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**Economic integration and the relationship
between profit and wage taxes**

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Economic integration and the relationship between profit and wage taxes

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Abstract

This paper analyzes the development of the ratio of corporate taxes to wage taxes using a simple political economy model with workers and capitalists that own internationally mobile and immobile firms. Among other results, our model predicts that countries reduce their corporate tax rate, relative to the wage tax, when preferences for public goods increase, or when the share of capital employed in multinational firms is rising. We further show how an increase in the wage share changes both the relative size of tax bases and the political influence of different income groups. The predicted relationships are tested using panel data for 23 OECD countries for the period 1980 through 2004. The results of the empirical analysis support our main hypotheses.

Keywords Capital and labor taxes, economic integration

JEL Classification H20 · H73 · F15 · F23

1 Introduction

A frequently raised concern in public policy is that increasing capital market integration is eroding the traditional role of the tax system in equalizing the (after-tax) distribution of income. These concerns are based on the differential development of wage and capital tax rates over the last decades. Data for the OECD countries show that in the early 1980s the statutory rate of the corporate income tax (CIT) was 50% higher, on average, than the labor tax wedge for the average worker. By the year 2000, however, the two tax rates had become roughly equal (see Table 1). Related evidence shows that, on average, European Union (EU) member states have reduced their reliance on capital taxes and increased the share of labor taxes in total tax revenues during the past 30 years (Eurostat 2005). These developments and the concern they cause underlie, for example, several EU policy initiatives which aim at a coordinated increase in the effective taxation of capital income (European Commission 1997, 2001).

In the aggregate, the trends described above are in line with the results of the tax competition literature, which predicts a reduction in the relative reliance on corporate taxes as the optimal response to greater capital market integration (see Wilson 1999 for a survey). It is also evident from Table 1, however, that the tax policy changes have been rather diverse, even among the relatively homogeneous group of OECD countries. In several countries (e.g., Austria, Finland, Greece and Sweden) the ratio of statutory CIT rates to labor taxes has fallen by more than 50% during the period 1980 through 2004, whereas the same ratio has stayed virtually constant in the United States and it has even increased in Italy and Spain. The pattern is very similar when the corporate tax burden is measured by effective average tax rates, which also include changes in the tax base.¹

Table 1 also shows that most of the classical welfare states in Scandinavia and continental Europe now have lower ratios of corporate to wage taxes than the Anglo-Saxon countries (except Ireland). For example, in 2004, the corporate tax rate was only 63% of the wage tax rate for an average worker in Sweden, but 171% of the wage tax rate in

¹While tax bases have been broadened in several countries since the 1980s, this change has been far less pronounced, on average, than the reduction of statutory CIT rates. For a detailed account of the development of corporate taxation in the OECD countries, see Devereux et al. (2002).

Table 1: Taxation of corporate and labor income in the OECD

Country	statutory CIT rate (τ) ^a		effective CIT rate ^b		tax wedge on labor (t) ^c		tax ratio (τ/t)	
	1980	2004	1980	2004	1980	2004	1980	2004
Australia	50.0	30.0	37.2	23.2	–	22.9	–	1.31
Austria	61.3	34.0	38.3 ^d	22.5	29.9	36.8	2.05	0.92
Belgium	48.0	34.0	32.4 ^d	24.4	41.6	44.9	1.15	0.76
Canada	44.8	35.6	26.7	25.9	18.3	27.6	2.45	1.29
Czech Republic	–	28.0	–	23.3	–	36.6	–	0.77
Denmark	40.0	30.0	–	–	36.9	35.7	1.08	0.86
Finland	60.2	29.0	42.7	21.1	37.4	40.3	1.61	0.72
France	50.0	35.4	34.0	24.8	–	43.2	–	0.82
Germany	62.2	38.3	44.9	28.6	36.1	41.5	1.72	0.92
Greece	43.4	35.0	32.2	22.4	17.4	34.9	2.49	1.00
Ireland	45.0	12.5	26.4	9.6	27.9	14.9	1.61	0.84
Italy	36.3	37.3	23.6	24.8	43.6	41.0	0.83	0.91
Japan	52.6	39.7	38.8	29.1	14.3	25.2	3.68	1.58
Luxembourg	45.5	30.4	–	20.0	29.1	20.6	1.56	1.48
Netherlands	48.0	34.5	35.3	25.2	43.8	38.9	1.09	0.89
New Zealand	45.0	33.0	–	–	20.0	20.7	2.25	1.82
Norway	50.8	28.0	35.9 ^d	21.6	37.3	32.4	1.36	0.86
Poland	–	19.0	–	16.0	–	42.3	–	0.45
Portugal	55.1 ^d	27.5	42.9 ^d	18.9	27.0	27.5	1.91	1.00
Spain	33.0	35.0	24.0	24.5	34.6	34.8	0.95	1.01
Sweden	60.4	28.0	42.9 ^d	19.5	46.7	44.6	1.29	0.63
United Kingdom	52.0	30.0	31.0	21.9	31.4	24.6	1.66	1.22
United States	49.6	39.3	31.5	25.5	29.4	23.0	1.69	1.71
OECD average	49.1	32.2	34.3	22.7	31.7	32.1	1.71	1.06
coeff. of variation	0.17	0.20	0.20	0.20	0.30	0.28	0.40	0.29

^a Including typical local income taxes and supplementary charges. In countries with more than one tax rate, the manufacturing rate was chosen.

^b Effective average tax rate for an investment in plant and machinery, financed with 1/3 debt and 2/3 equity. Other assumptions: rate of economic profit: 20%; true economic depreciation: 12.25%; real interest rate: 10%; inflation: 3.5%. For details, see Devereux and Griffith (2003).

^c Average tax rate rate faced by a manufacturing employee on average income, assuming half of employees are married. Includes personal income and payroll taxes, and social security contributions. For details, see OECD (2006). The tax rates based on the old definition were chosen (as only for those historical time series data are available).

^d 1982

Sources: Corporate taxes: IFS tax data (www.ifs.org.uk/publications.php?publication_id=3210); own calculations. Labor tax wedge: OECD (2006).

the United States. Such differences are in striking contrast to the common perception that social democratic governments (as in Scandinavia and continental Europe) share a higher preference for redistribution, as compared to more conservative and free market oriented types of governments (Hibbs 1977).

Surprisingly, very little theoretical work has been devoted so far to explain the substantial and persistent cross-country differences in the relative reliance on capital and labor taxation. The only robust link that has been derived in the theoretical tax competition literature is that small countries will face a more elastic capital tax base and will therefore, on average, have a smaller capital tax rate than their larger neighbors (Bucovetsky 1991; Wilson 1991). Even this result is not unambiguously found in the data, however. While some small countries such as Ireland and Austria have indeed strongly reduced their relative reliance on corporate taxation since the 1980s, so have some large countries such as Germany or Japan. At the same time, other small countries like Luxembourg and New Zealand maintain ratios of corporate to wage taxation that are significantly above the OECD average.

These observations raise a number of interesting issues. Do the forces of globalization and, in particular, capital mobility affect countries in structurally different ways? Are countries with large governments more prone to cut capital taxes? And do the relative sizes of tax bases matter for the ratio of wage and profit taxes? Our aim in this paper is to explore these questions from both a theoretical and an empirical perspective.

We begin by setting up a simple political economy model with two groups of voters, workers and capitalists. The model takes into account some of the most pronounced trends in the global economy such as the rise in foreign direct investment (FDI) and the growing importance of multinational income in the tax base of developed countries (Markusen 2002). We determine the effects of a rising share of multinational income and of increased preferences for public good supply on the mix of factor taxes. Moreover, since capital owners may stand to gain more than wage earners from globalization, we also analyze how a change in relative factor incomes and thus a shift in the balance of powers in the political equilibrium can affect relative tax rates. The model is stylized on purpose, allowing us to derive sharp comparative static effects.

In a second step we bring our model to the data. The distinguishing feature of our empirical analysis is that it tests directly the hypotheses derived from our theoretical

model, focusing on the effect that several country-specific variables have on the ratio of capital to labor taxation. This is done using a panel dataset from 23 OECD countries for the period 1980 through 2004.

Our analysis yields three main results. First, our theoretical analysis shows that an increase in government consumption leads to a more than proportional increase in the wage tax and thus reduces the relative reliance on capital taxation. The empirical analysis finds strong support for this hypothesis. This offers an explanation for why countries with a history of ‘big government’ nevertheless rely relatively more on the taxation of wages than their more market-oriented counterparts.

The second main prediction of our theoretical analysis is that an increasing share of the income earned in multinational firms will, other things being equal, lower the corporate income tax. The focus on multinational firms as an indicator for the exposure of a country to the forces of globalization follows from the fact that multinational firms are particularly apt at exploiting international tax differentials through both real investment decisions and cross-country profit shifting.² Based on empirical evidence that multinationals are more prevalent in manufacturing than in the service sector, we proxy the share of multinationals in the economy by the ratio of value added in services relative to manufacturing. This proxy proves to have a robust and significant effect on the factor tax mix, supporting our theoretical expectation.

Third, our theoretical analysis yields ambiguous effects for an increase in the wage share on the composition of factor taxes: it increases the relative size of the labor tax base but simultaneously increases the political influence of workers. The empirical results show, however, that a higher income share of workers has an unambiguously positive effect on the capital-labor tax ratio. This indicates that changes in the economic importance of different interest groups may have significant repercussions on their political power.

The paper also contributes to the literature which studies the relationship between economic integration and capital taxation.³ This literature has yielded mixed findings so far. Studies that employ revenue-based measures of corporate taxation often find a positive relationship between integration and capital taxation, thus contradicting the

²See Devereux (2006) for a recent survey of the empirical evidence.

³A parallel strand of the literature focuses on the effects of globalization on the size and composition of public expenditures. See, e.g. Rodrik (1998) and Dreher et al. (2008).

tax competition hypothesis (Quinn 1997; Swank and Steinmo 2002; Dreher 2006). In contrast studies focusing on statutory or effective average tax rates mostly estimate a negative relationship that is consistent with the theory (Rodrik 1997; Bretschger and Hettich 2002; Slemrod 2004). These divergent results seem to be driven by the fact that corporate tax revenues as a share of GDP have risen in many countries, despite the fall in statutory and effective tax rates. Recent empirical research suggests that the rise in corporate tax revenue is partly caused by a rising share of businesses choosing incorporation, due to the fall in corporate tax rates relative to the personal income tax (de Mooij and Nicodème 2008). Moreover corporate profitability seems to have risen in recent decades as a result of globalization itself (Becker and Fuest 2007). Based on this evidence we argue that an analysis focusing on the actual tax choices of governments should employ tax measures that are based on legal tax codes, rather than tax revenue.

Another critical issue in the relevant literature is the measurement of market integration, or ‘country openness’. Krogstrup (2004) finds no support for the tax competition hypothesis if capital mobility is measured by (the absence of) capital account restrictions, or by parameters for the stock of foreign direct investment (FDI). The theory is confirmed, however, when covered interest parity differentials are used as an instrument for the FDI stock. Similar results are obtained by Garretsen and Peeters (2007). Winner (2005) uses a low savings-investment correlation as a proxy for capital market openness, and finds a significantly negative effect on the rate of profit taxation. Finally, Schwarz (2007) finds that capital mobility (measured as the absence of capital controls) has a weakly negative effect on the ratio of corporate to labor taxation. He also shows, however, that country size and the share of investment expenditures are more important determinants of the relative tax burden on capital. In this paper we propose a new indicator for ‘country openness’ which is based on the share of multinational firms in the economy.

The outline of this paper is as follows. Section 2 develops the theoretical model and derives its comparative static effects, which serve as hypotheses for the ensuing empirical analysis. The data and our empirical approach are described in Section 3. Section 4 presents our results. Section 5 concludes.

2 A simple political economy model of the capital-labor tax ratio

2.1 The framework

In this section we develop a simple model of a small open economy that incorporates several country-specific parameters and derives their effects on the mix of capital and labor taxes chosen in the political-economic equilibrium.⁴ Our analysis merges elements from the political economy literature on factor taxation in open economies (e.g., Persson and Tabellini 1992; Fuest and Huber 2001) and from the literature on the taxation of multinational firms (e.g., Kind et al. 2005). At the same time we restrict our analysis to the most basic effects discussed in the tax competition literature (see Wilson 1999). This allows us to derive reduced-form expressions for both tax rates and it greatly facilitates our comparative static analysis. Despite its simplicity the model delivers some results that have not been reported in the literature thus far.

We consider a country with two groups of consumers, capitalists and workers. Capitalists receive only capital income, whereas workers receive only wage income. The total population is normalized to unity, and it is divided between μ workers and $(1 - \mu)$ capitalists. Each capitalist owns a fixed capital stock k_d in a representative domestic firm, and a capital stock k_m in a multinational enterprise (MNE). The total endowment of each capitalist is thus denoted $K \equiv k_d + k_m$. Capital cannot be shifted between the domestic and the multinational firm.

The representative capitalist in the small home country receives an exogenous, above-normal return on each unit of capital, which is set equal to one. Capital income is taxed by a proportional corporation tax levied at rate τ . The multinational firm, but not the domestic firm, can respond to the tax by relocating part of its capital between the home country and a foreign country, where the foreign tax rate is exogenously given by $\bar{\tau}$. We focus here on the real effects of capital relocation, implying that capital taxation reduces the capital stock in the home country.⁵ We denote the share of relocated capital,

⁴For a survey of the literature on the political economy of taxation, see Hettich and Winer (2004).

⁵Another well-known tax avoidance mechanism by multinational firms is the shifting of accounting profits to low-tax countries. Empirically, there is strong evidence that both capital relocation and

relative to the domestic capital stock of the MNE, by β_c . If $\beta_c > 0$ then some of the domestic capital stock is moved abroad, whereas $\beta_c < 0$ implies a relocation of capital from the foreign to the domestic country. In either direction the relocation of capital is costly for the MNE. The costs are a convex (for simplicity, quadratic) function of the share of relocated capital and are given by $F_c = \alpha_c k_m (\beta_c)^2 / 2$, where α_c is a net-of-tax cost parameter. The after-tax income of the capitalist, indexed by subscript c , is then

$$I_c = [k_d + (1 - \beta_c) k_m] (1 - \tau) + \beta_c k_m (1 - \bar{\tau}) - \frac{\alpha_c k_m (\beta_c)^2}{2}, \quad (1)$$

where the first two terms are the after-tax incomes in the home and the foreign country, respectively, and the last term gives the (net-of-tax) cost of relocating operations.

The owners of the MNE maximize (1) with respect to the relocation parameter β_c . This yields $\beta_c = (\tau - \bar{\tau}) / \alpha_c$ so that $\beta_c > 0$ if the home country's corporation tax exceeds the exogenously given foreign tax rate $\bar{\tau}$, and $\beta_c < 0$ if the tax differential points in the opposite direction. Incorporating this profit-maximizing behavior and introducing $k_m = sK$ to describe the multinational sector's share of the total capital stock, the maximized after-tax income of each capitalist is

$$I_c^* = \left[1 - \tau + \frac{s(\tau - \bar{\tau})^2}{2\alpha_c} \right]. \quad (2)$$

The aggregate domestic capital stock, denoted κ , is determined by the optimizing decision of capitalists and by the share of capitalists in the economy $(1 - \mu)$. Hence

$$\kappa = (1 - \mu)[k_d + (1 - \beta_c)k_m] = (1 - \mu) : K \left[1 - \frac{s(\tau - \bar{\tau})}{\alpha_c} \right]. \quad (3)$$

Turning to the representative worker, her gross wage depends on the amount of capital operating in the home country. For simplicity, we assume that the gross wage is a linear function of the total capital stock employed domestically (by national and by multinational firms).⁶ Let $0 < \rho < 1$ be the proportionality factor with which the

profit shifting occur simultaneously in response to international tax differentials (see Hines 1999).

⁶This implies that the marginal product of capital is constant. In a static model like the one used here this assumption is clearly an oversimplification. In the longer run, however, it is often argued that the size of the domestic capital stock also exerts positive effects on R&D activity as well as on human capital formation. If these effects are taken into account then the marginal productivity of capital may indeed be constant, as in the linear benchmark model of endogenous growth (often referred to as the *AK* model; see Romer 2006: chap. 3). In this case the wage rate is also independent of labor supply conditions, as in eq. (4).

domestic capital stock affects the gross wage. Then

$$\omega = \rho \kappa = \rho(1 - \mu)K \left[1 - \frac{s(\tau - \bar{\tau})}{\alpha_c} \right]. \quad (4)$$

The dependence of the wage rate on the domestic capital stock gives workers an incentive to choose a mix of wage and profit taxes, rather than rely exclusively on profit taxation.

The second tax in the model is a linear tax on wages, levied at rate t . Workers can avoid the wage tax by working in the shadow economy thereby creating a deadweight welfare loss. We formulate the tax avoidance decision of workers in an analogous way as that for multinational firms and denote by β_w the share of work income relocated to the shadow economy. The deadweight cost of this reallocation is $F_w = \alpha_w \omega (\beta_w)^2 / 2$. The net income of a representative worker (subscript w) is then, using (4)

$$I_w = \rho(1 - \mu)K \left[1 - \frac{s(\tau - \bar{\tau})}{\alpha_c} \right] \left[1 - t(1 - \beta_w) - \frac{\alpha_w (\beta_w)^2}{2} \right].$$

Maximization with respect to β_w gives $\beta_w = t / \alpha_w$. Substituting this into the expression for I_w yields the maximized after-tax income of each worker as

$$I_w^* = \rho(1 - \mu)K \left[1 - \frac{s(\tau - \bar{\tau})}{\alpha_c} \right] \left[1 - t \left(1 - \frac{t}{2\alpha_w} \right) \right]. \quad (5)$$

The share of capital income earned domestically forms the base of the corporation tax, whereas the labor tax falls on all wage income that is legally earned. Recalling that there are μ workers and $1 - \mu$ capitalists in the economy, total tax revenue is given by

$$T = (1 - \mu)K \left[1 - \frac{s(\tau - \bar{\tau})}{\alpha_c} \right] \left[\tau + t\mu\rho \left(1 - \frac{t}{\alpha_w} \right) \right]. \quad (6)$$

Each income group derives utility from its maximized after-tax income (I_c^* and I_w^* , respectively) and a public good. The marginal benefit of the public good, γ , is assumed to be constant and equal for both income groups. It exceeds the private marginal utility of income (which is normalized to unity), thus introducing a motive for taxation.⁷ With

⁷The condition $\gamma > 1$ can be seen as a short-cut way of incorporating scale economies in the provision of public goods. The assumption of a constant marginal utility from public good supply is made to simplify the analysis, but it should not bias our results for the optimal *mix* of capital and labor taxes in any particular direction. Note also that finite optimal tax rates are obtained in our model, despite the linearity of the objective function in both private income and public goods. This is because the excess burden of taxation is strictly convex in each of the two tax rates.

these specifications, the utility function of capitalists (c) and workers (w) has the form

$$U_g = I_g^* + \gamma T, \quad g \in \{c, w\}. \quad (7)$$

We first determine the optimal tax mix from the perspective of capitalists. Using (2) and (6) in (7) and maximizing with respect to the optimal labor tax rate gives

$$t_c^* = \frac{\alpha_w}{2}, \quad (8)$$

where a subscript c indicates that this is the optimal labor tax from the perspective of capitalists. Note that (8) is simply the revenue-maximizing tax rate on labor income.

Differentiating the capitalists' utility function with respect to the capital tax yields

$$\frac{\partial U_c}{\partial \tau} = [\gamma(1 - \mu) - 1] : K \left[1 - \frac{s(\tau - \bar{\tau})}{\alpha_c} \right] - \gamma(1 - \mu)K \frac{s}{\alpha_c} \left[\tau + t\mu\rho \left(1 - \frac{t}{\alpha_w} \right) \right].$$

The second term on the RHS is unambiguously negative, whereas the first term has the same sign as $[\gamma(1 - \mu) - 1]$. If workers form the majority of the population and, hence, $1 - \mu$ is small, then this expression will also be negative for moderate levels of γ . Excluding negative tax rates, capitalists will then favor a capital tax of

$$\tau_c^* = 0. \quad (9)$$

Hence the preferred tax policy of capitalists is straightforward. They prefer a zero tax on their own income source but the revenue-maximizing tax rate on wage income.

To derive the optimal tax policy for workers, substituting (5) and (6) in (7) gives

$$U_w = (1 - \mu)K \left(1 - \frac{s(\tau - \bar{\tau})}{\alpha_c} \right) \left\{ \rho \left[1 - t \left(1 - \frac{t}{2\alpha_w} \right) \right] + \gamma \left[\tau + t\mu\rho \left(1 - \frac{t}{\alpha_w} \right) \right] \right\}.$$

In a first step the optimal wage tax from the perspective of workers is then derived as

$$t_w^* = \frac{\alpha_w(\gamma\mu - 1)}{(2\gamma\mu - 1)}. \quad (10)$$

The workers' preferred wage tax is thus linearly rising in the cost parameter α_w . It will be positive if the marginal benefit from this tax, $\gamma\mu$ (the value of one unit of the public good, times the share of workers on whom the tax is imposed), exceeds the marginal cost of unity. In the following we assume that this condition is met and $t_w^* > 0$.

In a second step the optimal corporation tax rate is derived using (10). This yields

$$\tau_w^* = \frac{\alpha_c}{2s} + \frac{\bar{\tau}}{2} - \frac{\rho}{2\gamma} \left[1 + \frac{\alpha_w(\gamma\mu - 1)^2}{2(2\gamma\mu - 1)} \right]. \quad (11)$$

The workers' preferred capital tax (11) consists of three parts. The two first terms are positive and describe the benefits, from the perspective of workers, of taxing capital income. These terms will be large when the share of the mobile, multinational tax base s is low, when it is costly for the MNE to relocate capital (α_c is large), or when the exogenous foreign tax rate $\bar{\tau}$ is high. The third, negative term describes the incentive for workers to subsidize domestic capital, in order to raise gross wages. This incentive is rising in ρ . The capital tax will be positive if ρ is moderate so that, in the valuation of workers, the revenue gains from the taxation of capital income exceed the induced reduction in gross wages. This is assumed in what follows. Workers will then prefer a mix of wage and profit taxes, due to the dependence of their gross wage on the domestic capital stock.

Finally we have to characterize the overall tax mix in the political-economic equilibrium. To keep our analysis as simple as possible we assume that the resulting equilibrium taxes are weighted averages of the tax rates desired by capitalists and workers, respectively, where the weights are determined by the share of the respective income group in the overall population.⁸ Specifically we assume that the equilibrium tax rates on wages and profits are determined as

$$t^* = \mu^\varepsilon t_w^* + (1 - \mu^\varepsilon) t_c^*, \quad \tau^* = \mu^\varepsilon \tau_w^* + (1 - \mu^\varepsilon) \tau_c^*, \quad (12)$$

where the parameter $\varepsilon > 0$ measures how strongly a change in the share of workers affects the political influence of this income group and hence the equilibrium tax mix.

2.2 Determinants of the equilibrium tax mix

We now derive the comparative static effects of changes in the exogenous parameters on the mix of wage and capital taxes in the political-economic equilibrium. In this analysis it is generally sufficient to consider the effects of exogenous parameter changes on the tax mix desired by the representative worker [eqs. (10)–(11)], as the tax rates favored by capitalists [eqs. (8)–(9)] are unaffected by most model parameters. Accordingly

⁸This specification can be interpreted as the simplest form of a political support function where the votes of capitalists and workers are perfect substitutes. See Hotte and Winer (2001) for an application of the political support function to explain changes in the capital-labor tax ratio in the United States during the period 1973-1983.

the weighting scheme (12) plays no role in the comparative static analysis, except for changes in the composition of the population (μ).

A first and straightforward exercise is to determine the effects of an increase in the foreign (world) tax rate $\bar{\tau}$. This unambiguously increases the relative reliance on the corporation tax desired by voters and has no effect on the desired tax mix of capitalists. Hence in equilibrium the ratio of corporate to labor taxes rises unambiguously

$$\frac{\partial(\tau^*/t^*)}{\partial\bar{\tau}} = \frac{\mu^\varepsilon}{2t^*} > 0. \quad (13)$$

Next, we consider the effects of market integration. Proceeding as before, an increase in the relocation cost parameter α_c changes the equilibrium tax mix by

$$\frac{\partial(\tau^*/t^*)}{\partial\alpha_c} = \mu^\varepsilon \frac{\mu}{2st^*} > 0. \quad (14)$$

The effects of lower shifting costs make the aggregate capital tax base more elastic and reduce the equilibrium tax on this base. Since the wage tax is not affected, economic integration also reduces the relative reliance on profit taxes.⁹

Changes in either the world (average) tax rate or the degree of capital market integration will affect all countries in similar ways. The latter holds at least for the OECD countries, which lifted all remaining capital controls in the early 1990s and where further capital market integration reflects general improvements in information technologies. Our model shows, however, that changing the *country-specific* share of capital in the multinational sector gives similar predictions as increased capital market integration. Raising s while holding the total capital stock constant yields

$$\frac{\partial(\tau^*/t^*)}{\partial s} = -\frac{\mu^\varepsilon \alpha_c}{s^2 t^*} < 0. \quad (15)$$

A higher proportion of internationally mobile capital raises the average elasticity of the corporate tax base, even when α_c is held constant. In equilibrium this lowers the tax rate on capital, relative to the wage tax.

A well-known result is that small countries levy lower capital tax rates than their larger neighbors (Bucovetsky 1991; Wilson 1991). We can relate our result in eq. (15) above to

⁹This comparative static effect has been frequently analyzed in the tax competition literature. See e.g., Persson and Tabellini (1992) or Kind et al. (2005).

this literature, if we assume that the share of the multinational sector is larger in small countries. One reason for this could be that the motive to engage in (market-seeking) FDI becomes more important when the firm's home market is small. We will examine this relationship in our empirical analysis below.

A further important determinant are the (workers') preferences for public goods, as captured by the parameter γ . This affects equilibrium taxes in our model by

$$\frac{\partial t^*}{\partial \gamma} = \frac{\mu^\varepsilon \alpha_w \mu}{(2\gamma\mu - 1)^2} > 0; \quad \frac{\partial \tau^*}{\partial \gamma} = \frac{\mu^\varepsilon \rho [2(2\gamma\mu - 1)^2 - \alpha_w(\gamma\mu - 1)(3\gamma\mu - 1)]}{4\gamma^2(2\gamma\mu - 1)^2} \geq 0. \quad (16)$$

A stronger preference for the public good will unambiguously raise the wage tax, but the same need not be true for the capital tax. The reason for the latter result is that an increase in τ raises revenues from the corporation tax but, through the negative effect on wages, simultaneously reduces labor tax revenues. If the cost of working in the shadow economy (α_w) is sufficiently large, implying – realistically – that most tax revenues are raised from wage taxes, the negative repercussions of a capital tax increase on wage tax collections will be strong. Intuitively, in this case the excess burden associated with corporate taxation rises more steeply than the excess burden of wage taxation. Hence a higher tax revenue requirement will be predominantly met by higher wage taxes, whereas the corporation tax remains largely unaffected or may even fall. To our knowledge this relationship has not yet been identified in the existing literature.¹⁰ Finally, we consider the effect of changing the share of workers μ .¹¹ This affects the desired tax mix of the representative worker by

$$\frac{\partial t_w^*}{\partial \mu} = \frac{\alpha_w \gamma}{(2\gamma\mu - 1)^2} > 0, \quad \frac{\partial \tau_w^*}{\partial \mu} = -\frac{\rho \alpha_w (\gamma\mu - 1) \gamma \mu}{2(2\gamma\mu - 1)^2} < 0. \quad (17)$$

The comparative static effects in (17) are driven by isolated changes in the size of tax bases. A rise in μ increases the base of the wage tax while decreasing the base of the capital tax. Other things equal, this will make it more attractive to tax wage income, rather than corporate income.

¹⁰ A related argument has been verbally made, however, by Apolte (2001). In his analysis an increase in the size of the government budget is caused by a more wasteful ('Leviathan') government, rather than by higher preferences for the public good.

¹¹ See Becker (1983) for a pioneering analysis of how a change in the number of persons in different pressure groups affects the political equilibrium.

At the same time, however, changing the composition of the population will also affect the political power of different income groups. Differentiating the tax rates in the political-economic equilibrium (12) with respect to μ , using $\partial t_c^*/\partial\mu = \partial\tau_c^*/\partial\mu = 0$ and signing the effects using (8)–(11) and (17) yields

$$\frac{\partial t^*}{\partial\mu} = \mu^{\varepsilon-1} \left[\underbrace{\mu \frac{\partial t_w^*}{\partial\mu}}_{(+)} + \underbrace{\varepsilon(t_w^* - t_c^*)}_{(-)} \right] \geq 0; \quad \frac{\partial \tau^*}{\partial\mu} = \mu^{\varepsilon-1} \left[\underbrace{\mu \frac{\partial \tau_w^*}{\partial\mu}}_{(-)} + \underbrace{\varepsilon(\tau_w^* - \tau_c^*)}_{(+)} \right] \geq 0. \quad (18)$$

A rise in the share of workers has two offsetting effects in our analysis. On the one hand, it changes the sizes of tax bases. As discussed above, this ‘tax base effect’ tends to increase the wage tax and reduce the capital tax. These are the first terms in the two square brackets in (18). On the other hand, the political impact of workers rises vis-à-vis that of capitalists. This is reflected in the second terms of the tax expressions. As workers desire a lower level of wage taxation, but a higher level of capital taxation, this ‘political effect’ counteracts the tax base effect. The political effect will dominate if the change in the political power of income groups, as measured by ε , is sufficiently strong. We summarize our theoretical results in the following proposition.

Proposition 1: *The following changes in exogenous parameters reduce the rate of the corporation tax, relative to the rate of wage taxation:*

- (a) *an increase in the preference for public goods (γ), if the costs of shifting domestic income to the shadow economy is sufficiently high;*
- (b) *a fall in the share of wage income (μ), if the effects of a changed composition of income on the political power of different income groups are sufficiently strong.*
- (c) *a fall in the costs of moving corporate activities abroad (α_c);*
- (d) *a higher share of capital income earned by multinational firms (s);*
- (e) *a lower world average tax rate ($\bar{\tau}$).*

3 Data and empirical approach

The stylized model described above has allowed us to derive rigorously a number of comparative static effects, which represent theoretical hypotheses on country-specific

determinants for the optimal mix of wage and profit taxation. In this section we discuss our empirical model, which aims to test these predictions with available data.

The data requirements for our analysis, which tests a relatively wide range of predictions, are substantial. Therefore we focus on a panel of 23 OECD countries, given in Table 1, for which the relevant data can be obtained. Our analysis covers the time period from 1980 to 2004. This period was characterized by the removal of the remaining capital market controls among the developed countries, and by a rapid growth of foreign direct investment and MNE activity (see Markusen 2002: ch. 1).

In constructing the data set for the empirical analysis, a first and important choice that needs to be made is how to measure tax rates. For convenience, implicit tax rates are often computed, where tax revenues from a given source are divided by the corresponding tax base obtained from national accounts statistics. The advantage is that such data are widely available, and that they include the effects of all aspects of complicated tax systems. For corporate income however, they also have important drawbacks. As documented in Devereux and Klemm (2004), the movement over time of revenue-based tax measures can have little in common with changes in tax laws. Instead they are mainly driven by the business cycle, historical effects, such as accumulated losses, and many other factors that are impossible to control for econometrically. Moreover, there is empirical evidence that falling corporate tax rates have caused an increased number of businesses to choose incorporation, raising corporate tax revenue at the expense of personal income taxes (de Mooij and Nicodème 2008). This implies that revenue-based measures of capital taxation that focus solely on corporate tax receipts will yield biased results.¹² For these reasons we use tax measures that are exclusively based on tax laws. In particular, we use the statutory tax rate, carefully adding any sub-federal taxes or averages thereof as well as any supplementary charges. We also test the robustness of our results when effective average tax rates are used instead and the effect of tax laws on the corporate tax base are thus included in the dependent variable.

A symmetric treatment of wage taxes would imply using the top marginal income tax

¹²These expectations are confirmed by the empirical results of Slemrod (2004), who tests alternative specifications using either statutory corporate tax rates or a corporate tax measure based on collected revenue. Slemrod's regressions for the revenue-based measure mostly yield coefficients that are insignificant, or of unexpected sign.

rate. This approach has, however, one important disadvantage: in the early 1980s top rates were extremely high in a number of countries. As the income threshold for such rates was also high, they were irrelevant for the large majority of the population, except for a few high income earners. What is needed instead is a typical tax rate faced by an average worker, as provided by the OECD (2006). This measure gives the tax rate faced by a manufacturing worker on the mean salary, and includes social security and payroll taxes.¹³

Turning to the explanatory variables, we proxy the preference for public goods (γ) by government consumption expenditure as a share of GDP.¹⁴ For the share of workers in the economy (μ) we use wages and salaries divided by GDP. This measure is used because it is likely to proxy not only for the quantity of workers, but also for their quality. The rest-of-the-world (ROW) average tax rate ($\bar{\tau}$) is based on a large sample of corporate tax rates in 70 countries. For each country in the regression, we calculate the inverse distance-weighted average of all other countries in this sample. Details on the definition and the sources of these data are given in the appendix (Table A.1).

A core variable in previous empirical studies has been the cost of international capital relocation (α_c), or the ‘openness’ of the economy. Several studies have employed a qualitative index of capital market restrictions, as developed in Quinn (1997); see, for example, Bretschger and Hettich (2002), Krogstrup (2004) and Schwarz (2007). For the OECD countries in our sample the Quinn measure exhibits little variation since the early 1990s, however, as capital markets have been almost completely liberalized throughout this period. Moreover, measures of capital market restrictions relate pri-

¹³We do not include consumption taxes into our wage tax measure, for two reasons. First, a differentiated rate structures and exemptions make it difficult to incorporate commodity taxes into an approach that is based solely on tax laws. Second, and more importantly, commodity taxes exclude the normal return to capital from tax, but they do fall on pure profits, along with wage income. Therefore no unambiguous link between commodity and factor taxation can be established in a model with pure profits, such as the one used here.

¹⁴Note that this measure does *not* include transfers, such as most social security expenditure. Including the latter would bias our results towards a positive relationship between public expenditure and labor taxes, as social security expenditures are financed in many countries by wage-related social security contributions. Moreover, government expenditures consist mainly of employees’ salaries. Once the initial hiring decision has been made, these expenditures are of a more long-run nature than transfers and social security expenditure and hence are more likely to be exogenous.

marily to the mobility of *portfolio* capital. When, as in our analysis, the focus lies on the taxation of corporate profits, it is preferable to use a measure of openness that is related to foreign direct investment (FDI). An important problem, however, is that all measures of FDI (both stocks and flows) are endogenous to the choice of corporate tax rates.¹⁵ In our model the size of the outward FDI stock depends on both the exogenous share of capital in multinational firms (sK) and on the endogenous share of capital that is moved abroad (β). But this implies that the theoretically expected relationship between the outward FDI stock (βsK) and the domestic tax rate is fundamentally ambiguous, because an exogenous increase in the potentially mobile, multinational tax base puts downward pressure on capital taxes, and this in turn reduces the share of capital that flows abroad in equilibrium. Nevertheless we will consider both the FDI stock and the Quinn measure of capital market restrictions as regressors in our empirical analysis.

It follows from this discussion that a suitable, country-specific indicator of ‘openness’ should focus on the *potential* mobility of capital and thus include the *entire* capital stock of mobile firms, rather than just the portion that is relocated abroad (the FDI stock). This figure is not readily available, however. The approach taken in this paper is to employ the industrial structure of the economy as a proxy for the share of the multinational sector. Specifically, we use the ratio of value added in the service sector to value added in manufacturing as an indicator of a *low* share of MNE activity in the economy. The use of this proxy is based on evidence collected by the OECD (2008) for most of the countries covered in our analysis. Table 2 shows that the employment share of affiliates of foreign-controlled companies in the sector’s total is, on average, less than half as large in the services sector as compared to manufacturing. Moreover the relationship is a very stable one, as is shown by the fact that this ratio is below 0.5 for all but three of the 17 individual countries listed in the table.

There are two main reasons for why this robust link between the sectoral composition of output and the importance of MNEs can be expected. First, a substantial part of the tertiary sector are locally provided services, including retail trade, transport and storage and community social services, which do not lend themselves to a multinational

¹⁵See our theoretical analysis where the domestic capital stock (κ), and hence also the FDI stock abroad $(1 - \mu)K - \kappa$, depends on the international tax differential [eq. (3)].

Table 2: Employment in MNEs: Services and manufacturing (2005)

	services ^a (1)	manufac- turing ^a (2)	ratio (1):(2)
Australia	10.5	22.7	0.46
Austria	9.7	22.5	0.43
Belgium	14.2	33.1	0.43
Denmark	6.1	14.4	0.42
Finland	11.9	16.5	0.72
France	10.5	26.4	0.40
Germany	6.5	15.2	0.43
Ireland	22.3	48.0	0.46
Italy	6.1	12.4	0.49
Luxembourg	16.3	39.3	0.41
Netherlands	8.9	25.1	0.35
Norway	3.5	22.3	0.16
Portugal	4.7	12.6	0.37
Spain	9.5	15.6	0.61
Sweden	22.4	33.8	0.66
United Kingdom	12.0	27.6	0.43
United States	3.8	11.2	0.30
unweighted average	10.5	23.0	0.44

^a employment of affiliates under foreign control, as a percentage of sector total.

2005 or latest available year.

Source: OECD (2008): OECD Factbook. www.sourceoecd.org/factbook - Economic globalisation - foreign direct investment (FDI) - activities of multinationals.

Table 3: Empirical implementation of the model

parameter in model	label in regression analysis	predicted sign on τ/t
$\bar{\tau}$	ROW average corporate tax rate	(+)
γ	public consumption/GDP	(-)
μ	wages/GDP	(+, -)
α_c	capital controls index	(-) ^a
$\beta_c \times s$	FDI stock abroad/GDP	(+, -)
s	service/manufacturing value-added (VA)	(+)
	GDP in US-\$ trillion	(+)

^a A low value of the index indicates strict capital controls.

organizational form. Second, MNEs are known to be particularly important in sectors characterized by high levels of R&D and by high levels of product differentiation (see Markusen 2002: ch. 1). While these characteristics also apply to certain parts of the service sector, they are more widespread, on average, in manufacturing.

To be sure, our proxy for the share of mobile firms in the economy is not without problems. One issue is that the sectoral composition may itself be affected by tax policies. High corporate income tax rates may, for example, encourage capital-intensive production, because capital expenditure qualifies for depreciation allowances, which are more valuable under high tax rates.¹⁶ However, the effect of taxes on the economy-wide production structure is arguably far less important than the effect of taxes on FDI stocks or flows. Moreover, by the above argument high taxes would favor the more capital-intensive manufacturing sector and thus work in the opposite direction of the postulated relationship. Hence if such feedback effects of tax policy on the composition of output are indeed present, the estimated coefficient would be biased downwards.¹⁷

Finally, we include the level of GDP (measured in purchasing power parities) as a measure of country size. This follows the results in the theoretical literature on capital tax competition that smaller countries tend face a more elastic capital tax base, other things being equal, and will thus have a lower ratio of corporate to wage taxes in equilibrium. Table 3 summarizes how the predictions from our theoretical model are tested empirically. Descriptive statistics on the variables employed in our analysis are given in the appendix (Table A.2).

¹⁶Davis and Henrekson (1999) discuss this issue in the context of Sweden.

¹⁷Another issue is that the sectoral composition of output may change over the economic cycle. There seems to be no literature addressing this question directly, but related studies suggest that this effect is not very pronounced. Jimeno (1992) argues that sectoral shocks have only limited aggregate effects. As he considers sectors at a more disaggregated level, this is consistent with assuming no major changes in the relationship between service and manufacturing sectors. Similarly, Ghosh and Wolf (1997) argue that geographical shocks are more important than sectoral shocks in explaining the US aggregate economic climate. In any event, time effects will allow for any common cyclical effects in our regression analysis.

4 Results

To explore the relationship between the ratio of corporate to labor taxes in individual countries and the exogenous parameters described above, we use standard panel data methods. Specifically we run (OLS) regressions of the form

$$(\tau/t)_{it} = X_{it}\beta + \eta_i + \zeta_t + \varepsilon_{it} \text{ ;}$$

where $(\tau/t)_{it}$ is the tax ratio in country i at time t , X_{it} is the vector of our explanatory variables, η_i and ζ_t are fixed country and time effects and ε_{it} is an error term.

An important feature of our empirical analysis is that we incorporate country fixed effects in all regressions. This procedure follows from a rigorous interpretation of our theoretical comparative static results: they derive hypotheses on how the tax mix adjusts *within a given country* when one of the exogenous variables changes. A cross-country interpretation of these effects would be permitted only if our model incorporated *all* variables that explain differences in the tax mix between countries. Clearly, this cannot be claimed for our simple model. The same point can also be stated econometrically. Since it is likely that we have omitted important variables, a regression that does not use fixed country effects will yield biased estimates, if the omitted variables are correlated in some way with the variables that are included in our regression. These expectations are confirmed by standard F- and Hausman tests, which suggest that fixed country effects should be used in our analysis.¹⁸ The estimates derived from our specification with country fixed effects will then be unbiased, if the unobserved variables do not change over time.

The results from our main set of regressions are presented in Table 4.¹⁹ In the final column, where we include the rest-of-the-world average corporate tax rate, we ex-

¹⁸F-tests on the fixed effect versus pooled model reject the pooled model for all regressions in Table 4 at the one percent level of significance. Hausman tests on the fixed versus random effect model reject the random effects model for regressions (4) and (5) in Table 4. Where Hausman tests cannot reject the random effect model, we have also obtained results under that model. These proved to be very similar, except that in regression (3) the coefficient on the FDI stock abroad is reduced to 0.011, but turns significant with a p-value of 2%.

¹⁹Constants are not shown in Table 4, because they are arbitrary in the presence of year effects, which are implemented as dummy variables.

Table 4: Estimation results - Baseline case

dependent variable	(1)	(2)	(3)	(4)	(5)
	corporate income tax /wage tax (τ/t)				
country effects	✓	✓	✓	✓	✓
year effects	✓	✓	✓	✓	—
public consumption/GDP	-6.526*** (1.583)	-7.342*** (1.611)	-4.788** (1.855)	-9.586*** (1.689)	-9.640*** (1.572)
wages/GDP	2.568*** (0.977)	2.941*** (1.038)	3.446*** (1.113)	2.501*** (0.850)	2.265*** (0.817)
GDP in US-\$ trillion	0.013 (0.021)	0.036** (0.017)	0.039* (0.022)	-0.033 (0.022)	-0.038* (0.020)
capital controls index		0.096*** (0.036)			
FDI stock abroad/GDP			0.018 (0.014)		
service/manufacturing VA				0.394*** (0.053)	0.402*** (0.052)
ROW average corporate tax rate					2.086** (1.014)
time trend					-0.036*** (0.007)
observations	470	302	382	351	339
Hausman statistic	0.2	1.0	0.6	67.6	79.5
R-squared [†]	0.86	0.92	0.86	0.90	0.90
R-squared [‡]	0.34	0.42	0.49	0.56	0.58

Notes: Robust (Huber/White) standard errors in parentheses.

Stars indicate level of significance (*: 10%; **: 5%; ***: 1%).

†: including time and country effects (where they are in the regression)

‡: excluding time and country effects

clude time effects. Otherwise we would estimate the trivial relationship between each country's own tax rate and the rest-of-the-world average, as within a year, the rest-of-the-world average tax rate will be lowest for the country with the highest tax rate and vice versa.

Column (1) of Table 4 relates the dependent variable to parameters of the domestic economy only. A first main result of our analysis is that the coefficient of the public consumption variable has the expected negative sign and is highly significant. To our knowledge this relationship has not been tested in the previous literature.²⁰ Moreover, this result is very robust across the different regressions. This provides evidence that an increase in government consumption changes the tax mix in the direction of a higher share of wage taxation, as predicted in Proposition 1(a). The relationship is also important in size, indicating that an increase in the government consumption share of GDP by one percentage point will reduce the ratio of tax rates by 6-9 percentage points. Recall, finally, that transfers and social security expenditures are *not* included in our measure of public consumption (cf. footnote 14). Hence the result does not derive from an increase in social security expenditures that are financed by wage-related contributions.

The coefficient of the wage share variable is positive and it is also highly significant. Recall from our theoretical discussion in section 2 that a pure optimal taxation perspective would instead predict a negative coefficient of the wage share variable, as it is more efficient to tax the relatively larger tax base. Hence our empirical analysis indicates that the tax base effect is dominated by political effects. Changes in the economic importance of different income groups therefore seem to have important repercussions on the political power of these groups, as stated in Proposition 1(b).²¹

²⁰The public consumption variable is incorporated by Slemrod (2004, Table 2), where it is found to be insignificant. However, Slemrod's study focuses only on the isolated determinants of the corporation tax and does not address the question of how increased public consumption affects a country's mix of wage and profit taxation. Schwarz (2007, Table 4) finds that a dummy for left-wing governments has a surprising, negative effect on the capital-labor tax ratio. He links this to the size of the welfare state but does not incorporate a public consumption variable in his empirical specification.

²¹Empirical support for an isolated tax base effect is found in a recent study by Kenny and Winer (2006). Their analysis simultaneously incorporates a number of political variables, thus controlling for simultaneous changes in the political equilibrium. Moreover, their analysis is based on a far larger

In contrast, the coefficient of the GDP variable is not significant in the regression of column (1) and it shows high volatility across the different regressions. Overall, the results therefore indicate that changes in the relative sizes of economies do not appear to exert an independent positive effect on the ratio of corporate to wage taxation. This is most likely explained by the fact that the relative sizes of economies do not change much during the observation period, and any permanent size effects are taken up by the country fixed effects.

The regressions in columns (2) and (3) add the two main proxies for capital market integration that have been used in the previous literature. Column (2) includes Quinn's (1997) measure of capital controls. This measure is statistically significant, but – recalling that an increase in the index represents an opening of capital markets – the coefficient has the wrong sign. This seemingly contradicts the earlier result of Rodrik (1997), who found that a liberalization of international capital controls reduces the corporate tax rate. The apparent discrepancy is resolved by noting that our specification in column (2) uses country fixed effects. When these are eliminated the sign of the capital control variable is reversed and now matches the theoretical expectations and previous findings. These results indicate that Proposition 1(c) is confirmed only from a cross-country perspective, but the capital control variable is not well suited to predict country-specific changes in the ratio of corporate to wage taxation over time.²²

Column (3) shows that the coefficient of the outward FDI stock is insignificant. This result should not be surprising, given that our theoretical analysis has derived a fundamentally ambiguous relationship between the FDI stock and the corporate tax rate. Furthermore, the FDI variable remains insignificant if the inward FDI stock is used instead, or if the endogeneity of the FDI stock is accounted for by an instrumental

sample of 100 countries (but covers only three time periods). The inclusion of many less developed countries may be an independent reason for the differences between their results and ours.

²²Results that are similar to ours are obtained in the analysis of Bretschger and Hettich (2002, Table 2). They find that the capital controls variable is statistically significant in a cross-country analysis without fixed country effects, but loses its significance when country dummies are added. Alternatively, Winner (2005) uses savings-investment correlations as a proxy for capital market openness. His analysis shows that this measure of openness has a robust, negative effect on the ratio of capital to labor taxation, even when country fixed effects are added.

variable (IV) approach.²³

Column (4) employs the ratio of service to manufacturing value added as an (inverse) proxy for the share of capital located in internationally mobile firms. This variable has the expected sign, as an increase in the share of relatively immobile capital in the service sector increases the relative reliance on profit taxation. Moreover, the relationship is found to be so highly significant (with t-values in the range of 7-8) that it can be expected to survive in many alternative model specifications. Taking into account that the ratio of service to manufacturing value-added increased on average by eight percentage points per year,²⁴ the coefficient is also economically significant and implies, other things equal, an increase in the tax ratio of about three percentage points per year. Proposition 1(d) of our theoretical model is thus strongly confirmed by the data.

Lastly, column (5) includes the rest-of-the-world average corporate tax rate as an explanatory variable. As discussed above this analysis cannot employ year effects, but we add a time trend to the regression analysis. In this specification both the time trend and the world tax rate are significant, suggesting the presence of both a general trend over time towards lower tax rates, and a dependence on neighboring countries' tax rates.²⁵ Proposition 1(e) is thus also confirmed by the data.

We now turn to evaluating the sensitivity of our results. The estimates in Table 4 measure the tax burden on profits by the statutory corporate income tax rate. The core relationships identified in our analysis are, however, identical in sign and similar

²³See our working paper version (Hauffer et al. 2006). This paper instruments the FDI stock using Quinn's measure of capital controls. As we have discussed in section 3, however, the limited variability over time of this measure reduces its empirical usefulness. Since it is possible that the insignificance of the FDI stock variable is caused by the limitations of the instrument, the results of this regression are not shown here. Krogstrup (2004) and Garretsen and Peeters (2007) show, however, that FDI stocks and flows can be used as proxies for capital market integration when they are properly instrumented and when an agglomeration variable is simultaneously incorporated in the estimation.

²⁴This increase of roughly eight percentage points is caused by the relatively high ratio of service to manufacturing value added (equal to four, on average; see Table A.2). This represents an increase of on average just 0.4 percentage points in the ratio of value added in services over the sum of value added in services and manufacturing.

²⁵Note that spatial autocorrelation is addressed in our estimation by using an inverse distance-weighted average. Moreover, while the world tax rate is not fully exogenous, endogeneity is reduced by basing the average tax rate on a large worldwide sample of 70 countries.

Table 5: Sensitivity analysis: Baltagi and Wu (1999) method

dependent variable	(1)	(2)	(3)	(4)	(5)
	corporate income tax /wage tax (τ/t)				
country effects	✓	✓	✓	✓	✓
year effects	✓	✓	✓	✓	—
public consumption/GDP	-1.637 (1.296)	-4.621*** (1.748)	-0.930 (1.287)	-5.419*** (1.594)	-5.409*** (1.478)
wages/GDP	1.775** (0.885)	2.672*** (1.241)	1.421 (0.907)	2.669*** (1.027)	2.644*** (0.982)
GDP in US\$ trillion	0.056 (0.057)	0.006 (0.067)	0.118* (0.060)	0.041 (0.053)	-0.048 (0.055)
capital controls index		-0.010 (0.043)			
FDI stock abroad/GDP			-0.006 (0.041)		
service/manufacturing VA				0.238*** (0.049)	0.212*** (0.049)
ROW average corporate tax rate					3.207*** (0.789)
observations	447	285	360	330	318
LBI statistic	0.51	0.80	0.42	0.69	0.74

Notes: Standard errors in parentheses.

Stars indicate level of significance (*: 10%; **: 5%; ***: 1%).

in magnitude when effective average tax rates are used instead.²⁶ This is shown in Table A.3 in the appendix. In particular, the share of public consumption, the wage share and the value-added shares of different sectors all remain highly significant in explaining the mix of profit to wage taxation, when the measurement of the corporate tax variable includes legal changes in the tax base.²⁷

Finally, the results presented in Table 4 all report heteroscedasticity-robust standard errors. It is however possible that the disturbances are also autocorrelated. To deal with this we reran the regression allowing for clustered standard errors. The results generally were robust to this change, except that the coefficient of the wage share turned insignificant in most regressions, as did the coefficient on the rest-of-the-world corporate tax rate. In small and unbalanced samples this correction to standard errors may, however, be biased. We therefore also employ the method developed by Baltagi and Wu (1999) to test and allow for AR(1) autocorrelated disturbances in our panel dataset. Table 5 reports the results from this sensitivity analysis. The results suggest that some autocorrelation is indeed likely to be present in our data, as is seen from low locally best invariant test (LBI) statistics. However, the results presented in Table 5 also show that our main findings are robust to allowing for autocorrelated disturbances, at least when the service share variable is included, as in columns (4) and (5) of Table 5. In these specifications the wage share variable is also once again significant at the 1% level.

5 Summary and conclusion

This paper has started from the observation that there are substantial and persistent differences in the ways OECD countries have adjusted their relative reliance on cor-

²⁶The effective average tax rate, developed by Devereux and Griffith (2003), is equivalent to a weighted average of the effective marginal tax rate on an investment that just earns a net rate of return equal to the going interest rate, and the statutory tax rate. The weight of the statutory tax rate in this measure rises with the (assumed) profitability of the underlying investment project.

²⁷The only qualitative difference in results is that the coefficient of the rest-of-the-world tax rate is insignificant in Table A.3. This is probably explained by the inconsistency between dependent variable, which is based on effective tax rates, and the explanatory variable, which, for lack of data, is still based on statutory tax rates.

porate and wage taxation to the forces of globalization. For this purpose we have set up a simple model that allows us to derive rigorously a number of testable hypotheses relating the mix of corporate and wage taxation to several country-specific variables. In a second step, we have tested the theoretical predictions using data from 23 OECD countries for the period 1980–2004.

Our theoretical and empirical analysis has isolated three important country-specific variables that shape the mix of profit and wage taxation in the OECD. First our theoretical analysis has shown that an increase in government consumption will lead to a more than proportional increase in the wage tax. The reasoning behind this result is that the excess burden of the capital tax rises more steeply than that of the wage tax, because the capital tax reduces not only the domestic capital stock but also wage income. Our empirical tests provide support for this hypothesis. Other things being equal, a rising share of government consumption in GDP will cause a country to increase its reliance on wage taxes, relative to the tax on corporate profits. This offers an explanation for why countries with a history of ‘big government’ and long periods of social democratic rule nevertheless rely relatively more on the taxation of wages than their more market-oriented counterparts. From a policy reform perspective, this result implies that reducing government consumption is a highly effective way of reducing the tax burden on the average wage earner.

The second main prediction of our theoretical analysis is that an increasing share of the income earned in multinational firms will, other things being equal, lower the corporate income tax. Based on empirical evidence that multinationals are more prevalent in manufacturing as opposed to the service sector, we have proxied the share of multinationals in the economy by the ratio of value added in services relative to manufacturing. This proxy proved to have a robust and significant effect on the factor tax mix. Moreover, it outperforms traditional measures of openness, such as the index of capital account restrictions, when country fixed effects are included in the regression analysis and the focus is thus on explaining the tax changes that occurred within a given country over time.

Third, and finally, our theoretical analysis has shown that an increase in the wage share simultaneously changes the relative size of tax bases, but also the political influence of different income groups. From a pure efficiency (or optimal tax) perspective only

the first effect should matter and the reliance on wage taxation should increase. Our empirical analysis yields the opposite result, however, indicating that changes in the economic importance of different groups have important repercussions on their political power and hence on the political economic equilibrium. These effects clearly deserve further analysis in future work on the determinants of the structure of factor taxation.

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Appendix

Table A.1: Data sources and methods

Variable	Source	Definition and methodology
Corporate income tax rate	Institute for Fiscal Studies; World Tax Database (Michigan)	Statutory tax plus typical local taxes and other surtaxes. Where multiple rates are available, the manufacturing rate is chosen.
Wage tax rate	OECD Taxing Wages	Average tax wedge of manufacturing worker on average income. This includes personal income taxes, employer and employee social security contributions and payroll taxes.
public consumption/GDP	OECD National Accounts	Public consumption expenditure divided by GDP
wages/GDP	OECD Nat. Accounts, OECD Econ. Outlook, OECD Analyt. Database	Gross wage bill divided by GDP (excluding income of self-employed and owner-managed firms)
GDP in US-\$ trillion	OECD National Accounts	GDP in trillion US\$, converted at purchasing power parity exchange rates
capital controls index	Comparative Welfare States Data Set*	Index ranging from 0 (closed capital markets) to 4 (open capital markets)
service/manufacturing value-added	OECD STAN (Structural Analysis Database)	Value added in the service sector divided by value added in the manufacturing sector
FDI stock abroad/GDP	IMF International Financial Statistics	Stock of foreign direct investment divided by GDP
rest-of-the-world average corporate tax rate	tax data from World Tax DataBase (Michigan); distance data from CEPII (Paris)	Inverse distance-weighted average statutory corporate tax rate of 70 countries for which continuous data are available from 1980-2004, excluding left-hand side country

Notes: - IFS data available from: www.ifs.org.uk/publications.php?publication_id=3210

- All OECD data available from: new.sourceoecd.org

- World tax data base available from: www.bus.umich.edu/otpr/otpr/introduction.htm

- Distance data available from: www.cepii.fr/anglaisgraph/bdd/distances.htm

*Full source: E. Huber, Ch. Ragin, J. D. Stephens, D. Brady, and J. Beckfield, Comparative Welfare States Data Set, mimeo 2004. Original source of the measure: Quinn (1997).

Table A.2: Descriptive statistics

variable	observations	mean	median	standard deviation	min.	max.
corporate tax/wage tax	509	1.258	1.155	0.548	0.272	3.745
public consumption/GDP	509	0.196	0.193	0.037	0.120	0.299
wages/GDP	470	0.420	0.423	0.057	0.225	0.536
GDP in US-\$ trillion	509	0.813	0.205	1.592	0.005	11.657
capital controls index	308	3.471	3.500	0.588	2.000	4.000
FDI stock abroad	382	0.301	0.031	2.466	0.000	32.695
service/manufacturing VA	390	4.028	3.702	1.595	1.886	11.825
ROW average tax rate	451	0.355	0.341	0.041	0.285	0.441

Table A.3. Sensitivity analysis: Effective average tax rates (EATR)

dependent variable	(1)	(2)	(3)	(4)	(5)
	EATR /wage tax				
country effects	✓	✓	✓	✓	✓
year effects	✓	✓	✓	✓	—
public consumption/GDP	-5.785*** (1.198)	-5.341*** (1.237)	-5.029*** (1.303)	-7.632*** (1.258)	-7.284*** (1.172)
wages/GDP	1.695** (0.749)	1.741** (0.741)	3.325*** (0.768)	1.921*** (0.584)	1.532*** (0.585)
GDP in US-\$ trillion	0.013 (0.014)	0.037*** (0.012)	0.025* (0.014)	-0.014 (0.015)	-0.010 (0.014)
capital controls index		0.0035 (0.050)			
FDI stock abroad/GDP			0.097* (0.058)		
service/manufacturing VA				0.266*** (0.034)	0.259*** (0.032)
ROW average corporate tax rate					0.077 (0.762)
time trend					-0.032*** (0.006)
observations	389	260	334	300	289
R-squared [†]	0.86	0.92	0.86	0.90	0.92
R-squared [‡]	0.34	0.42	0.49	0.56	0.59

Notes: Robust (Huber-White) standard errors in parentheses.

Stars indicate level of significance (*: 10%; **: 5%; ***: 1%).

†: including time and country effects (where they are in the regression)

‡: excluding time and country effects