Labour Taxation and Foreign Direct Investment

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Abstract

This paper compiles data on personal income tax profiles for 49 economies and the year 2002. We decompose tax profiles into the component borne by employers and those borne by employees. We determine effective tax rates for employees across four centiles of the distribution of gross wages: at 33 percent, 100 percent, 167 percent, and 500 percent of the average following the OECD Taxing Wages Approach. Apart from describing features of the personal income tax data, we use them to shed light on their role for bilateral outward FDI stocks among the economies considered. Not surprisingly, personal income tax rates turn out somewhat less important than profit tax rates (in terms of their marginal contribution to explaining the variance of bilateral outward FDI stock data). However, the employee-borne part of labor taxes determines bilateral FDI significantly different from zero: both a higher employee-borne tax on average wages and, in particular, a higher progression from the average wage to five times the average wage is less conducive to headquarters location and, hence, bilateral outward FDI.

Keywords: Labour taxation, effort, foreign direct investment, multinational firms

JEL-Classification: F21, F23, H24, J22, J3

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1 Introduction

The vast literature on the effects of taxation on the investment decisions of multinational firms has until now focused on capital as a production factor. An exception is Elschner et al. (2006) who look at the effective tax burden on both capital and highly skilled labour and study the different tax policy strategies applied by different countries.

This interest on capital was primarily based on the assumption that capital is mobile across borders while labour is not. In recent years however, there is evidence that labour has become increasingly mobile as well, especially high-skilled labour.

Given these findings we analyse the implications the effective taxation of labour has for the investment decision of multinationals. The literature on the influence of wages on FDI of course also considers the social security contributions paid by the employer when controlling for the labour cost which influences the multinationals’ investment decision. These studies, however, do not decompose the labour cost into its ‘wage’ and its ‘tax’ component, nor do they look at the employees’ tax burden and analyse its influence on FDI. We argue that not only the taxation of capital matters for investment decisions but also the taxation of labour. Given that taxes influence a worker’s or manager’s effort and thus his/her labour supply, we argue that it might very well be that a firm very much cares about the taxation of its employees as well.

We follow the Taxing Wages approach of the OECD\(^1\) to compile the average and marginal effective tax burden on labour which includes state and local income taxes as well as social security contributions paid by both the employer and the employee for 49 countries for the year 2002. In addition, we decompose tax profiles into the component borne by employers and those borne by employees. We compute these tax wedges for a single employee earning 33%, 100% 167% and 500% of the average wage in the manufacturing sector. Moreover, we determine for each country the degree of the progressivity of the tax system which also influences the individuals’ effort and implicitly labour supply and thus the location decision of firms.

\(^1\)See Heady (2004).
Using these effective tax rates and using bilateral trade flows between 49 countries for the year 2002, our findings show that the employee-borne part of labor taxes determines bilateral FDI significantly different from zero: both a higher employee-borne tax on average wages and, in particular, a higher progression from the average wage to five times the average wage is less conducive to headquarters location and, hence, bilateral outward FDI.

The paper is structured as follows: Section 2 reviews the literature on the influence on the effect of incentives on workers’ effort and the link between this and a company’s output, given that taxes and social security contributions influence to a large degree the employee’s effort. Section 3 presents the OECD Taxing Wages approach applied as well as some descriptive statistics while the empirical analysis is performed in Section 4. Finally Section 5 concludes.

2 Why Should Personal Taxes Matter for a MNC?

At first glance the question might arise, why a firm should care about the tax burden of its employees. It cares about the taxes it has to pay and about the wage cost, but why should it make a difference what the burden is, its employees have to bear.

The answer is simple. It is the employee’s effort which influences also a firm’s output and productivity. There is an extensive literature (mostly in personnel economics) showing that indeed incentives and different compensation policies matter and individuals change their effort in response to these incentives.\(^2\)

On the one hand, the theoretical literature, mostly that from efficiency wage theory and equity theory, predict that high wages increase a worker’s effort, though by different mechanisms. While the efficiency wage theory\(^3\) assumes that given that workers compare outside opportunities with the current pay and some threat of discharge and the ability to reduce this threat are important when arguing that high wages can be used to motivate

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\(^2\)For a review of different paper on the effect of compensation policies see Ehrenberg (1990) and Prendergast (1996).

\(^3\)See Akerlof and Yellen (1986).
workers, equity theory uses internal pay comparisons for the link between high pay and high effort.\textsuperscript{4}

On the other hand, empirical papers study the way workers vary their productivity in response to a given incentive structure. A prominent example is Lazear (2000). Using data from Safelite Glass Corporation, a large US installer of automobile glass, Lazear shows that changing the compensation towards a performance linked pay increased the average productivity. The productivity effects amount to a 44 percent increase in output per worker. Thus, the author shows that not only the firm’s output but also its profits increased with the move towards a system of piece rate pay. The author concludes that half of the increase in productivity results from the average worker producing more because of incentive effects (see also Lazear (1996)). Accordingly, the direct link between a worker’s effort and a firm’s output shows that the variables which might influence an employee’s effort are of key interest for a company. Other well-known contributions include Asch (1990) and Bognanno and Ehrenberg (1990). Asch examines how US navy recruiters respond to the faced compensation structure which involves among others piece rates and prizes which recruiters can win. Given that the output, meaning the quality and number of recruits can be directly observed in the analysed five month period, the author finds that recruiters increase their output immediately prior to qualifying for a prize and decrease it afterwards. Bognanno and Ehrenberg (1990) employ another imaginative dataset, namely that on professional golfers from the 1987 European Men’s Professional Golf Association Tour to find that both the level and structure of prizes in this tournament influences the players’ performance. For firms it is harder to find a suitable measure for performance. Kahn and Sherer (1990) solve this problem by using performance evaluations provided by a superior as a proxy for worker performance. Using data on a company which employs workers in different locations and where the bonus pay policies vary across locations, the authors find that the employee’s rating over time improves more in the locations where the bonus-productivity relationship is steeper.

Thus, in the following, we apply the model of Lazear (1996) extended by a personal

\textsuperscript{4}Nevertheless, these efficiency wage models which also look at the effect of taxes, are usually employed for explaining the link between different taxes and employment/unemployment (see also Pisauro (1991)).
income tax and show that indeed a labour income tax levied on the employee also affects a firm’s profits.

Assume an employee’s pay $P$ comprises a part $\alpha$ which is independent of the output and a piece rate component $\beta q$. $q$ denotes output and $\alpha$ and $\beta$ are chosen by the employer. Moreover, the employee is subject to a tax on its income denoted by $t$. Accordingly, net of tax pay is determined as

$$P = (\alpha + \beta q)(1 - t)$$  \hspace{1cm} (2.1)

Moreover, output depends on effort $e$ (which in itself depends positively on the wage and negatively on the tax $e'(t) < 0$) and luck $v$. $v$ can also stand for a measurement error. The measurement of effort is normalized to unity.

$$q = e + v$$  \hspace{1cm} (2.2)

Furthermore, working involves some distaste such that by $C(e)$ with $C'(e) > 0$ and $C''(e) > 0$ we denote the distaste function.

The employee’s labour supply is derived from maximizing his pay earned from working less the costs involved by working. From the FOC we get

$$C'(e) = \beta(1 - t)$$  \hspace{1cm} (2.3)

From eq. (2.3) we can see that the worker’s effort increases with $\beta$ and decreases with the tax rate $t$. Thus, higher taxes induce less effort or less hours of work.

The firm’s objective is to maximize its profits $\pi$ subject to the wages it has to pay to its employees:

$$\pi = E(q) - (\alpha + \beta e)$$  \hspace{1cm} (2.4)

$$\max_{\alpha, \beta} E(q) - (\alpha + \beta e)$$  \hspace{1cm} (2.5)

$$= \max_{\alpha, \beta} [e - (\alpha + \beta e)]$$  \hspace{1cm} (2.6)
subject to the individual rationality constraint that the worker is willing to take up the job
\[(\alpha + \beta q)(1 - t) \geq C'(e)\] (2.7)

Substituting eq. (2.7) into eq. (2.8), the firms’ maximization problem translates into
\[\text{Max} \left[ e - \frac{C(e)}{1 - t} \right] \] (2.8)

From the FOC we get
\[e'(\beta)\left[1 - \frac{C'(e)}{1 - t}\right] = 0\] (2.9)

Moreover, we can infer the following relationship between labor taxes borne by the employees and firm profits:

**Proposition 1** The labor borne income tax negatively influences a firm’s profit by reducing workers’ effort
\[\frac{d\pi}{dt} < 0\] (2.10)

**Proof.** Differentiating eq. (2.8) with respect to the income tax we get
\[e'(t) - \frac{C'(e) \cdot e'(t) \cdot (1 - t) + C(e)}{(1 - t)^2} = e'(t) \left(1 - \frac{C'(e) \cdot (1 - t) + C(e)}{(1 - t)^2}\right) < 0\] (2.11)
since \(e'(t) < 0\) because effort negatively depends on the income tax and \((1 - t)^2 - C'(e) \cdot (1 - t) + C(e) > 0\)

Therefore, one can say that a multinational firm will be concerned with the effective tax burden faced by its employees since a high tax burden reduces the employee’s effort and thus the firm’s profits. Moreover, given that effort decreases with the tax rate \(e'(t) < 0\), one can infer that a higher marginal tax burden on labour also reduces profits. Thus,

\[\text{Since } (1 - t)^2 > 0, C'(e) < 0 \text{ such that } -C'(e) \cdot (1 - t) > 0 \text{ and } C(e) > 0.\]
if a firm is in the position to choose between two locations which differ with respect to the marginal tax burden they levy on labour, it will c.p. decide in favour of the country where labour faces lower effective average and marginal tax rates.

3 The OECD Taxing Wages Approach

To determine the effective tax burden on the employees in different countries, we employ the OECD Taxing Wages Approach. We compute the effective average and marginal tax rates of employees earning 33%, 100%, 167% or 500% of the average wage in the manufacturing sector for 49 countries for the year 2002 (see OECD (2002) and Heady (2004)). According to this approach, the average effective tax burden $T^A$ is defined as the ratio between the sum of the average labour income tax $T^L$, the social security contributions paid by the employee $T^{SE1}$ and the social security contributions paid by the employer $T^{SE2}$, divided by the sum of the gross wage $w$ and the social security contributions paid by the employer $T^{SE2}$. Accordingly

$$T^A = \frac{T^L + T^{SE1} + T^{SE2}}{w + T^{SE2}} \quad (3.12)$$

Using for instance the following numbers for Italy for 2002, one can compute an effective average tax rate on labour of 45.6 per cent.
Overview: Average effective tax rates on labour: An example

1. Gross earnings 20582.5
2. Ded. for social sec. contributions (=8) 1893.6
3. Taxable income (=1-2) 18688.9
4. Tax liability 4121.2
5. Tax credit 490.6
6. Final tax (=4-5) 3630.6
7. State and local income taxes 168.2
8. Employee soc. sec. contributions (=9.2% of 1) 1893.6
9. Employer soc. sec. contributions (=33.08% of 1) 6808.7
10. Effective average tax rate (=[(6+8+9)/(1+9)]) 45.6%

Moreover, we decompose this average effective tax burden into an employee tax wedge (ITE) and an employer tax wedge (ITR). The first is defined as the share of the labour income tax ($T_L$) plus the social security contributions paid by the employee ($T_{SE1}$) and the overall gross wage plus the employer’s contributions ($w + T_{SE2}$). The employer tax wedge (ITR) is defined as the ratio between the employer’s social security contributions ($T_{SE2}$) and the overall labour cost to the employer which includes beside the above mentioned contributions also the gross wage ($w + T_{SE2}$).

\[
ITE = \frac{T_L + T_{SE1}}{w + T_{SE2}} \\
ITR = \frac{T_{SE2}}{w + T_{SE2}}
\]  

(3.13)

Furthermore, given that the progressivity of a tax system also influences effort and thus labour supply, we also compute a measure for the progressivity of each tax system as the ratio of the difference between the average effective tax rates for an individual earning 100% and 500% of the average wage ($ITE(500) - ITE(100)$) and the average effective tax for an individual earning the average wage in the manufacturing sector.

\[
ITP = \frac{ITE(500) - ITE(100)}{ITE(100)}
\]  

(3.14)
The higher this value is, the stronger is the progressivity of a country’s tax system and thus the managers have lower incentives to provide an additional unit of effort which increases their income by an additional monetary unit, given that they can only keep a small fraction of this extra earning.

Figures 1a and b show the correlation between the employee and the employer tax wedge for an individual earning the average wage or five times the average wage in the manufacturing sector in the 49 countries. From Fig. 1a one can see that the employee tax wedge is almost independent of the employer tax wedge. The mean of the employee tax wedge is 17.5%, the standard deviation 7.9% and it has a minimum value of 1.85% in Mexico and a maximum value of 42.65% in Denmark. The mean and standard deviation of the employer tax wedge for an employee earning the average wage amount to 15.8% and 7.8% respectively. The minimum value is recorded for Denmark with 0.6% and the maximum value for Ukraine with 30.6%. These values do not change much if we consider an employee earning five times the average wage, however, given the progressivity of the tax system, the values for the employee tax wedge visibly change (see Fig. 1b). Thus, the mean now amounts to 28.7% and the standard deviation to 12.2%.

![Figure 1a: Employer vs. Employee Tax Wedge 100](image_url)
Finally, the scatterplot in Figure 2 depicts the relationship between the progression of the respective tax system (denoted as $ITP$ above) and the employee tax wedge ($ITE$).

One can note a clear negative relationship. The higher the tax burden of an employee earning the average wage, the lower the progression of the respective country’s tax system will be. Or, to put it differently, given that a country already has high labour income taxes and social security contributions borne by employees, it can not afford to tax higher incomes even more since this would have negative incentive effects on the employees’ effort.
4 Empirical Analysis

4.1 Summary of hypotheses about the impact of personal income taxation on bilateral foreign direct investment

As we indicated before, there are two major routes along which taxation of income should affect the activity of firms in generals and of multinationals in specific. First, given average wages gross of taxes, a higher fraction of average wages that is taxed away at the expense of workers, the lower worker effort might be. Higher labor-borne taxes on personal income should then have a negative impact on productivity and, hence, on the prevalence of multinational firms to locate in such a country. In particular, we argue that countries with very high labor-borne effective tax rates on personal income will not be candidates for the location of headquarters, where highly productive labor is particularly important. Accordingly, we may formulate the first testable hypothesis as follows.

Hypothesis 1: A higher labor-borne effective tax rate on personal income – given gross wages – reduces a country’s ability to attract headquarters. In particular, a larger difference in such tax rates between a potential parent and a host country will reduce the associated bilateral FDI stock.

In particular, this argument should be important for skilled employees and managers required in the set-up of headquarters of firms and, even more importantly, of multinationals. The gross income of such employees typically falls in the highest income tax bracket. The second hypothesis may then be formulated as follows.

Hypothesis 2: A stronger progression of the labor-borne effective tax rate on personal income – given gross wages and the level of the average labor-borne tax rate on personal income – reduces a country’s ability to attract headquarters. In particular, a larger difference in the associated progression between a potential parent and a host country will reduce the associated bilateral FDI stock.
One could be tempted to expect similar hypotheses for the employer-borne level and progression of income tax rates. Yet, employer-borne contributions are not progressive at all in the sample of economies considered below (see Fig. 1a and 1b). Moreover, employers should in principal not care about whether given expenditures on gross wages go directly to workers or not. This leads to the last hypothesis we will consider in the subsequent empirical analysis.

**Hypothesis 3:** A higher employer-borne effective tax rate — given gross income — should not affect a country’s ability to attract headquarters. In particular, a larger difference in such tax rates between a potential parent and a host country will not affect the associated bilateral FDI stock.

In the subsequent empirical analysis, we infer these hypotheses, controlling for other observable variables. It is the aim of the next section to introduce the empirical specification, the variables in use, the sources of the data, and summary statistics thereof.

### 4.2 Specification and Data

In the empirical analysis, we will use the log of bilateral stocks of outward FDI among 49 economies for the year 2002 (for which data on profit and personal income taxation are available) as the dependent variable. Data on stocks of outward FDI are taken from UNCTAD’s Foreign Direct Investment database. Regarding notation, we use subscripts $i$ and $j$ to indicate parent and host countries throughout so that the dependent variable in the econometric benchmark model may be written as $LFDI_{ij}$.

The explanatory variables we use to determine bilateral FDI stocks may be collected in three categories: gravity model variables (or economic fundamentals) such as parent

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6 The countries included in our data-set are the following: Argentina, Austria, Belgium, Brazil, Bulgaria, Canada, China, Colombia, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, India, Indonesia, Ireland, Italy, Japan, Latvia, Lithuania, Luxembourg, Macedonia, Malta, Mexico, Netherlands, Norway, Peru, Poland, Portugal, Romania, Russia, Slovak Republic, Slovenia, South Korea, Spain, Sweden, Switzerland, Thailand, Turkey, Ukraine, United Kingdom, United States, Uruguay.

Given the enormous effort necessary to collect profit taxes and the level as well as the progression of personal income tax data for such a wide sample of countries, this paper’s focus has to be on cross-section data analysis.
and host country size (GDP), parent and host country average wages per employee, and the bilateral distance between the parent and the host economy (which commonly serves as a compound measure of bilateral trade and investment costs among these economies); profit tax variables based on statutory corporate tax rates and depreciation allowances (or fixed cost deductibility parameters) of the parent and the host economy as well as two indicator variables reflecting whether the credit method or the exemption method are applied bilaterally to avoid or reduce double taxation of foreign-earned, repatriated profits; finally, we use personal income tax variables based on the effective rates of contribution of employers versus employees at average wages and the progression of the employees’ contribution.

Let us focus more closely on how the variables used in the specification are actually constructed, and what their sources are. Table 1 provides summary statistics we refer to below, especially, with the personal income tax variables covered.

*Gravity model variables*

We use the gravity model variables in logarithmic form on the right-hand side of the empirical model: $\text{LGDP}_i$ and $\text{LGDP}_j$ indicate parent and host country log GDP, respectively (from the World Bank’s World Development Indicators 2006); $\text{LWAGE}_i$ and $\text{LWAGE}_j$ refer to parent and host country log average wages per worker, respectively (from OECD(2002) and UN). Bilateral distance is measured in kilometers and computed using the great circle method based on coordinates of the parent and host’s capitals. Again, we use the log of bilateral distance, $\text{LDIST}_{ij}$.

*Profit tax variables*

Regarding the profit tax variables, we hypothesize that parent country firms will more likely set up production plants in a host country if the corporate statutory tax rate is higher at home than abroad (see Egger, Pfaffermayr, Loretz, Winner, 2008). To capture this relationship, we introduce the parent-to-host statutory corporate tax rate differential $(\text{TAX}_i-\text{TAX}_j)$ as an explanatory variable in the model. Moreover, we hypothesize that a similar differential for tax deductibility parameters, i.e., depreciation allowances $(\text{DEPR}_i-\text{DEPR}_j)$, exhibits the opposite sign. The reason for the latter is that better depreciation
allowances in the parent country would make it unattractive for firms to set up production facilities abroad. On top of these tax rates and depreciation allowances, countries establish bilateral tax law, mostly through tax treaties. Such treaties have two purposes: to reduce the profit tax burden on foreign-earned, repatriated profits and to exchange information to limit multinational firms’ possibilities of tax avoidance. The net effect of such treaties is therefore ambiguous. We include two dummy variables that are based on unilateral as well as bilateral, treaty-based regulations about the regime of double taxation relief in place: CREDITij (referring to the credit method) and EXEMPTij (referring to the exemption method). One should not expect any particular sign for the parameters of these dummy variables in the empirical model, since it is impossible to distinguish between the true double taxation relief effect and the information exchange effect brought about by bilateral tax treaties. These variables are collected by Egger, Pflaflerlmayr, Loretz, Winner (2008), using information from national tax codes as well a bilateral tax treaties.

**Personal income tax variables**

As for personal income tax rates, we use three variables as indicated in Hypotheses 1-3 before. The first one is based upon the effective tax rate on personal income borne by employees with an average wage (ITE). This amounts to the difference between gross income visible to the employee and her net income relative to the gross income. In our data, ITE varies between about 1.9 percent (Mexico) and about 42.7 percent (Denmark) across countries. Similar to profit tax rates, we use the corresponding difference in parent-to-host contributions (ITEi-ITEj). Furthermore, we compute the progression in ITE between an employee with a wage that is five times higher than the average and the average earner relative to the average. We refer to this measure of progression by the acronym ITP. The latter varies between -0.64 (or about -63.5 percent; Austria) and 3.31 (or about 331 percent; for Mexico) in the data. Similar to ITE, we include the difference between parent and host country (ITPI-ITPj) as a determinant of FDI in our empirical model.

< Table 1 >
Finally, we include the employer contributions as a counterpart to ITE in the model. Let us use the acronym ITR for the corresponding variable, which varies between 0 (Austria, Chile, and New Zealand) and about 30.6 percent (Ukraine) in our data, according to Table 1. Similar to ITE, we include the parent-to-host difference (ITRi-ITRj) of this variable as a determinant of the parent’s bilateral outward FDI in the model.

4.3 Estimation Results

In all model estimations carried out, we assume that the stochastic error term is uncorrelated with variables belonging in the three aforementioned groups of determinants. Generally, we do not require the disturbances to be identically distributed across country-pairs. Therefore, we generally report standard errors which are robust to heteroskedasticity. Table 2 summarizes the parameter estimates from a set of ordinary least-squares models. We estimate three models in Table 2 to shed light on the contributions of different blocs of variables to the total variance in LFDI.

< Table 2 >

Model 1 only includes the fundamental gravity model control variables. Not very surprisingly, these five variables together with the constant alone explain (the log of) bilateral outward FDI stocks among quite: they account for more than 56 percent of the variation in the data.

Adding the aforementioned four profit tax variables in Model 2 leads to a non-trivial increase in explanatory power when using the adjusted R2 (hence, taking the loss of degrees of freedom in Model 2 relative to Model 1 taking into account): Model 2 explains more than 62 percent of the variation in bilateral FDI, and we may state that it works about as well as bilateral gravity models do for the log of bilateral exports. As for the parameter estimates of the profit tax variables, we find – in accordance with our expectations – that a larger discrepancy in statutory tax rates between the parent and the host country leads to more outward FDI. The reason is that it then pays off to
locate production abroad for profit tax reasons. Higher depreciation allowances in the parent country relative to the host should render the former relatively more attractive for activities involving high fixed costs – such as headquarters. Hence, we expect a positive parameter for this variable. Indeed, the point estimate turns out positive, yet we can not estimate the parameter significantly at conventional levels. The negative parameters of the credit and exemption dummies most likely capture adverse effects on FDI associated with information exchange effects (and, hence, the reduced possibilities of shifting profits and charging transfer prices by multinational firms).

In Model 3, we add the three personal income tax variables to the ones in Model 2. Several findings there are worth noting. First of all, the overall explanatory power of the model is only marginally increased. Yet, this is not surprising. We would have found the results suspicious, if personal income taxation had turned out more important than profit taxation for bilateral FDI. Second, the parameters of (ITEi-ITEj) and (ITPi-ITPj) are significantly different from zero and negative. The latter results are supportive of the worker-effort-related Hypotheses 1 and 2 – headquarters are less likely to be located in countries, where average wage taxes (ITEi-ITEj) or their progression (ITPi-ITPj) are relatively high. In other words, countries where skilled workers and managers have to sacrifice a larger portion of their gross wages will less likely host headquarters and conduct bilateral outward FDI. Third, given gross wages, it does not matter to multinationals whether their wage expenditures accrue to wage taxes/health or social security contributions or not, as suggested by Hypothesis 3.

In the remainder of this section, we assess the robustness of these findings in various regards: the importance of influential observations, the sample composition, the inclusion of additional control variables, and the functional form assumption about of the stochastic process. Table 3 summarizes the corresponding findings which should be compared to the benchmark results in Model 3 of Table 2.

< Table 3 >

Model 3a in the table represents a least-absolute deviations (median) regression. Overall, the parameter estimates in this model are very similar to Model 3 in Table 2. This
suggests that our original findings were not driven by influential observations in the tails of the distribution. Models 3b and 3c indicate that our conclusions for the impact of personal income tax rates apply qualitatively for both intra-OECD and extra-OECD FDI relationships. Also the other results in these models are qualitatively similar to each other and the original ones in Table 2.

Model 3d includes additional control variables such as the difference in skilled labor endowments between the parent and the host country (suggested by Markusen, 2002; using secondary school enrolment ratios from the World Bank’s World Development Indicators 2006; not significant), the difference in an index capturing political institutions between the parent and the host country (using the Polity IV data-set; not significant); the number of years since the last war between the parent and the host country (using the Armed Conflict Dataset provided by the International Peace Research Institute; significant at 1 percent); the cumulative number of months of war between the parent and the host country since 1940 (using the aforementioned Armed Conflict Dataset; significant at 1 percent). Descriptive statistics of these variables are provided in Table A1 of the Appendix. A comparison of the results in Model 3d with those in the original Model 3 indicates that the original findings were not biased by our focus on a more parsimonious model.

Model 3e represents a Poisson Pseudo-maximum likelihood (PPML) model rather than an ordinary least-squares approach. Santos Silva and Tenreyro (2006) indicated for trade data that depending on the nature of the measurement error of bilateral exports, heteroskedasticity may lead to biased parameter estimates. This bias can be avoided in a PPML model with heteroskedasticity-robust standard errors. The same argument applies, of course, with data on bilateral stocks of outward FDI. Again, the results indicate that such a bias seems to be of minor importance in our application. This conclusion is derived from the similarity of the parameter estimates in Models 3 and 3e. However, the negative parameter of (ITEi-ITEj) can not be estimated significantly any more. Yet, that one of the tax progression variable (ITPi-ITPj) even gained in importance relative to the original results.
5 Concluding Remarks

This paper reports on a large data-set on labor income taxation among 49 economies. We provide descriptive comparisons with respect to the taxation of the salaries of average income earners and the corresponding progression. In the empirical part of the paper, we shed light on how important the taxation of labor income is for outward foreign direct investment (FDI) relative to profit taxation. Moreover, we consider the role of the contributions of employers versus those of employees across four centiles of the distribution of gross wages: at 33 percent, 100 percent, 167 percent, and 500 percent of the average. Not surprisingly, personal income tax rates turn out somewhat less important than profit tax rates (in terms of their marginal contribution to explaining the variance of bilateral outward FDI stock data). However, the employee-borne part of labor taxes determines bilateral FDI significantly different from zero: both a higher employee-borne tax on average wages and, in particular, a higher progression from the average wage to five times the average wage is less conducive to headquarters location and, hence, bilateral outward FDI.
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Table 2: Regression analysis of the impact of corporate versus personal taxation on bilateral FDI

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<td>Gravity model control variables</td>
<td></td>
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<tr>
<td>Log GDP</td>
<td>Log GDP</td>
<td>0.386 ***</td>
<td>0.101 ***</td>
<td>0.995 ***</td>
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<tr>
<td>Log GDP</td>
<td>Log GDP</td>
<td>0.043 ***</td>
<td>0.059 ***</td>
<td>0.083 ***</td>
</tr>
<tr>
<td>Log average wages per worker</td>
<td>Log WAGE</td>
<td>0.189 ***</td>
<td>0.149 ***</td>
<td>1.267 ***</td>
</tr>
<tr>
<td>Log average wages per worker</td>
<td>Log WAGE</td>
<td>0.189 ***</td>
<td>0.149 ***</td>
<td>1.267 ***</td>
</tr>
<tr>
<td>Log distance</td>
<td>Log distance</td>
<td>-0.084 ***</td>
<td>-0.166 ***</td>
<td>-1.067 ***</td>
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<tr>
<td>Profit tax variables</td>
<td>Statutory corp. tax differential</td>
<td>1.884 **</td>
<td>1.953 **</td>
<td>1.953 **</td>
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<tr>
<td>Profit tax variables</td>
<td>(TAI - TAI)</td>
<td>-0.127 ***</td>
<td>-0.170 ***</td>
<td>-0.382 ***</td>
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<td>Profit tax variables</td>
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<td>0.049</td>
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<td>Exemption of personal income tax paid on average income by employer differential</td>
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<td>0.049</td>
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<td>Income tax paid on average income by employee differential</td>
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<td>Income tax paid on average income by employee differential</td>
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<tr>
<td>Personal income tax variables</td>
<td>Progression of income tax paid by employee differential</td>
<td>0.010</td>
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</table>

Notes: *** = * are indicating statistical significance at 1, 5, and 10 percent, respectively (using t-statistic based on standard errors).
Table 3: Sensitivity analysis of Model 3 in Table 2

<table>
<thead>
<tr>
<th>Explanatory variables</th>
<th>Model 3a</th>
<th>Model 3b</th>
<th>Model 3c</th>
<th>Model 3d</th>
<th>Model 3e</th>
</tr>
</thead>
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<td>Gravity model control variables</td>
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</tr>
<tr>
<td>Log GDP</td>
<td>-0.99</td>
<td>-1.02</td>
<td>-0.99</td>
<td>-1.01</td>
<td>-0.99</td>
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<td>Log GDP</td>
<td>0.053</td>
<td>0.058</td>
<td>0.058</td>
<td>0.058</td>
<td>0.058</td>
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<tr>
<td>Log average wages per worker</td>
<td>1.397</td>
<td>2.396</td>
<td>1.110</td>
<td>1.245</td>
<td>1.363</td>
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<tr>
<td>Log average wages per worker;</td>
<td>0.018</td>
<td>0.018</td>
<td>0.018</td>
<td>0.018</td>
<td>0.018</td>
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<tr>
<td>Log distance</td>
<td>-1.122</td>
<td>-1.124</td>
<td>-1.123</td>
<td>-1.078</td>
<td>-0.862</td>
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<tr>
<td>Profit tax variables</td>
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<tr>
<td>Statutory corp. tax differential</td>
<td>1.731</td>
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<td>-2.056</td>
</tr>
<tr>
<td>Depreciation allowance differential</td>
<td>0.171</td>
<td>-1.224</td>
<td>-1.224</td>
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<td>-1.224</td>
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<tr>
<td>Credit method of double taxation relief</td>
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<td>-0.638</td>
<td>-0.638</td>
<td>-0.638</td>
<td>-0.638</td>
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<tr>
<td>Exception method of double taxation relief</td>
<td>0.086</td>
<td>-0.086</td>
<td>-0.086</td>
<td>-0.086</td>
<td>-0.086</td>
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<tr>
<td>Personal income tax variables</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Income tax paid on average income by employer differential</td>
<td>-0.001</td>
<td>-0.001</td>
<td>-0.001</td>
<td>-0.001</td>
<td>-0.001</td>
</tr>
<tr>
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<td>0.008</td>
<td>0.008</td>
<td>0.008</td>
<td>0.008</td>
<td>0.008</td>
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<tr>
<td>Progression of income tax paid by employee differential</td>
<td>-0.333</td>
<td>-0.333</td>
<td>-0.333</td>
<td>-0.333</td>
<td>-0.333</td>
</tr>
<tr>
<td>Observations (country pairs)</td>
<td>1055</td>
<td>1055</td>
<td>1055</td>
<td>1055</td>
<td>1055</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>0.494</td>
<td>0.713</td>
<td>0.516</td>
<td>0.633</td>
<td>0.772</td>
</tr>
<tr>
<td>Root mean squared error</td>
<td>1.025</td>
<td>1.716</td>
<td>2.294</td>
<td>2.196</td>
<td>1.866</td>
</tr>
</tbody>
</table>

Notes: *, **, *** indicating statistical significance at 10%, 5%, and 1% level, respectively. Standard errors are robust to heteroscedasticity. Model 3c is a least absolute deviation (median) regression model. The corresponding $R^2$ is a pseudo-$R^2$. Model 3d restricts the sample to intra-OECD relationships only. Model 3e excludes intra-OECD relationships from the data. Model 3d includes four additional control variables: the difference in skilled labor endowments between i and j (using secondary school enrolment ratios from the World Bank’s World Development Indicators 2008, not significant); the difference in the political environment index between i and j (using the Polity IV dataset, not significant); the number of years since the last war between i and j (using the Armed Conflict Dataset provided by the International Peace Research Institute, significant at 1 percent); and the cumulative number of months of war between i and j since 1940 (using the aforementioned Armed Conflict Dataset, significant at 1 percent). Model 3e is a Poisson model with robust standard errors, using the level of bilateral stocks of outward FDI as the dependent variable.
Appendix

Table A1 contains a summary of the additional control variables used in the sensitivity analysis (Model 3d in Table 3).

<table>
<thead>
<tr>
<th>Additional variables in use</th>
<th>Acronym</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skilled labor endowment differential of country i minus j</td>
<td>(TE)</td>
<td>6.066</td>
<td>2.629</td>
<td>-103.813</td>
<td>96.504</td>
</tr>
<tr>
<td>Policy index differential of country i minus j</td>
<td>(TE/TE)</td>
<td>1.070</td>
<td>2.851</td>
<td>0.000</td>
<td>17.000</td>
</tr>
<tr>
<td>Number of years since last political conflict between i and j</td>
<td>(TP)</td>
<td>54.301</td>
<td>49.637</td>
<td>0.000</td>
<td>122.000</td>
</tr>
<tr>
<td>Cumulated duration of political conflict between i and j in days since 1940</td>
<td>(TR+TR)</td>
<td>12.604</td>
<td>195.676</td>
<td>0.000</td>
<td>621.000</td>
</tr>
</tbody>
</table>

Table A1: Summary statistics for additional variables used in the sensitivity analysis

References


