Country Characteristics and The Incidence of Capital Income Taxation on Wages: An Empirical Assessment[*]

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Abstract

This paper examines the incidence of corporate income taxes on wages using data from the Bureau of Labor Statistics which are prepared specifically to allow international comparisons of labour costs and productivity in the manufacturing sector. The econometric analysis shows that a substantial share of the corporate tax burden is shifted from capital to labour. However the magnitude of this shift is strongly driven by country characteristics influencing the mobility of capital and the world price of output. Further explorations suggest indeed that the domestic labour's burden would be lower, the lower the degree of trade openness, the higher the relative position of a country in the world capital market and in the world market supply, the lower the level of depreciation allowances and when the corporate income tax is residential-based.

Keywords: Tax incidence, corporate taxation, capital mobility.

JEL classification: H22, H25, H32, H87.

1 Introduction

The economic burden of the capital income tax does not mechanically fall with the shareholders who have the statutory liability for paying the tax to the fiscal authorities. Knowing who actually bears the burden of the capital income tax is crucial to maintain the progressivity of the tax system and to avoid inefficiencies caused by a distortion of the allocation of capital. Following and extending the seminal work of Harberger (1962) to the case of an open economy, tax burden analysis have consistently concluded that domestic labour bears a sizeable share of the corporate income tax, ranging from 70% (Randolph, 2006) to 250% (Harberger, 1995). One exception is Gravelle and Smetters (2006) who, by relaxing the assumption of perfect demand substitution between domestic and foreign internationally tradable goods, find that labour bears approximately 21% of the burden. Without considering factors which can influence the mobility of capital, the empirical literature finds results consistent with theoretical models where capital is perfectly mobile and domestic and foreign products are perfect substitutes.

Using data from the Bureau of Labor Statistics prepared specifically to allow international comparisons of labour costs and productivity in the manufacturing sector for 13 OECD countries, this paper extends the literature on corporate tax incidence in two important ways. First, the paper replicates existing empirical studies by using for the first time one of the most reliable database on labour costs and productivity (International Labour Office, 2009). Second, we allow for the magnitude of the shift to diverge by country characteristics. This paper explores indeed the extent to which the degree of shifting of capital taxation on labour can be explained by country characteristics influencing the mobility of capital and the world price of output. Five characteristics are considered: (i) the degree of trade openness, (ii) the country size in the world capital market, (iii) the country size in the world market supply, (iv) source-based versus residential-based corporate income tax, and (v) the level of depreciation allowances.

First, the theoretical literature shows that in a closed economy capital bears the full tax burden, and how, in an open economy, the domestic owners of capital can avoid most of the corporate tax burden by reallocating capital abroad. These analysis are however silent about the relationship between the shift of the tax burden and the degree of openness of a country. Nevertheless, the literature on international capital mobility suggests a complementary relationship between trade and capital mobility (Markusen, 1983; Feeney, 1994; Fouquau et al., 2008; Eslamloueyan and Mahbobeh, 2010). If the degree to which a country is open to trade has an influence on the mobility of capital flows, the magnitude of the tax burden that is shifted from capital to labour might increase with a country's degree of trade openness. Second, the corporate tax incidence theory predicts that in smaller open economies, where the higher

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tax burden cannot be absorbed through a general worldwide decline in the rate of return to capital nor reflected in a rise of the price level of the products, the degree of shifting to wages is higher than in larger open economies. This paper tests this prediction by interacting the corporate tax rate with a measure of the relative size of a country in the world capital market and with a measure of the relative size of a country in the world market supply. Third, countries diverge in the way they tax capital income. One would expect the shifting of corporate taxation to workers to be larger in countries allowing capital allocation to be diverted by taxes, such as under tax exempt systems where the corporate income tax is source-based, than in countries trying to limit capital distortion due to tax considerations, such as under tax credit systems where the corporate income tax is residential-based. This assumption can be tested by distinguishing tax credit systems from tax exempt systems when investigating the effect of corporate taxes on wages. Finally, the reallocation of capital abroad can be facilitated by the rate of depreciation allowances in an economy, since the latter influences the rate of growth of investment and the replacement of old asset with new one (Eisner, 1952; Auerbach, 2006). We test whether the generosity of depreciation allowances can be linked with a higher shift of the corporate tax burden on labour.

Conditional on value added per worker, our baseline equation indicates that an increase of corporate tax rate by 1 percentage point reduces wages by 0.1%. This coefficient estimates the direct effect of taxes on wages through wage bargaining (Arulampalam et al., 2008). By removing the intervening value added variable, we roughly allow the tax coefficient to also capture the indirect effect of corporate taxes through a change in capital which reduces labour productivity. In so doing, the elasticity estimated, which can be considered as a upper bound of the effect of corporate taxes on wages, reaches -0.265. Using data on GDP, on corporate tax revenue, and on labour income as a share of GDP, we estimate that 60% of the corporate tax burden is directly shifted to labour (through wage bargaining) in average for the 13 OECD countries. In line with Harberger (1995), when combining the direct and indirect effects, the labour's burden estimated exceed the tax revenue generated. Finally, there is evidence that the magnitude of the shift is strongly influenced by the mobility of capital and by a country's ability to influence the price of tradables. We find that the domestic labour's burden would be lower, the lower the degree of trade openness, the higher the relative position of a country in the world capital market and in the world market supply, the lower the level of depreciation allowances and when the corporate income tax is residential-based.

The paper is organized as follows. The next section review the related literature. Section 3 discusses the role played by the degree of trade openness, the country size, the tax system and the level of depreciation allowances on the relationship between corporate taxes and wages. Section 4 presents the data

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sources, the methodology and descriptive statistics. Section 5 presents the results and Section 6 offers concluding remarks.

2   Related literature

The first paper to provide a theoretical framework for the analysis of the incidence of corporate income taxes on wages was done by Harberger (1962). This seminal model of a closed economy with two factors and two sectors (one corporate and the other non-corporate), indicates that corporate income tax is not shifted to labour but is fully borne by capital. In this model, labour and capital are fixed but perfectly mobile between sectors. An increase in taxes in the corporate sector reduces the after-tax return and drives capital into the non-corporate sector, thus reducing the non-corporate after-tax return. In equilibrium, the after-tax returns in both sectors must be equal. Producers and consumers substitution decisions combine in such a way that the decrease of the new equilibrium after-tax return corresponds to the amount consistent with owners of capital (both corporate and non-corporate) bearing the entire burden of the corporate income tax.

With increasing volume of trade and capital flows over time the same relationship necessitated to be analyzed in the context of an open economy. In the two country models developed by Bradford (1978) and Kotlikoff and Summers (1987), capital is assumed to be perfectly mobile between countries and labour is immobile. They show that an increase in corporate tax rates induces a shift of capital from this country to other countries to escape the additional tax burden. This decline of capital results in a lower productivity of labour in the home country leading to a labour force which bears a substantial share of the corporate income tax burden. Randolph (2006) and Harberger (1995, 2006) develop a general equilibrium model to analyze the long-run incidence of capital taxation in an open economy and provide a quantification of the amount of the tax burden that is shifted to the labour force. Under the assumptions that capital is perfectly mobile internationally and that there is a perfect demand substitution between domestic and foreign tradable goods, Harberger (1995) predicts that labour bears 2 to 2.5 times the U.S. corporate tax burden. This prediction is only based on changes in the source of income. With a measure of the burden which combines the source and the use of income, Randolph (2006) finds that domestic labour and domestic owners of capital bear the tax burden roughly in proportion to their factor income shares in the economy, i.e. the labour force bears slightly more than 70% of the corporate tax burden. With the same measure of the burden but with different assumptions about the U.S. economy, Harberger (2006) reports a higher shift, finding that domestic labour bears up to 96% of corporate income taxes.

The incidence of the corporate tax depends crucially on the basic assumptions in the model. In particular, relaxing the hypothesis of perfect demand substitution between domestic and foreign tradable goods can modify the prediction of the open economy tax incidence model. Considering that tradable goods are not perfect substitute across countries, Gravelle and Smetters (2006) introduce imperfect competition in a general equilibrium model and show that most of the burden is borne by domestic capital as in the Harberger (1962) closed-economy model.[1] Indeed, if consumers are less disposed to substitute between foreign and domestic goods, capital will be less sensitive to corporate tax differentials. Their model effectively show that the decrease in capital mobility rises the share of the tax burden that falls on capital. Increasing the mobility of labour would lead to the same result. Harberger (2006) and Randolph (2006) general equilibrium models make the assumption that capital is mobile internationally and that labour is immobile. As emphasized by Gentry (2007), this type of model obviously results in labour - the less mobile factor - bearing the burden of the corporate income tax. An increase in labour mobility, should also rise the share of the tax burden that falls on capital.

The results of the empirical literature are consistent with general equilibrium models based on an open economy in perfect competition.[2] With different methodologies, five recent papers, Hassett and Mathur (2006), Felix (2007), Desai et al. (2007), Arulampalam et al. (2008) and Moore and Kasten (2009) find indeed that labour bears the major share of the corporate income tax burden. Hassett and Mathur (2006) investigate the incidence of various measures of corporate tax rates on manufacturing wages across 72 developed and developing countries between 1981-2002. They use the Labor Statistics database provided by the International Labor Organization (ILO). Controlling for value-added and trade openness, they find that labour is substantially affected by corporate tax rates. Indeed, an increase by 1% in the statutory corporate tax rate, decreases wages by 0.95% on average across the estimations. The magnitude of the impact is amplified for poor economies and also varies with the measure of the corporate tax rates. These effects are considerably lower when corporate tax rates are measured using the effective marginal tax rate or the effective average tax rate. Felix (2007) analyses the impact of corporate income taxes on gross wages in 19 industrialized countries between 1979-2002, using the Luxembourg Income Study database. Corporate tax rates appear to have only a statistically significant negative impact on wages when, using her data, Felix (2007) runs Hassett and Mathur (2006) specifications. She finds that a 1% point increase in the corporate tax rate decreases annual wages by 0.43%.[3] Distinguishing

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[1]With a domestic-foreign product substitution elasticity of 1 and a perfectly mobile capital, they predict that labour bears 21% of the burden.

[2]See Auerbach (2006) and Gentry (2007) for a detailed review on the incidence of corporate income taxes.

[3]Felix (2007) runs several other regressions controlling for openness, GDP per capita, education, age and gender, and only

low-, middle-, and high-skill workers, it appears that the incidence of corporate taxes on wages is not statistically different across skill-level. Desai et al. (2007) investigate the same relationship but with aggregate data on U.S. multinational firms operating in around 50 countries for the years 1989, 1994, 1999 and 2004. They jointly estimate the incidence of corporate taxes on the ratio of total employee compensation (including benefits) and return to capital and find that between 45 and 75 percent of the burden is borne by labour, the remaining part being borne by capital. In the models set by Hassett and Mathur (2006), Felix (2007), and Desai et al. (2007), corporate tax rates affect wages *indirectly*, through the decrease of investment and the resulting decrease of labour productivity. Arulampalam et al. (2008) underline that controlling for value added, as it is done in Hassett and Mathur (2006), does not allow to insulate the effect of taxes that comes from changes in capital intensity (the value added variable and the tax variable being dependent). Hassett and Mathur (2006) overcome this limitation with an unreported two-step procedure which confirm their intuition; where taxes can influence the capital-labour ratio in the first-stage, and where the capital-labour-ratio can affect wages in the second-stage.

Arulampalam et al. (2008) propose a second mechanism through which corporate income taxes can influence real wages: wage bargain. For a given pre-tax economic rent, an increase in corporate tax rate reduces the post-tax economic rent over which the firm and the union will bargain. By introducing a corporate income tax into McDonald and Solow (1981)'s model where the firm and the labour force bargain over both wages and employment, Arulampalam et al. (2008) show that wage bargaining provides a *direct* mechanism by which the corporate tax burden can be shifted from capital to labour. They empirically measure the size of this direct effect by using firm-level data for the period 1996-2003 in nine European countries. To interpret their results as resulting from the bargaining mechanism, they include as control the value-added per worker (which captures the capital intensity mechanism that affects productivity). They find that a 1 USD increase in the corporate tax rate, decreases total wages by 92 cents in the long-run. They also distinguish multinational firms from domestic firms with the assumption that being multinational increases firm's bargaining power by providing the firm with an outside option: the possibility to shift production abroad. They find however, that the magnitude of the elasticity between corporate taxes and total wage does not depend on the internationalisation of the firm.

Using firm-level data, Moore and Kasten (2009) investigate the *direct* effect put forward by Arulam-

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finds that corporate tax rates have a statistically significant effect on wages when an interaction term between taxes and trade openness is included in the regression. She concludes that a 1% point increase in corporate tax rates decreases wages by 0.7-1.2%. However, by simply looking at the coefficient of corporate taxes, Felix (2007) incorrectly concludes that taxes have a negative effect on wages. This coefficient measures the effect when openness=0. For a more meaningful value of openness such as its mean (0.77), the results indicate surprisingly that a 1% point increase in corporate taxes increases wages by 1.37%.

palam et al. (2008) of the German Tax Reform 2000 -consisting in a decrease of the corporate tax rate- on wages in the manufacturing sector over the period 1996-2005. They conduct a difference-in-differences analysis and use French and British companies as control groups for German companies. With the French control group, the results are ambiguous. With the British control group, the results indicate that the tax rate cut of 2000 has a statistically significant positive effect on wages, with a 1.21 percent increase in the post-reform period.

3 Country Characteristics and Tax Incidence

3.1 Openness

The theoretical literature suggests two opposite incidences of corporate income taxes for a closed economy, where capital bears the full tax burden, and for an open economy, where labour bears most of the tax burden. As previously explained, in a close economy, an increase in corporate taxes decreases the after-tax rate of return and drives capital into the non-corporate sector, pushing down the non-corporate after-tax rate of return. The fall in the level of the after-tax rate of returns of both sectors (which must be equal in equilibrium) will fully absorb the additional tax burden.[4] In an open economy, with labour which is immobile and capital which is perfectly mobile internationally, domestic capital can escape much of the tax burden by locating abroad. The decrease in domestic capital reduces the productivity of domestic workers which translates in lower wages at home.

The tax incidence theory predicts thus that having an open economy is likely to shift the corporate tax burden from capital to labour. But does the degree of openness matters? A number of papers, in the literature on international capital mobility, show a complementary relationship between trade and capital mobility (Markusen, 1983; Feeney, 1994; Fouquau et al., 2008; Eslamloueyan and Mahbobeh, 2010). If the degree to which a country is open to trade has an influence on the mobility of capital flows, we might expect that the magnitude of the tax burden that is shifted from capital to labour would increase with a country degree of trade openness. We test this assumption in the empirical part.[5]

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[4]The results found by Harberger (1962) two-sectors model are confirmed by other computable general equilibrium models with a larger number of sectors such as in Shoven (1976).

[5]Note that without considering the potential effect of trade on capital mobility Felix (2007) makes the assumption that the degree of trade openness should not influence the corporate tax incidence on wages. She thus interacts a measure of trade openness with corporate tax rates, expecting the coefficient estimated for the interaction term to be negative, but close to zero. Unexpectedly, the interaction term exhibits a positive sign and is statistically significant when interacted with the marginal corporate tax rate. She explains that this might be because firms are more able to avoid taxes in more open countries.

3.2 Small Country Effect

Based on a price-formation equation, Harberger (2006) provides a simple framework to investigate the incidence of an increase in corporate taxes through the changes in factor prices and product prices for a small open economy and a large open economy. He considers an economy with a tradable sector "a" which price-formation equation with a tax on capital T_{Ka} is

$$dp_a = f_K(dp_K + T_{Ka}) + f_L dp_L \tag{1}$$

where f_K and f_L are the shares of capital and labour in the production costs of "a".

Small open economy. In a small open economy, with capital which is perfectly mobile internationally, labour which is fixed and immobile, and a fixed worldwide capital stock, the burden of a tax imposed on capital will fall entirely on labour. Indeed, the corporate income tax temporarily decreases the return to capital. Capital flows out of the country to escape taxes until the domestic pre-tax return is increased so that the new domestic after-tax return is equal to the previous one. Therefore, with a small open economy which is price-taker for tradables and price-taker in the world capital market, $dp_a = dp_K = 0$, leading to

$$0 = f_K T_{Ka} + f_L dp_L \tag{2}$$

For simplicity, the initial prices are set to be equal to 1. It results that $f_K = K_a/a$ and $f_L = L_a/a$. Therefore, Equation (2) resolves into

$$L_a dp_L = -K_a T_{Ka} \tag{3}$$

A small open economy is a small part of the world market and is unable to influence its terms of trade by its own actions nor the return to capital. If the price of product p_a cannot increase and the return to capital p_K cannot decrease, this is labour which has to bear the entire corporate tax burden to maintain the activity of "a". Therefore, p_L decreases by just the amount consistent with labour bearing the entire corporate income tax.

Large open economy. Suppose now that the economy is large, that labour is still immobile, that capital is still perfectly mobile and that the worldwide capital stock is fixed. The corporate tax incidence is expected to be different than in a small open economy since placing a tax on capital in a large economy can decrease the world rate of return. As in the small open economy, the lower domestic after-tax return, which is caused by the implementation of the corporate income tax, drives capital abroad. However, with

a higher proportion of the world's capital stock, the decrease of the domestic rate of return will generate a worldwide decline in the return to capital. Domestic capital flows abroad until the pre-tax rate of return abroad is reduced, equalizing then the rates of return around the world. In other words, placing a tax on capital results in a decrease of p_K which spreads to all capital. In a large economy, the burden of the tax is therefore also borne by capital and the decrease in p_L should be lower than in a small open economy. The difference in the tax burden borne by labour in a large economy as compared with a small economy is strengthened by the fact that even under the assumption of homogenous products, the large open economy can shift part of the tax burden on the price of the product. By exporting large quantities of products that are in strong demand, a large economy can influence the price it charges and therefore have a non negligible impact on world prices. Part of the tax burden will be then reflected in a rise of p_a.

The Harberger (2006)'s framework indicates that in smaller open economies, where the higher tax burden cannot be absorbed through a general worldwide decline in the rate of return to capital nor reflected in a rise of the price level of the products, the degree of shifting to wages is higher than in larger open economies. This hypothesis should empirically translate in an higher elasticity between corporate tax rates and wages for smaller open economies. We test this prediction in the empirical part by interacting the corporate tax rate with a measure of the relative size of a country in the world capital market and with a measure of the relative size of a country in the world market supply.[6]

3.3 Tax Systems

As emphasised by Auerbach (2006), the analysis of the corporate income tax incidence is complexified by the tax treatment of cross-border capital flows. The intuition of open-economy theoretical models is simple: capital is reallocated abroad in response to the increase in the corporate tax rate to avoid the additional tax burden. However in practice, the incentive to benefit from lower taxes abroad can be significantly limited when capital is taxed on a residence basis as compared to a source basis. A pure worldwide tax system, also called a tax credit system, would indeed not distort the decision about whether to locate investment at home or abroad since companies would be subject to taxation on all income regardless of where that income is earned. Double taxation of the foreign income is avoided by

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[6]Note that introducing imperfect product substitution, as in Gravelle and Smetters (2006), allows even a small open economy to shift part of the tax burden in a rise in p_a relative to p_a^* the external price level. With a rise in p_a, the decrease in wages, p_L, is less important than with a scenario of homogeneous products. In an economy with both homogeneous products and differentiated products, we can however infer that, following an increase in corporate taxes, dp_L will remain higher in a small economy than in a large economy, simply because in a large economy the price of both homogeneous and differentiated domestic outputs can rise.

allowing investors to claim foreign tax credits for income taxes paid in the host country, up to the home statutory tax rate. At the opposite, exempt tax systems calculate corporation tax only on profits made by firms operating domestically, regardless of their nationality. Consequently, profits earned abroad are not subject to the home country corporation tax.

It is worth noting that worldwide tax systems are generally hybrid as they combine elements consistent with capital-export neutrality and with capital-import neutrality. For instance, the possibility to defer taxes until income earned abroad is remitted as dividends to the home country, or the possibility (such as in the United-States) to use the total worldwide foreign income of the taxpayer to calculate the foreign tax-credit limit, provide an incentive to locate in low-tax jurisdictions. Indeed, tax deferral increases the reinvestment in each period (when the foreign taxes are lower than the home country statutory tax rate), and thus increases the net cumulative profit at the end of the period. By averaging foreign tax liabilities, the cross-crediting method provides an incentive for 'excess credit' investors to locate activities in low-tax countries, since taxes imposed by a high-tax country can be used to offset home country taxes on income earned by the same tax payer in the low-tax country. On the other hand, these systems also contain provisions to limit the incentive to locate in low-tax countries, such as anti-deferral regimes for passive income and various sales and services' activities, or cross-crediting limitations that allow averaging within basket only. All in all, one would expect the shifting of corporate taxation to workers to be larger in countries allowing capital allocation to be diverted by taxes, than in countries trying to limit capital distortion due to tax considerations. We test this prediction by distinguishing tax credit systems from tax exempt systems when investigating the effect of corporate taxes on wages.

3.4 Depreciation Allowances

The reallocation of capital in a domestic non-corporate sector or abroad can be significantly influenced by the rate of depreciation allowances in an economy. Any corporate income tax makes some allowances for the amortization of the cost of capital assets. With depreciation allowances, an investor is able to finance a share of its investment from depreciation charges. The larger are the depreciation allowances, the larger is the share of investment that is finance from depreciation charges and the lower is the taxable profit.

Depreciation allowances vary considerably across country and over time, not only in terms of magnitude but in the way they are calculated. Under normal depreciation allowances, the period of depreciation for an asset corresponds to the period of its useful life. The cost of depreciable asset can generally be

written-off in equal annual installments, corresponding to the straight-line method, or with a declining fraction of the original cost, corresponding to the declining-balance method. The deviation of these allowances from economic depreciation can influence the rate of growth of investment, the length of life of assets and thus the replacement of old assets with new ones (Eisner, 1952; Auerbach, 2006). Some countries also provide accelerated allowances which imply a concentration of depreciation allowances in the first years of an asset's life. This acceleration of the rate at which the original cost of an asset can be credited from taxable profit - which is equivalent to a decrease in the cost of the capital asset - is expected to stimulate investment. Indeed, with future depreciation allowances that are higher in present value, new assets are more attractive than old ones (Domar, 1953; Goode, 1955; Auerbach, 2006). In any case, the rate of depreciation allowances, which can be measured by their present discounted value, can facilitate the reallocation of capital following an increase in corporate tax rates. Consequently, they can influence the corporate tax incidence. We empirically test whether the generosity of depreciation allowances can be linked with a higher shift of the corporate tax burden on labour.

3.5 Direct and Indirect Effects

3.5.1 Relative Influence Over the Mobility of Capital

With the exception of the ability of a large country to influence the price of tradables, the country characteristics previously discussed have a point in common: they influence the mobility of capital. (i) *Degree of Openness*. With a potential complementary relationship between trade and capital flows, a larger degree of openness is expected to increase capital mobility. (ii) *Ability to influence the world return to capital*. Regarding the size of an open economy, the mobility of capital from large open economies, as compared to small open economies, is limited by the fact that capital cannot completely escape the burden of the corporate tax since the decrease of the domestic rate of return will generate a worldwide decline in the return to capital. (iii) *Tax systems*. Capital from a tax credit system, where the corporate tax is residence-based, is expected to be less mobile than capital from a tax exempt system, where the corporate tax is source-based. Indeed, the former can hardly escape the tax burden since the profit earned abroad is subject to home country taxation. (iv) *Depreciation allowances*. Finally, by facilitating the reallocation of capital, larger depreciation allowances should enhance capital mobility.

As previously mentioned, the incidence of corporate taxes on wages can be explained by two mechanisms. The first mechanism put forward by the literature is that more capital mobility causes the burden to shift from capital to labour. The decrease in the stock of capital decreases workers' productivity which

in turn reduces their wages. Therefore, shareholders can shift part of the tax burden onto workers indirectly, through a decrease in their productivity. The second mechanism, put forward by Arulampalam et al. (2008), is through wage bargaining. Corporate taxes reduce the economic rents over which firms and workers bargain, affecting thus directly the income of workers. As emphasised by Arulampalam et al. (2008), under the wage bargaining process, the corporate tax can decrease wages even if it has no impact on the quantity of capital used by the firm or on the price of the product sold by the firm. However, by improving a firm's fallback profit, the possibility for the firm to reallocate capital should increase its bargaining power. Hence, country characteristics influencing capital mobility facilitate firms generation of outside options and should strengthens their position in the wage bargaining with unions.

Factors enhancing capital mobility can influence the relationship between corporate tax and wages by both the indirect and direct channels. Based on the theoretical framework developed by Arulampalam et al. (2008), this paper seeks to identify the direct incidence of corporate tax rates on wages. Focusing on the direct incidence presents the advantage to have a simple empirical formalization: productivity is added as a control variable and captures the effects of corporate taxes through the change in capital. The coefficient estimated for corporate taxes measures thus the direct effect of taxes on wages through wage bargaining.

3.5.2 Relative Influence Over the World Price of Output

Finally, the burden of the corporate tax can be affected by a country's ability to influence the price of tradables. In a large country, an increase of the firm's output price would not endanger the activity of the firm. Wages fall less than in a small country because the prices of the output can rise (Harberger, 1995, 2006; Randolph, 2006). Contrary to the small economy scenario where the decrease of wages is the only possibility to maintain the activity of the firm, the existence of this potential passthrough of the corporate tax in large economies is expected to weaken the bargaining position of the firm in their ability to negotiate lower wages.

4 Empirical Model and Data Description

We estimate the relationship between corporate taxation, unit labour costs, and the country characteristics discussed in Section 3, using annual data on the manufacturing sector for a panel of 13 OECD countries:

Australia, Belgium, Canada, France, Germany, Italy, Japan, the Netherlands, Norway, Spain, Sweden, the United Kingdom, and the United States. The period covered is 1980-2004. That can be a shorter period for some countries depending on data availability.

4.1 Basic Model

The basic specification we estimate is based on standard theoretical wage bargaining models, such as Wulfsberg (1997), and is of the form:

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\begin{aligned}
\text{Ln(Wage)}_i^t \;=\;& \alpha_i + \beta_1 \text{Statutory Tax Rate}_i^t + \beta_2 \text{Ln(Value added)}_i^t \\
& + \beta_3 \text{Ln(GDP per capita)}_i^t + \beta_4 \text{Ln(Trade openness)}_i^t \\
& + \beta_5 \text{Unemployment rate}_i^t + \beta_6 \text{Price Wedge}_i^t + \lambda_t + \epsilon_i^t
\end{aligned}
\tag{4}
$$

where α_i denotes country-specific fixed effects, λ_t denotes time dummies; and ϵ_i^t is the error term. Real hourly wage is expected to be negatively related to the variable of interest -the corporate statutory tax rate-, and to be positively and closely related to the hourly value added which proxies for labour productivity. The sign of the GDP per capita variable is ambiguous. A boost in employment and output can be achieved through a reduction in the bargaining power of workers (fall in the replacement ratio) or through a reduction in the market power of firms (increase in the degree of product market competition), leading to changes in the real wage diametrically opposite despite similar outcomes. With the openness of economies, models à la Hecksher-Ohlin predict that countries will modify their production to benefit from their comparative advantage in trade. In so doing, developed countries increase their demand for skilled labour while developing countries increase their demand for unskilled labour. Factor price equalization predicts a convergence of returns to labour and thus a decrease in wages in developed countries. Larger unemployment rate should have a negative effect on wages as the growing lack of outside opportunities reduces the bargaining power of workers. Finally, workers evaluate the wage offers in terms of purchasing power that they will deliver, implying that a wedge between the consumer price index (CPI) and the producer price index (PPI) is likely to raise wage pressures.

The dependent variable is the average hourly direct pay per worker in the manufacturing sector as computed by the Bureau of Labor Statistics (BLS). Values come from the underlying 2006 revised data used by the BLS to construct trend indexes and annual percent changes of output per hour, hourly compensation, unit labour costs in manufacturing for sixteen countries. Data have been prepared specifically

to allow international comparisons of labour costs and productivity in the manufacturing sector and have been described by the International Labour Organisation as the most reliable available series (International Labour Office, 2009). The hourly direct pay corresponds to all payment made directly to the worker, before payroll reduction, consisting in pay for time worked and other direct pay such as holidays, seasonal bonuses, pay in kind (Bureau of Labor Statistics, 2006). The value added also comes from the BLS and corresponds to the average value added per worker in manufacturing. Both measures have been deflated by the manufacturing producer price index (PPI, base year 2000) given in the OECD Factbook 2007. Unemployment rate series come from the IMF World Economic Outlook database (October 2008), the consumer price index (CPI, base year 2000) from the World Bank Development Indicators database, while trade openness (sum of exports and imports divided by GDP) and income per capita come from the Penn World Table v6.2 (Heston et al., 2006). The corporate statutory tax rates come from Devereux et al. (2002).

Figure 1 presents the real average hourly direct pay per worker and the statutory tax rate for each country of the sample. Wages and the level of corporate taxes vary substantially from one country to another, with higher wages in Germany and Norway (approximately $20/hour) and higher levels of corporate tax rates in Belgium, France, Germany, Italy, Japan and the United States (with a statutory tax rate higher than 40%), on average for the 1980-2004 period. Figure 2 shows the average trend of wages and corporate taxes for the 13 OECD countries of the sample between 1980 and 2004. The average level of wages was around $11/hour in 1980 and was at $19/hour in 2004. The average level of corporate taxes was close to 47% in 1980 and had decreased by approximately 13 percentage points to reach 34% in 2004. This figure suggests that the increase of real wages is accompanied by a decrease in corporate tax rates which is close to be symmetrical.

4.2   Country Characteristics

The second step of the exercise consists in examining the effects of some country characteristics on the relationship between corporate taxes and wages.

The following equation is estimated:

Figure 1: Wages and Statutory tax Rates (average for the period 1980-2004)
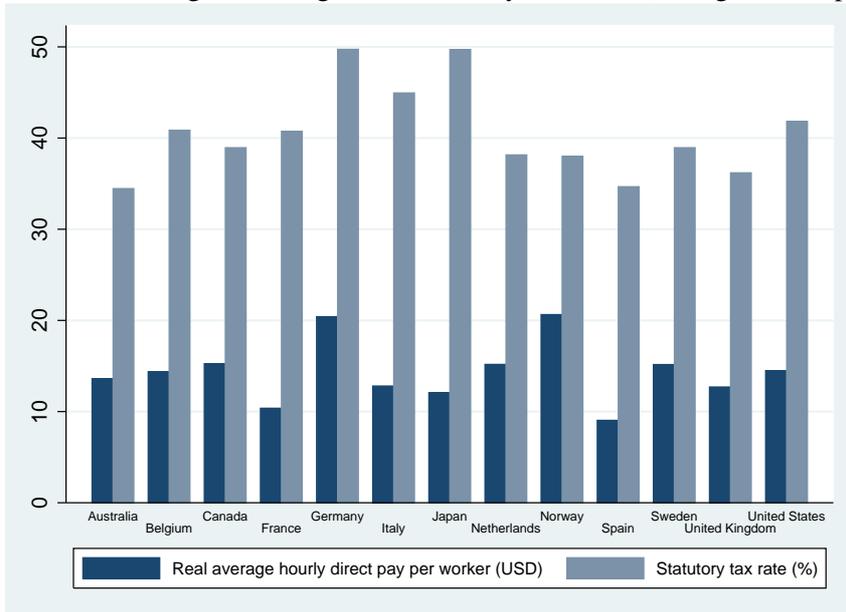
Notes: The average hourly direct pay per worker in the manufacturing sector are from the BLS and are deflated by the manufacturing producer price index (PPI, base year 2000) given in the OECD Factbook 2007. The corporate statutory tax rates come from Devereux et al. (2002).

Figure 2: Wages and Statutory tax Rates Trends over the period 1980-2004 (average for 13 OECD countries)
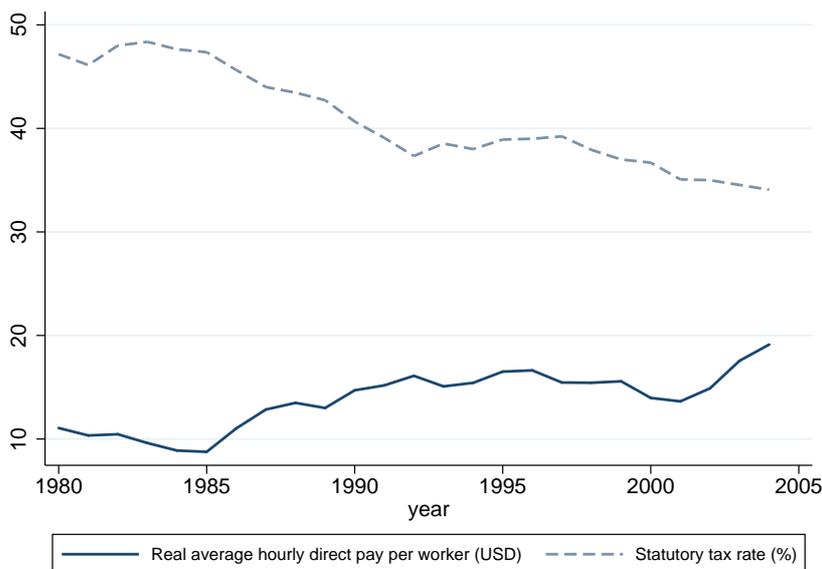
Notes: The average hourly direct pay per worker in the manufacturing sector are from the BLS and are deflated by the manufacturing producer price index (PPI, base year 2000) given in the OECD Factbook 2007. The corporate statutory tax rates come from Devereux et al. (2002).

$$\text{Ln(Wage)}_i^t = \alpha_i + \beta_1 \text{Statutory Tax Rate}_i^t + \beta_2 \text{Ln(Value added)}_i^t + \beta_3 \text{Ln(GDP per capita)}_i^t \quad (5)$$

$$+ \beta_4 \text{Ln(Trade openness)}_i^t + \beta_5 \text{Unemployment rate}_i^t + \beta_6 \text{Price Wedge}_i^t$$

$$+ \beta_7 (\text{Statutory Tax Rate}_i^t * Z_i^t) + \beta_8 Z_i^t + \lambda_t + \epsilon_i^t$$

The baseline equation (4) is completed by an interaction term between the statutory tax rate variable and Z_i^t, corresponding in turn to one of the four following country characteristics: (i) the logarithm of trade openness, (ii) the logarithm of liability share, (iii) the logarithm of export share, and (iv) the depreciation allowances. *Trade openness*. The effect of a country's degree of openness on the incidence of corporate taxes is investigated by interacting the tax variable with the trade openness one. *Logarithm of liability share*. It is commonly accepted that a small country cannot affect the capital rate of return in the world capital market. Empirically, the size of a country can be measured by its position in the international financial integration (Lane and Milesi-Ferretti, 2007). The logarithm of liability share is our measure of a country's ability to influence the world return to capital and corresponds to the ratio of gross stocks of liabilities of a country i to the world stock of liabilities. The stock of liabilities is composed by portfolio equity, foreign direct investment, and debt. These measures are from Lane and Milesi-Ferretti (2007) External Wealth of Nations Database. *Logarithm of export share*. As emphasised by Carbaugh (2009) an economy whose exports constitute a very small portion of the world market supply is also a small country but facing a constant world price level for its exported commodities. The logarithm of export share is our measure of a country's ability to influence the world price of output and corresponds to the ratio of a country i 's exports in goods and services to the world exports of goods and services. These data come from the World Bank. *Depreciation allowances*. The depreciation allowances data are obtained from Devereux et al. (2002). They are measured at their present discounted value with time and country specific inflation rates.[7] The present discounted value of the depreciation allowance represents the percentage of the asset's cost that can be deducted from tax over the expected life of the asset. Its values range between zero, if there are no allowances, and 100% when the entire cost of the asset can be deducted from tax immediately. Figure 3 shows that the present discounted value of allowances vary substantially across country and over time.

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[7]Depreciation allowances are based on the historical cost of the asset and are not subject to adjustments for inflation. As emphasised by Devereux et al. (2002), as inflation has an impact on nominal interest rates, the latter will in turn affect the present discounted value of allowances. To facilitate international and temporal comparisons, depreciation allowances are based on actual inflation rates.

Finally, because our fixed effects model does not allow to control for a variable which does not vary over time, the effect of the tax system on the relationship between wage and corporate taxes is investigated by dividing the sample in two groups: the countries with a tax credit system (Belgium, Italy, Japan, Norway, Spain, Sweden, the United Kingdom, and the United States) and the countries with a tax exempt system (Australia, Canada, France, Germany, Netherlands). Summary statistics are given in Table 1.

Figure 3: Present Discounted Value of Depreciation Allowances
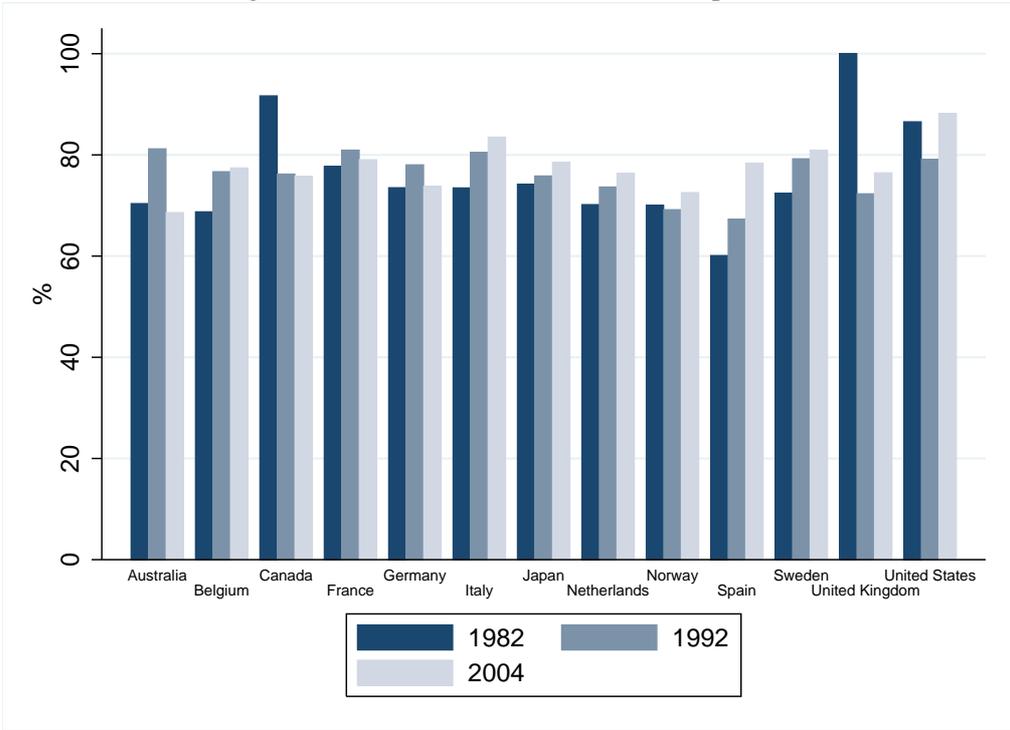
Source: The data are from Devereux et al. (2002).

5 Empirical Results

5.1 The Incidence of Corporate Tax Rates on Wages

Table 2 presents the results of the basic specification (4). Leverage observations and outliers have been removed using a Cook's D test. Column (1) indicates that the coefficients on value added, price wedge and trade openness variables have the predicted sign and are statistically significant. Therefore, higher labour productivity or a positive price wedge are associated with higher wages. In line with a Hecksher-

Table 1: Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Ln wage	288	2.58	0.34	1.45	3.32
Statutory tax rate	288	0.40	0.08	0.28	0.60
Ln value added	288	3.37	0.33	2.20	4.04
Ln GDP per capita	288	9.98	0.20	9.38	10.46
Ln trade openness	288	3.96	0.56	2.77	5.11
Unemployment rate	288	0.08	0.04	0.02	0.24
Price wedge	288	-0.06	0.11	-0.37	0.11
Ln liability share	288	0.05	0.05	0.004	0.22
Ln export share	288	0.04	0.03	0.01	0.13
Depreciation allowances	288	0.77	0.06	0.59	1.00

Ohlin framework, trade openness has a negative effect on wages; an effect that can be interpreted as a consequence of the increased competition from developing countries in the production of manufacturing goods. The positive sign of GDP per capita tends to indicate that growth in OECD countries has been partly achieved by an increase in the degree of product market competition which have weakened the bargaining power of firms. The unemployment rate is unexpectedly insignificant and has the wrong sign.

With the inclusion of the value added in Column (1), we estimate the direct effect of corporate tax rates on wages, through the wage bargaining channel. The statutory tax rate variable has an expected negative sign but is only statistically significant at the 10% level. The magnitude of its coefficient indicates that a 1 percentage point increase in corporate taxes decreases wages by approximately 0.1%. This elasticity is substantially lower than the elasticity estimated by previous empirical studies. The most comparable results are those of Hassett and Mathur (2006) and Arulampalam et al. (2008), since they both control for labour productivity. With aggregated data from 72 developed and developing countries over the 1981-2003 period, Hassett and Mathur (2006) find that a 1 percentage point increase in the statutory tax rates leads to a fall in wages by 0.8% to 1%. In their report for Congress, Gravelle and Hungerford (2007) calculate that with a corporate tax revenue collected at about 2.5% of GDP and a labour income at about two third of GDP, such an elasticity implies that a 1 dollar increase in corporate tax would reduce wages by 22 to 26 dollars.[8] For comparison, on average for the 13 OECD countries in 2004, corporate tax revenue represented 3.7% of GDP, labour income about two third of GDP, and

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[8]According to Gravelle and Hungerford (2007), the improbable magnitude of their results can be explained by an inappropriate measure of the wage variable which is in nominal term. By replicating Hassett and Mathur (2006) tests with a real wage variable, Gravelle and Hungerford (2007) obtain a lower coefficient (-0.51) which looses considerably in statistical significance. The noisy value added variable, which is calculated from three different sources, can be an additional reason for these large effects. If the value added variable used diverges from the true value added variable, the corporate tax coefficient is likely to capture part of the indirect effect of taxes on wages through changes in labour productivity.

the statutory tax rate was at 34%.[9] With a mean GDP of 2.243 trillion dollars and assuming a constant tax base, an increase of 1 percentage point of the statutory tax rate (from 34% to 35%), which decreases wages by 0.1%, implies that a 1 dollar increase in taxes reduces wages by 0.6 dollar. With firm level data for 9 European countries[10] over the period 1996-2003, Arulampalam et al. (2008) find that a 1 dollar increase in taxes decrease compensations by 0.96 dollar.

Note that the inclusion of the value added in Column (1) does not allow to measure the indirect effect of corporate taxes on wages, through labour productivity. The overall effect, i.e. through wage bargaining and through changes in labour productivity, can be roughly estimated by removing the value added variable. By removing the intervening variable, the decline of capital which lowers labour productivity should be captured by the statutory tax rate coefficient which absolute size is expected to increase. Column (2) presents an estimation of the incidence of corporate taxes on wages when the value added variable is deleted. With an elasticity of -0.265, the magnitude of the tax coefficient is higher in Column (2) than in Column (1) and its level of significance is improved.[11] Even if statistically we cannot reject the null hypothesis that both coefficients are similar, quantitatively, the magnitude of the tax coefficient tends to indicate that corporate taxes have an indirect effect on wages through changes in value added and that controlling for value added along with corporate taxes underestimates the tax incidence. As in Betts (1995) when investigating the relationship between high school quality, education and earnings, one can think of the coefficient of the tax variable as a upper bound of the effect on wages. The magnitude of the labour's burden can again be calculated using average values (for our 13 OECD countries) of GDP (2.243 trillion dollars), corporate tax rates (34%), and corporate fiscal receipts as a share of GDP (3.7%) for 2004. With these values, the elasticity of -0.265 between wages and corporate taxes implies that a 1 dollar increase in taxes decreases wages by 1.6 dollars.

Are these results close to what is predicted by the theoretical literature on corporate tax incidence? Calculating the labour's burden for the U.S. case would allow us to compare our results with the simulations of Harberger (1995), Randolph (2006), Harberger (2006) and Gravelle and Smetters (2006). With different assumptions about capital intensities, output shares, perfect or imperfect product substi-

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[9]The data on corporate tax revenue as a percentage of GDP comes from the OECD.

[10]Belgium, Finland, France, Germany, Italy, the Netherlands, Spain, Sweden and the UK.

[11]This result has to be interpreted with cautious since this estimation suffers from an omitted variable bias. Because the omitted value added variable is correlated with the statutory tax rate (-0.35), the latter variable is thus correlated to the error term leading to an OLS estimator which is inconsistent. The direction of the bias can be estimated. With $\beta_1 < 0$ and a negative correlation between the statutory tax rate and the value added, OLS with the statutory tax rate alone overstates the effect of corporate taxes on wages. The size of the bias is however expected to be limited by the presence of the GDP per capita which is strongly correlated with the value added (0.70).

tution, or about the measure of the burden (sources of income versus a combination of sources and uses of income), their theoretical models suggest that labour bears 200% to 250% (Harberger, 1995), 74% (Randolph, 2006), 96% (Harberger, 2006), or 21% (Gravelle and Smetters, 2006) of the U.S. corporate income tax. In 2004, with a GDP of 11.63 trillion dollars, a corporate tax revenue of 2.52% of GDP, a corporate tax rate of 39% and a labour income of 69% of GDP[12], a 1 dollar increase in taxes causes wages to fall by 1.02 dollars (with an elasticity of -0.096) to 2.84 dollars (with an elasticity of -0.265, upper bound). These results are close to what is predicted by Harberger (1995) and Harberger (2006).

To address the issue of a potential bias due to endogeneity, we estimate the first-difference of equation (4) using two-stage least squares in which the first-difference of the tax variable has been instrumented by its first lag (Column (3)). Such an instrument is permitted in first-difference by the absence of autocorrelation of the first-differenced errors. The large Cragg-Donald Wald F statistic suggests that the instrument is valid. However, a Durbin-Wu-Hausman test cannot reject the exogeneity of the corporate tax variable, suggesting that the OLS estimator is consistent and more efficient than the IV estimator (the variance of the OLS estimator being smaller than the IV one).

5.2 Country Characteristics and The Incidence of Corporate Tax Rates on Wages

Table (3) presents several variants of the equation (5) where the influence of five country characteristics are in turn tested. In Column (4) we test the assumption that the magnitude of the tax burden that is shifted from capital to labour would increase with a country degree of trade openness. The statutory tax rate is thus interacted with trade openness. The interaction term has the expected sign and is statistically significant at the 10% level. Following Brambor et al. (2006), we calculate meaningful marginal effects and their corresponding standard errors and presents the findings in Figure (4). The central line represents the elasticity of corporate taxes with respect to wages for different values of trade openness, and the upper and lower dashed lines correspond to the bounds of a 95% confidence interval. The figure shows that the impact of a rise in corporate taxes on wages increases with the degree of openness. The elasticities are statistically significant when the logarithm of trade openness ranges between 4 and 5.11, corresponding to countries such as Belgium, Canada, France, Italy, Germany, Norway, Netherlands, Spain, Sweden, and the United Kingdom. The minimum and maximum shifts correspond respectively to a fall in real wages by about 0.09% and 0.25% following a 1 percentage point rise in the statutory tax rate.

In Columns (5) and (6) we test the small country effect. The shift of the tax burden from capital

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[12]This data comes from Timmer et al. (2003) Total Economy Growth Accounting Database.

Table 2: The Incidence of Corporate Tax Rates on Wages

	Direct incidence All (1)	Overall incidence All (2)	Instrumentation* All, IV (3)
Statutory tax rate	-0.096^c	-0.265^b	-0.062
	(0.053)	(0.126)	(0.159)
Ln value added	0.761^a	-	0.836^a
	(0.022)	-	(0.024)
Ln GDP per capita	0.361^a	-0.140	-0.174
	(0.084)	(0.199)	(0.116)
Ln trade openness	-0.263^a	-1.090^a	-0.263^a
	(0.037)	(0.067)	(0.039)
Unemployment rate	0.144	-1.033^a	-0.691^a
	(0.163)	(0.384)	(0.199)
Price wedge	0.916^a	1.761^a	0.539^a
	(0.073)	(0.164)	(0.088)
Constant	-2.567^a	8.645^a	0.018^b
	(0.957)	(2.053)	(0.007)
Observations	288	288	263
Number of countries	13	13	13
R-squared	0.98	0.90	0.97
Autocorrelation test AR(1) p-value	-	-	0.4534
Autocorrelation test AR(2) p-value	-	-	0.8554
Cragg-Donald Wald F statistic	-	-	21.304
Exogeneity test p-value	-	-	0.275

Notes: The letters "a", "b" and "c" indicate respectively a significance level of 1, 5 and 10 percent. Standard errors are in parenthesis and time dummies are included. The price wedge corresponds to $ln(CPI) - ln(PPI)$. * The first-difference of equation (4) is estimated using two-stage least squares in which the first-difference of the tax variable has been instrumented by its first lag.

to labour is expected to increase with a country inability to influence the world return to capital nor the terms of trade. The liability share variable, which measures the relative size of a country in the world capital market, and the export share variable, which measure the relative size of a country in the world market supply are interacted with the statutory tax rate respectively in Columns (5) and (6). Both interaction terms have the expected sign.[13] Figures (5) and (6) show that the magnitude of the negative effect of corporate tax rate on wages decreases with the size of an open economy. Figure (5) indicates that the elasticity is only statistically significant when the logarithm of liability share is between 0.004 and 0.05, corresponding to countries such as Norway, Sweden, Australia, Spain, Belgium, Canada, Italy, Netherlands and Japan. Then, following an increase of the corporate tax of 1 percentage point, wages decline between 0.12% and 0.09%, depending on a country's relative influence over the world capital market. Regarding now Figure (6), the elasticity between wages and corporate taxes is statistically significant when the logarithm of export share is comprised between 0.01 and 0.065, corresponding to Norway, Australia, Sweden, Spain, Belgium, the Netherlands, Canada, Italy, France and the United Kingdom. Therefore, depending on a country's relative influence over the world price of output, wages fall by about 0.24% to 0.13%, following a 1 percentage rise in corporate taxes.

In Columns (7) and (7') the effect of corporate taxes on wages is tested by distinguishing countries with a tax credit system from countries with a tax exempt system. With the assumption that a residence-based capital tax limits the mobility of capital, since the burden of the tax can hardly be avoided by investing in a foreign country, the elasticity between wages and corporate taxes is expected to be higher in tax exempt systems than in tax credit systems. Columns (7) and (7') not only show a difference in magnitude between both elasticities but also indicate a difference in terms of statistical significance. These results suggest that the burden of a residence-based capital tax falls on capital, whereas the burden of a source-based capital tax falls on labour.

In Column (8), we finally investigate the role played by the level of depreciation allowances, which is supposed to facilitate capital mobility. The statutory tax rate is interacted with the present discounted values of depreciation allowances. The interaction term has the expected sign, indicating that the shift of the corporate tax burden to workers is higher the larger the depreciation allowances. With elasticities statistically significant when depreciation allowances are higher than 0.73, which concerns at some point the 13 countries of the sample, Figure (7) indicates that a 1 percentage point increase of corporate taxes

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[13]Note that the coefficients and the standard errors of both interaction terms, as displayed in Table (3), measure the effect of corporate taxes on wages when liability share and export share equal zero. This is not interesting since the minimum value of both variables is higher than zero.

Table 3: The Incidence of Corporate Tax Rates on Wages: Country Characteristics

	Openness	Small country effect		Tax systems		Dep. allowances
		World capital market	Tradables			
	All	All	All	Tax credit	Tax exempt	All
	(4)	(5)	(6)	(7)	(7)'	(8)
Statutory tax rate (STR)	0.488	-0.120^b	-0.259^a	-0.071	-0.243^b	1.476^a
	(0.309)	(0.059)	(0.071)	(0.065)	(0.103)	(0.475)
Ln value added	0.761^a	0.757^a	0.746^a	0.799^a	0.806^a	0.759^a
	(0.022)	(0.022)	(0.023)	(0.032)	(0.036)	(0.022)
Ln GDP per capita	0.340^a	0.421^a	0.280^a	0.322^a	-0.651^a	0.301^a
	(0.085)	(0.086)	(0.090)	(0.110)	(0.216)	(0.084)
Ln trade openness	-0.201^a	-0.267^a	-0.312^a	-0.221^a	-0.427^a	-0.320^a
	(0.049)	(0.037)	(0.041)	(0.053)	(0.072)	(0.039)
Unemployment rate	0.136	0.102	-0.132	0.136	-1.825^a	-0.087
	(0.163)	(0.167)	(0.177)	(0.202)	(0.382)	(0.179)
Price wedge	0.934^a	0.944^a	1.002^a	0.912^a	0.463^a	0.842^a
	(0.073)	(0.073)	(0.076)	(0.101)	(0.132)	(0.077)
STR*Ln trade openness	-0.145^c					
	(0.076)					
STR*Ln liability share		0.686				
		(0.760)				
Ln liability share		-0.942^b				
		(0.440)				
STR*Ln export share			1.974			
			(1.401)			
Ln export share			-0.457			
			(1.016)			
STR*Dep. allowances						-2.105^a
						(0.620)
Dep. allowances						1.004^a
						(0.272)
Constant	-2.609^a	-3.109^a	-1.444	-2.507^b	8.534^a	-2.449^a
	(0.952)	(0.968)	(1.026)	(1.235)	(2.369)	(0.940)
Observations	288	288	288	192	95	288
Number of countries	13	13	13	8	5	13
R-squared	0.98	0.98	0.98	0.98	0.99	0.98

Notes: The letters "a", "b" and "c" indicate respectively a significance level of 1, 5 and 10
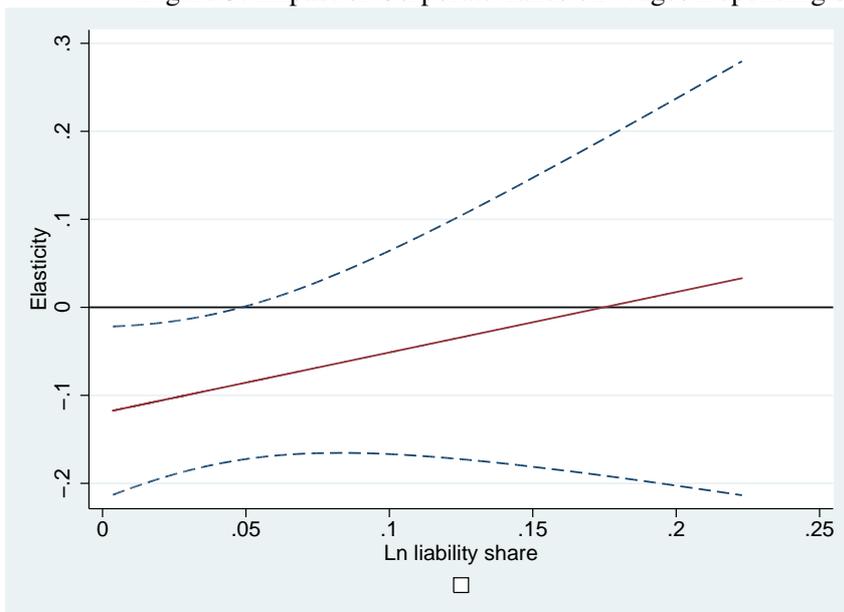percent. Standard errors are in parenthesis and time dummies are included.

Figure 4: Impact of Corporate Taxes on Wages Depending on the Degree of Trade Openness
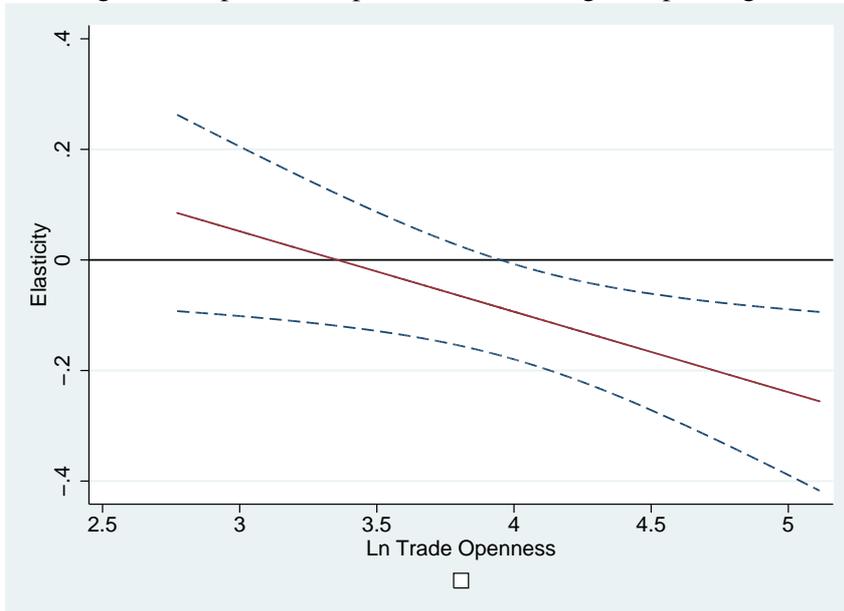
Figure 5: Impact of Corporate Taxes on Wages Depending on the Liability Share

Figure 6: Impact of Corporate Taxes on Wages Depending on the Export Share

Notes: The center line corresponds to the
elasticity between corporate tax rates and wages. The dashed lines correspond to the upper and lower bounds of a 95% confidence interval.
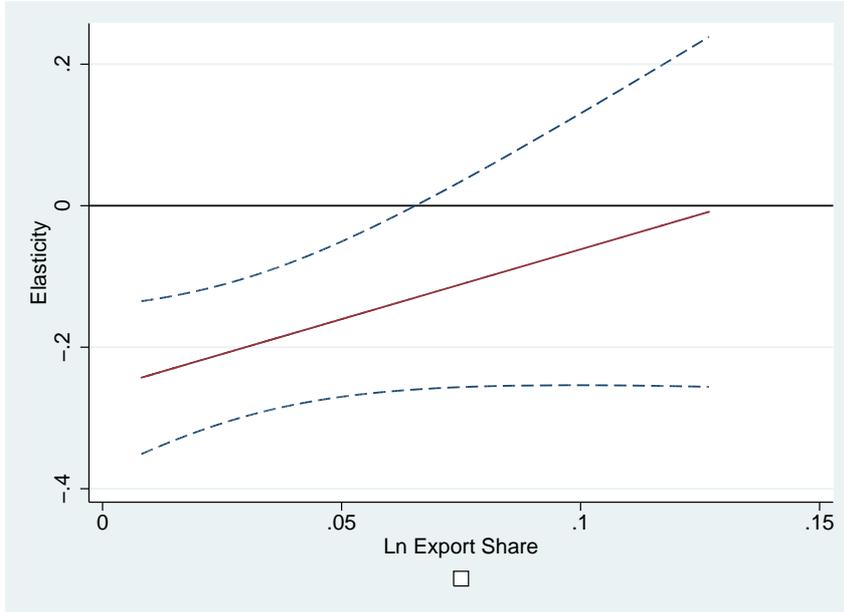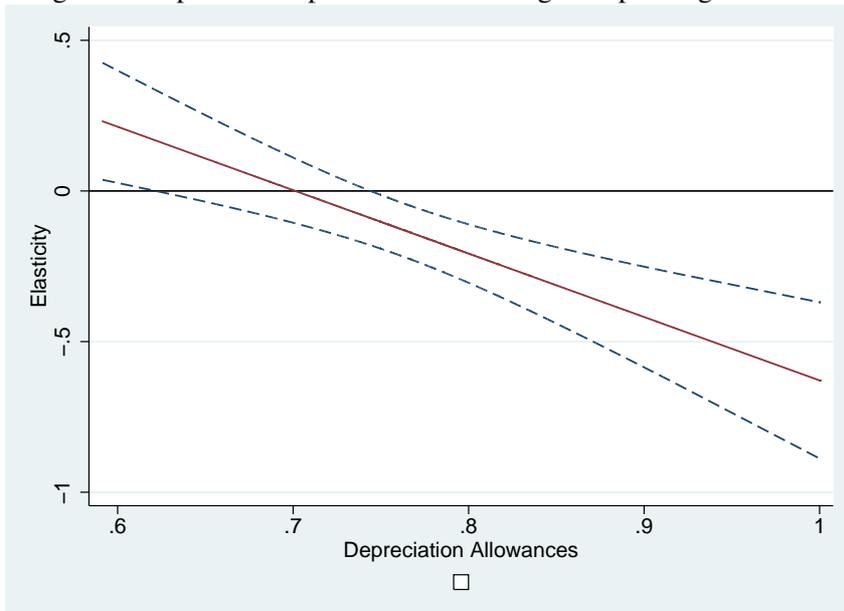
Figure 7: Impact of Corporate Taxes on Wages Depending on the Level of Depreciation Allowances

Notes: The center line corresponds to the
elasticity between corporate tax rates and wages. The dashed lines correspond to the upper and lower bounds of a 95% confidence interval.

decreases wages by -0.06% to -0.63% depending on the generosity of depreciation allowances.

6   Conclusion

This paper has showed that a substantial share of the corporate tax burden can be shifted from capital to labour and that the magnitude of the shift is significantly determined by country characteristics influencing the mobility of capital and the world price of output. The domestic labour's burden is increasing with the degree of trade openness, and with the level of depreciation allowances, and is decreasing with the size of an economy in the world capital market and in the world market supply. It is also considerably reduced when the corporate income tax is residential-based. These results suggest that in a small open economy with a tax exempt system and generous depreciation allowances, the domestic labour cost due to a change in the corporate tax can largely exceed the fiscal receipts generated. These results give credence to Gordon (1986). Economies with these characteristics might be better off taxing immobile labour directly to avoid inefficiencies caused by a corporate tax. In line with Gravelle and Smetters (2006), the results also suggest that an open economy does not necessarily imply that labour bears the burden of a capital income tax. To the extent that capital is less mobile internationally, domestic labour's burden would therefore be lower.

One point that has been left out of our discussion is to what extent the burden estimated would be higher in the long-run. It is not unreasonable to expect that the capital adjustment and the wage bargaining process following a change in corporate taxes might take time. The magnitude of the elasticities estimated suggest however that the integrality of an increase in corporate tax can be passed on in lower wages in the short-run. This occurs when the cost for labour is higher than the fiscal receipts generated by the increase in corporate tax. Arulampalam et al. (2008) tend to confirm these results as they find that the whole shift from capital to labour happens within one period. According to Harberger (2006), the transfer of the burden is faster, the smaller is the increase in the corporate tax: "*with a tiny tax change, the needed adjustment of the capital stock might turn out to be possible almost instantaneously, and without any extra cost. In such a case we might jump to the long-run equilibrium solution in a single period*" p31. In our study, with 80% of the tax changes which are lower or equal to 5 percentage points (with more of one thirds of these changes corresponding to 1 percentage point) and less than 10% which are higher than 10 percentage points, considering that the elasticity estimated captures the ultimate effect of corporate tax on wages, is not unreasonable.

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