contributions to the first pillar of public old-age insurance ωe^g naturally are part of old-age provision yielding

$$f_p E^* = C + \omega e^g . \tag{3}$$

Since the shares f_c and f_p of both compensation components refer to employment costs, social security contributions and payroll taxes have to be assigned to one of the two compensation components. While contributions to the first pillar of old-age insurance are part of old-age provision according to (3) we assume that all other contributions count towards the compensation component cash. With this convention, we now have all elements in place which are needed to derive the unknown variables e^g and e^t in the remuneration period from employment costs E^*.

The employer's contributions to social insurance $\hat{\omega} e^g$ and $\hat{\gamma} e^g$ as well as payroll taxes θe^g usually are not part of gross income. Gross income then can be obtained as

$$e^g = E^* - C - \left(\hat{\omega} + \hat{\gamma} + \theta\right) e^g . \tag{4}$$

Solving equation (3) for C,[3] inserting in (4), and rearranging yields

$$e^g = \frac{E^* \left(f_c + \beta f_p\right)}{1 + \hat{\gamma} - \overline{\omega} + \beta\omega} \tag{5}$$

The taxable income e^t is the difference between the gross income e^g and the deductions d_0 available to a taxpayer who receives work income. For example, such deductions may be

[2] For the sake of simplicity, we use linear schedules of social security in this description. In Appendix A-1 it is shown that the system can be solved for general schedules.

[3] Notice that f_p and E^* are fixed by assumption, and that ω is fixed by law. Thus, the free variables in equation (3) are C and e^g.

granted for business-related expenses, contributions to social security including the pension system, children, and personal allowances. Thus,

$$e^t = e^g - d_0 \,. \tag{6}$$

On this taxable income, the tax schedule is applied, where personal characteristics take the values x_0 applying in period t_0, yielding the tax payment $T(e^t, x_0)$.

As the cash component is the only income that initiates direct payments to the employee, the disposable income of period t_0 is the difference of cash compensation less taxes and tax-like social security charges other than for compulsory public pensions:

$$E_0 = f_c E^* - T\left(e^t, x_0\right) - \left(\hat{\gamma} + \theta\right) e^g \,. \tag{7}$$

In order to account for progressive taxation, we determine the disposable income during retirement in two steps. In the first step, we derive the tax rate applying to the employee's total pension income which he earned during his entire working life. In the second step, the annual pension resulting from contributions during the remuneration period t_0 is determined. Subtracting from this pension taxes according to the tax rate derived in the first step then yields the annual disposable income E_p.

The total annual pension consists of annual payments $\tilde{\Pi}$ received from the first pillar of old-age insurance, and an annuity $\tilde{A}$ received from occupational pension plans. For both kinds of pensions, we assume constant contributions during working life amounting respectively to $\omega\, e^g$ and C per year. The public pension $\tilde{\Pi}$ is calculated according to the country-specific pension formulae currently in force which often depend on the number of years during which the employee has worked and paid into social insurance. The occupational pension $\tilde{A}$ is calculated as an investment under market conditions. Formally, $\tilde{A}$ is obtained from equating the value of contributions and of pension claims at the beginning of the retirement phase:

$$\sum_{t=0}^{t_p-1} C(1+\hat{r})^{t_p-t} = \sum_{t=t_p}^{t_p+P-1} \frac{\tilde{A}}{(1+\hat{r})^{t-t_p}} \tag{8}$$

The left-hand-side of equation (8) is the capital stock accumulated by the occupational pension plan during the working years $t = 0,1,\ldots,t_p\text{-}1$, valued at the beginning of retirement in period t_p. The right-hand-side of (11) is the present value at time t_p of a stream of annuities $\tilde{A}$ received by the retired employee throughout the retirement phase $t_p, t_p\text{+}1, \ldots, t_p\text{+}P\text{-}1$. In (8) $\hat{r}$ is the interest rate relevant for the pension institution the contributions are invested in, taking account of the tax treatment of these payments on the institution's level.

Adding both annuities and subtracting deductions d_p applying to the retired employee, for example due to a favourable treatment of income from public pensions, one arrives at the taxable income in each year of retirement. Denoting personal characteristics in the retirement phase by x_p the tax payment $T\left(\tilde{\Pi}+\tilde{A}-d_p, x_p\right)$ results. Dividing this by the pension income gives the average tax rate

$$\tau_p = \frac{T\left(\tilde{\Pi}+\tilde{A}-d_p, x_p\right)}{\tilde{\Pi}+\tilde{A}} \tag{9}$$

during each year of retirement.

In the second step, the pension is calculated that would result exclusively from the contributions paid out of the employment costs relating to period t_0. For occupational pensions, the resulting annuity A is determined by

$$C(1+\hat{r})^{t_p-t_0} = \sum_{t=t_p}^{t_p+P-1} \frac{A}{(1+\hat{r})^{t-t_p}} \tag{10}$$

For the public pension, we assume that € 1 of contributions increases the pension by the same amount, no matter when it was paid. Together with the assumption of a constant stream of contributions, and noting that the working phase $t = 0,1,\ldots,t_p\text{-}1$ is of length t_p, this implies that the public pension linked to employment costs E^* is equal to

$$\Pi = \frac{\tilde{\Pi}}{t_p} \tag{11}$$

The tax rate in (9) is applied to the sum of both kinds of pensions according to (10) and (11). We so arrive at the disposable income

$$E_p = \left(1-\tau_p\right)\left(\Pi + A\right). \tag{12}$$

With equations (7) and (12), all elements for computing the *EATR* according to (1) and (2) are in place.

4. International comparison

The following analysis provides effective tax rates on highly qualified manpower in the United States and Europe. In the first subsection, we analyse effective tax rates for Germany, Slovakia, Switzerland, and the United States. We selected these countries because their tax and social security systems differ markedly. This allows us to clearly display the working of the model and to identify important tax drivers. We measure the tax burden that occurs under

varying conditions regarding the employee's characteristics (income level, compensation package, and family situation) and regarding the interest rate before and after taxes. In the second subsection, we determine the effective average tax rate in 22 regions across Europe and the United States. In all simulations, we refer to legislation in force in 2005.[4]

4.1. Effective tax rates in selected countries

Switzerland and the United States levy income tax on the federal and the state or cantonal level. In addition, Swiss municipalities also levy income tax which however is linked closely to the cantonal income tax. In this analysis, we therefore consider the canton and the capital of Zurich and the state of California. In Germany and Slovakia, there is no local variation with regard to personal income tax.

In a first step, we analyse the EATR for a single employee without children. The employment costs comprise 80 per cent cash compensation and 20 per cent old-age provision. Employer and employee contribute equal shares to the second pillar of old-age insurance. The individual rate of return equals the market interest rate in order to isolate tax effects. Fig. 1 shows the effective tax burden when the disposable income increases from € 40,000 to € 200,000.

In Switzerland, effective average tax rates increase substantially by 20 percentage points. For the lower income levels, Switzerland is on first rank ahead of Slovakia. Despite the strong increase, Switzerland however remains on second rank since Germany and the United States display far higher tax rates even for the low income levels. The uniform increase of EATRs in Switzerland is mainly explained by the income tax schedule which is progressive over a long range of incomes: The combined top tax rate of federal, cantonal and municipal income tax of 40.4 per cent is applicable only to income exceeding Fr. 664,400 (€ 430,199). In addition, social security in Switzerland is characterised by low contributions rates but no income ceiling.

The EATR for the United States increases by 10 percentage points. Compared to Switzerland, the progression of income tax is not that distinctive since the highest bracket starts already with an income of $ 326,450 (€ 241,118) with a combined top tax rate of 44.3 per cent. Thus income tax payments increase less steeply than in Switzerland. In addition, the increase in EATR slows down because contributions to social security are capped at an income level of $ 90,000. Thus for exceeding incomes, the progression of tax payments is partly compensated by the regressive effect of tax-like contributions to social insurance.

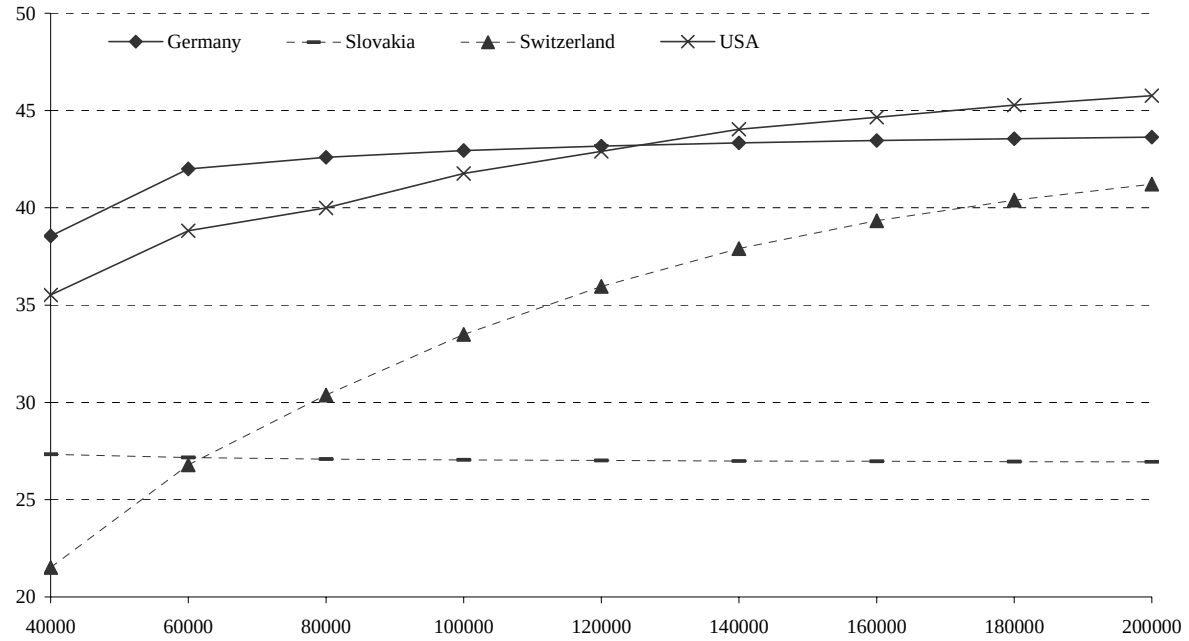
In Germany, these two effects are even more pronounced. The increase of EATRs amounts to 5 percentage points. In Germany, the top income tax rate of 44.3 per cent is reached with a taxable income of € 52,152. The contribution rate to social insurance is comparably high but

[4] See Appendix A-2. The authors will provide more details upon request.

income ceilings are reached fast, at around € 60,000. Both effects together result in a quick increase of the EATR by 3.5 percentage points from € 40,000 to € 60,000 disposable income. This increase slows down considerably for higher incomes.

In Slovakia, the tax burden decreases by 0.4 percentage points. In that country, there is no progression in the income tax schedule since a flat tax of 19% is applied on all income. At the same time, income ceilings for contributions to social insurance are low with around Sk 520,000 (€ 13,400). Thus with increasing income the proportion of charges decreases, the proportion of tax payments remains constant. In consequence, we find a small regressive effect, with the EATR declining a little.

Fig. 1: EATR for disposable incomes from € 40,000 to € 200,000, in % (2005)

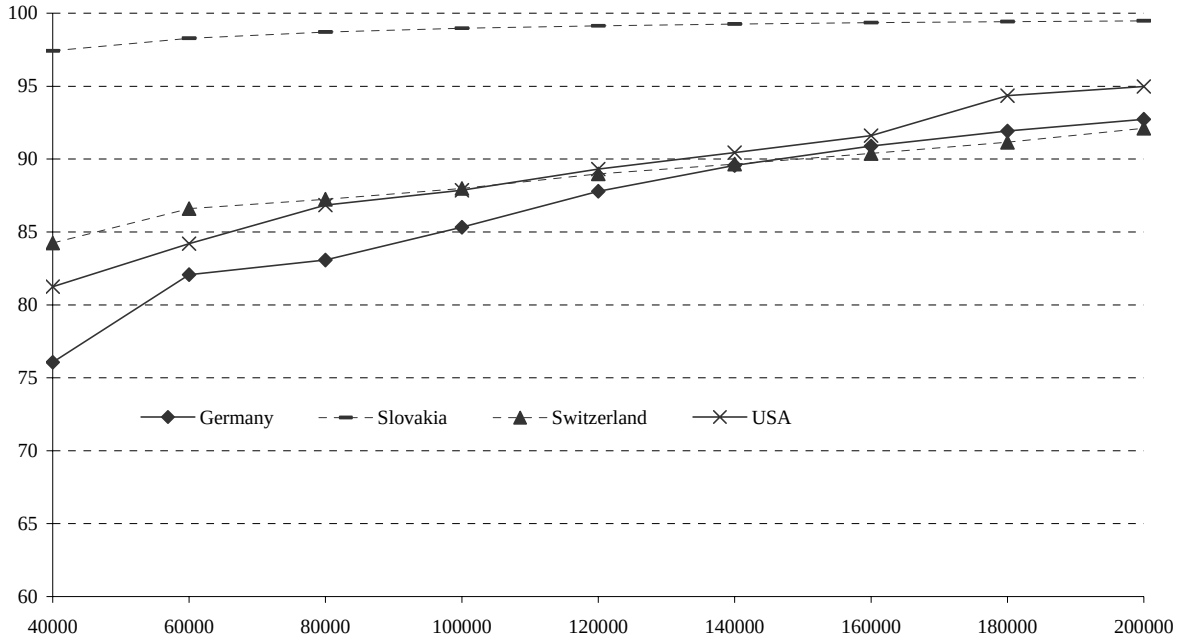


In a second step, we look on the tax treatment of families. Families receive several tax allowances in all countries. One kind of tax relief for families consists of allowances for married couples, usually in the form of joint filing and special tax schedules. The other kind of relief is granted in the form of tax allowances or transfer payments for dependent children.

In the simulation, we consider a married employee with a non-working spouse and two children. Fig. 2 illustrates the family advantage by displaying the ratio of the EATR of a family over the EATR of a single with the same disposable income. In Germany, this ratio is lowest, i.e., the family advantage is highest. The ratio is 76 per cent for a family receiving a disposable income of € 40,000. A married couple is subject to the average tax rate which applies to a single earning half of their joint income. This reduces the tax liability as long as the tax schedule is progressive. In addition, there are high allowances for dependent children. The family advantage thus decreases for higher incomes up to a ratio of 93 per cent for a disposable income of € 200,000.

The United States and Switzerland also favour families by granting special tax schedules for married couples. For lower incomes these provisions have a smaller effect than joint filing in Germany. For higher incomes the family advantage is comparable to that in Germany. In Switzerland, the family advantage even falls below the one of Germany for disposable incomes exceeding € 140,000. In Slovakia, the family advantage resulting exclusively from child allowances decreases rapidly from 97 to 99 per cent with increasing income leaving virtually no family benefit at an income of € 200,000.

Fig. 2: Family/single ratio for disposable incomes from € 40,000 to € 200,000, in % (2005)



The third part of the analysis concerns the compensation component old-age provision. In principle, deferring compensation to the retirement phase may be favourable or detrimental because of two kinds of effects: The *interest effect* arises if the pension institution faces a different interest rate after taxes than the employee. This will arise, for example, when the employee has to pay tax on interest income while the pension institution can accumulate tax-free. If this is the case, it is more advantageous to save in the form of an occupational pension scheme rather than to save on the household level.

Schedule effects stem from the schedules of income taxes and social security. A progressive tax schedule implies a lower average tax rate if compensation is transferred into a period (typically the pension period) in which the total income is lower. Furthermore, the compensation package may influence the base used to compute the contributions to social security. However, it turns out that schedule effects are less important in our simulations than the interest effect because of the high level of income analysed.

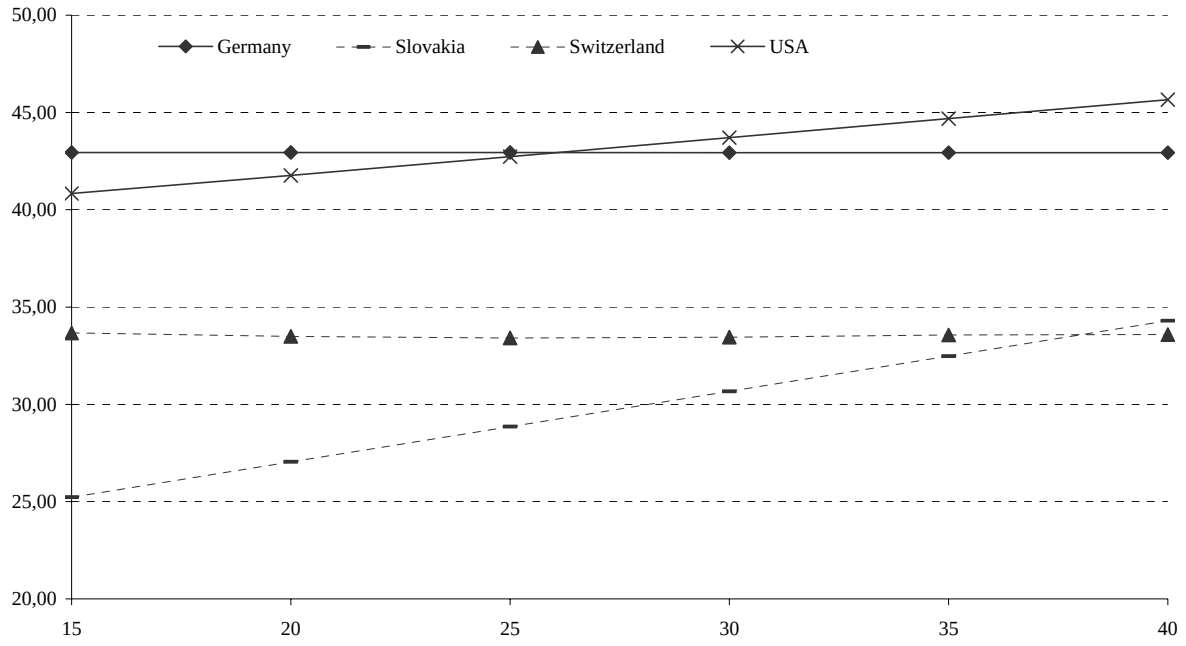
To illustrate the working of the interest effect we simulate two scenarios. In the first scenario, we assume that the employee's interest rate after taxes $\bar{r}$ equals the market interest rate r. This means that interest income derived from a hypothetical alternative investment is tax free. In the second scenario, we consider the other extreme where the interest income derived from the alternative investment is subject to the top marginal tax rate applicable to interest income i.e. $\bar{r}$ falls short of the market interest rate.

Turning to the case $\bar{r} = r$ first, we compute the EATR for different compositions of the compensation package for the disposable income of € 100,000. For that purpose, we vary the share of old-age provision, which is composed of contributions to the first and the second pillar of old-age insurance, from 15 to 40 per cent. Notice that we have to assume a certain minimum amount of old-age provision because contributions to the first pillar are compulsory.

As is apparent from Fig. 3, increasing the part of old-age provision in the compensation package produces diverging effects on the EATR in the four locations. The effective tax burden nearly stays constant in Germany and Switzerland. These two countries operate a so-called EET system with respect to the taxation of occupational pension plans. Contributions to the pension plan are tax *E*xempt, investment income of the pension institution also is *E*xempt, resulting pensions are *T*axable with the total amount. Thus, the tax system treats occupational pensions like a hypothetical investment whose interest is tax free.

In Slovakia, contributions to occupational pension plans are tax exempt up to 3% of gross income; resulting pensions are subject to tax. Exceeding contributions are taxable; therefore resulting pensions only are taxable with that part that exceeds the contributions and thus constitutes a return on investment. In both cases, investment income of the respective pension institutions is subject to the 19% flat tax. The interest rate $\hat{r}$ thus is less than the market interest rate. With regard to the taxation of old-age provision, Slovakia thus applies a combination of an ETT and a TTE system. Compared to the hypothetical investment which is accumulated tax free, old-age provision in Slovakia is therefore less attractive. By consequence, the EATR increases by 9 percentage points with increasing old-age provision.

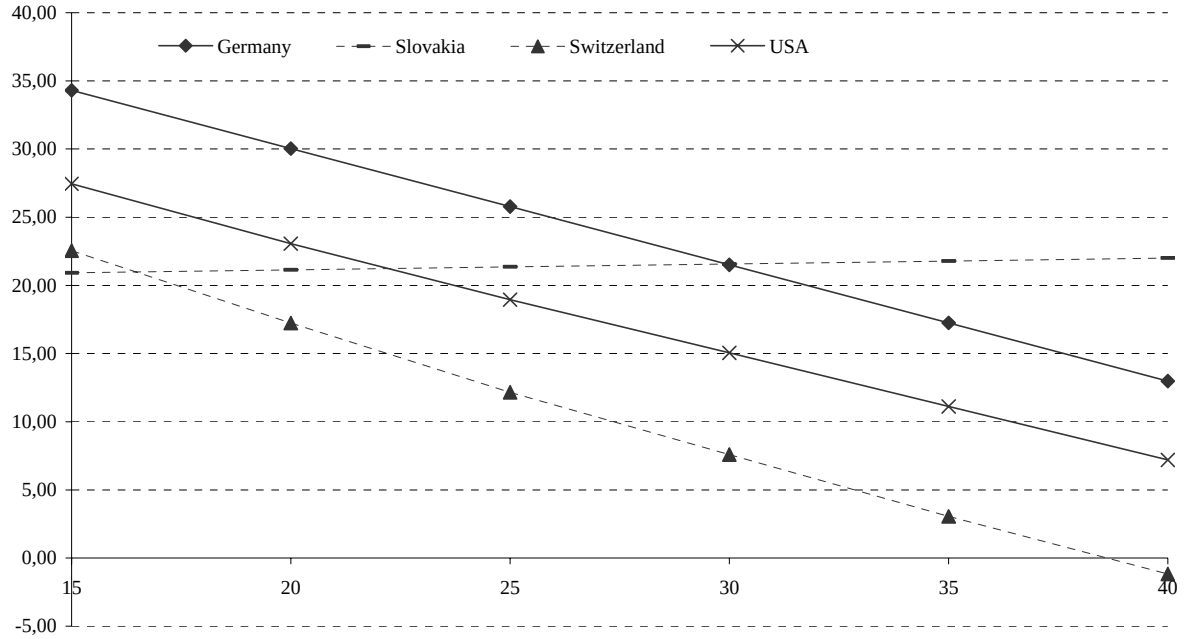
Fig. 3: EATR for varying old-age provision in scenario 1, in % (2005)



In the United States, contributions paid by the employer are tax exempt and the resulting pensions are taxable during retirement (EET system). Contrary to that, contributions paid by the employee are not deductible. That part of the resulting pensions which represents a payback of contributions is tax free whereas the rest, corresponding to the return on investment, is subject to tax (TEE system). Because the exemption of pensions does not extend to the return on investment, investing into occupational pension plans by employees is not attractive compared to the hypothetical tax-free investment. Therefore, the EATR increases by 6.0 percentage points.

In the second scenario with $\bar{r} < r$, it pays off in Germany, Switzerland, and the United States to defer compensation into the future by old-age provision, as shown in Fig. 4. The tax burdens fall with increasing old-age provision by 20 percentage points in the USA, 21 percentage points in Germany, and 24 percentage points in Switzerland. In these three countries, contributions are invested at a higher interest rate than the interest rate of the hypothetical alternative investment. The Slovakian EATR is almost constant because the interest income of the pension plan is subject to the same tax rate the employee's hypothetical investment is subject to.

Fig. 4: EATR for varying old-age provision in scenario 2, in % (2005)



4.2. Results for twenty-two regions in comparison.

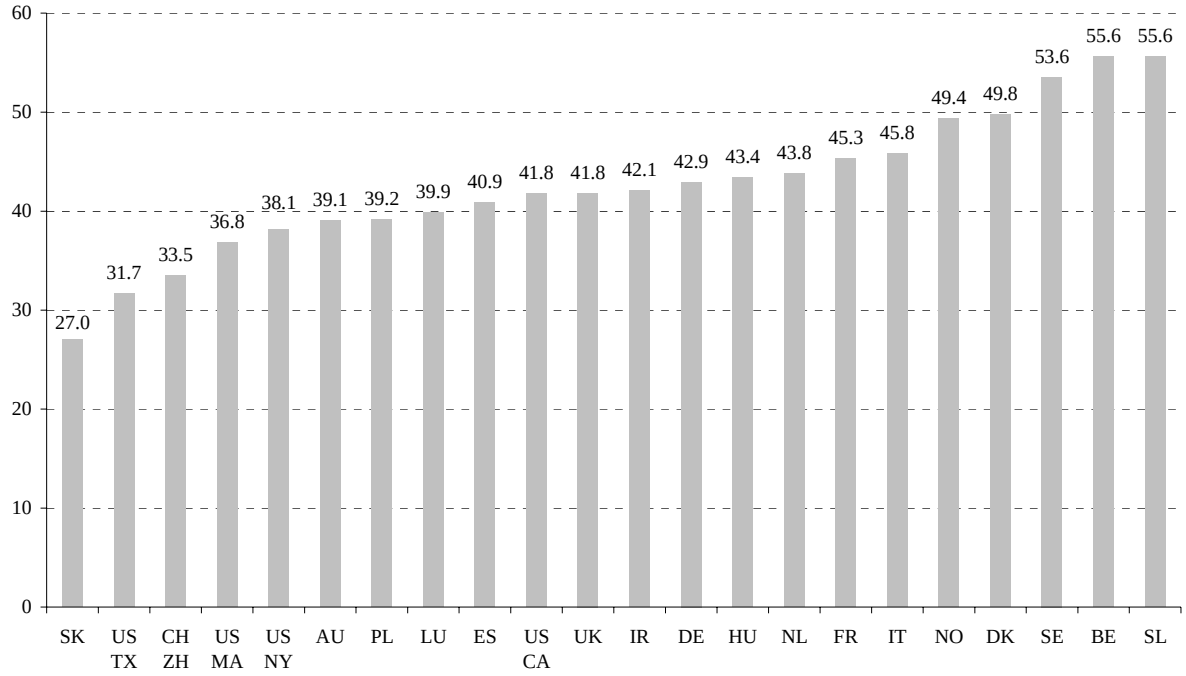
In this subsection we determine the effective tax burden on the deployment of a highly skilled employee for 22 regions across Europe and the United States. With respect to the United States we distinguish between the tax burden in California, Massachusetts, New York, and Texas which have different state income tax systems. We consider the effective tax burden in 16 EU countries including three new EU member states. Beside, we also measure the tax burden in Norway and Switzerland. If there are local differences within a country or state we focus on the tax applicable in the major city.

Considering an unmarried employee without children requiring a disposable income of € 100,000 and a compensation package of 80% cash and 20% old-age provision, we obtain the effective average tax rates displayed in Fig. 5. They vary between 27.0 per cent in Slovakia and 55.6 per cent in Slovenia. In other words, employers in Slovenia have to incur expenses of € 225,387 to compensate their highly skilled employees with a disposable income of € 100,000. Employers in Slovakia only have to pay € 136,986 to grant the same disposable income. The remaining two new EU member states Poland and Hungary display moderate tax burdens. The four US states show low or moderate tax levels, with California's EATR exceeding the one of Texas by nearly 10 percentage points. Switzerland (Canton of Zurich) ranks third behind Slovakia and Texas.

Most of the European countries considered display EATRs between 36 and 46 per cent. Some of the lower tax countries in the EU such as Austria, Luxembourg, and the UK, can compete successfully with California. The largest EU member states France, Germany, and Italy have

somewhat higher EATRs. Not surprisingly we find that the Scandinavian countries have rather high tax burdens, however topped by Belgium and Slovenia.

Fig. 5: EATRs in international comparison



All in all, one can tentatively draw some general conclusions from these results. Switzerland and the United States, which host R&D intensive industries, apparently want to boost their attractiveness for the highly skilled by taxing them lightly. Scandinavian countries applying the dual income tax system, with high taxes on labour and low taxes on investment income, are the rear-lights in the ranking. Most other Western European countries tax on a similar, moderate level. In contrast to the Eastern European countries' reputation as low tax countries with respect to company taxation, there is no clear trend among these countries in the taxation of highly skilled manpower.

5. Conclusions

This paper aims at quantifying the effective average tax rate (EATR) of highly skilled employees from an employer's point of view. We measure the employer's expenses for a highly qualified employee under the assumption that the highly qualified has to obtain an internationally comparable disposable income after taxes. Using this method, we derive EATRs for several income levels, structures of compensation, and family situations which are typical for highly qualified employees. The results show that there are considerable differences in tax burden across the countries studied. The main tax drivers for the tax burden on highly skilled labour are the tax rate of the personal income tax and contribution rates and income ceilings to social security.

Our analysis suggests two main lines for future research. Firstly, the model can be extended and applied in several ways. While the current paper provides an international comparison, it does not deal with genuinely international transactions. Therefore, a major structural extension will consist of integrating the taxation of expatriate staff into the model. A different issue which in principle could be modelled with our approach is the taxation of employees who change residence when they retire. More ambitiously, our approach might be combined in an integrated model of both life cycle savings and residence decisions. Secondly, the results of our simulation model can serve as an input into empirical research projects which aim at testing the impact of taxes on other economic variables. For example, our simulation results may be used to assess empirically the impact of the taxation of highly qualified employees on regional growth rates or on migration flows.

Appendix

A-1: General schedules for social security contributions

Social security schedules often are not linear but display one or several income ceilings up to which contributions at different rates are payable. We therefore denote contributions to the first pillar of old-age insurance by some schedule $\Omega(e^g)$ and other contributions by the schedule $\Gamma(e^g)$. Distinguishing between payments by the employer (^) and the employee ($\bar{}$), we have $\Omega(e^g) = \bar{\Omega}(e^g) + \hat{\Omega}(e^g)$ and $\Gamma(e^g) = \bar{\Gamma}(e^g) + \hat{\Gamma}(e^g)$ for all e^g. Payroll taxes are denoted by $\Theta(e^g)$. Furthermore, in some countries contributions to occupational pension plans are part of gross income and thus liable to social insurance. Denoting therefore by $\hat{z}$ ($\bar{z}$) the fraction of the employer's (employee's) contributions to occupational pension plans which are part of gross income according to social security regulations equation (4) can be generalised to $e^g = E^* - \left[(1-\hat{z})(1-\beta) + (1-\bar{z})\beta\right]C - \hat{\Gamma}(e^g) - \hat{\Omega}(e^g) - \Theta(e^g)$. Solving $f_p E^* = C + \Omega(e^g)$, the generalised version of (3), for C, inserting and rearranging yields $e^g - \bar{\Omega}(e^g) = E^*\left[f_c + [\beta\bar{z} + (1-\beta)\hat{z}]f_p\right] - \hat{\Gamma}(e^g) - \Theta(e^g) - \Omega(e^g)[\beta\bar{z} + (1-\beta)\hat{z}]$.

In all schedules used in the simulations, marginal contributions are non-negative and less than unity. Therefore, in this equation, the left hand side is strictly increasing and the right hand side is weakly decreasing in e^g. Moreover, when $e^g = 0$ the left-hand-side is zero while the right-hand side is positive. Finally, as gross income grows without bound, average contributions are bounded below one in all cases studied, implying that the left hand side approaches infinity. Thus, for all schedules, there exists a unique solution e^g.

A-2: Exogenous variables

r	market interest rate 5 per cent
exchange rates	nominal exchange rates on 01/01/2005
	$ to €: 1.3539; Fr. to €: 1.5444; Sk to €: 38.655
number of years in work	40
number of years during retirement	20
Tax and social security regulations of each country	See IBFD, *Individual Taxation in Europe*, 2005; IBFD, *European Tax Handbook*, 2005; European Commission, *MISSOC*, 2005.

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