Taxes and Wages

By
Kevin A. Hassett[1]
American Enterprise Institute

and

Aparna Mathur[2]
American Enterprise Institute

We thank Alan Auerbach, Steve Davis, Jason Cummins, Doug Holtz-Eakin and seminar participants at the AEI conference on "Corporate Income Taxation and the Economy" for helpful comments, and Anne Moore, Kathryn Newmark, Gordon Gray and Batchimeg Sambalaibat for excellent research assistance. We also thank numerous interns who worked on the International Tax Database.

[1] Email: khassett@aei.org
[2] Corresponding author. Email:amathur@aei.org

Abstract

Using panel data for 72 countries and 25 years, we explore the link between taxes and manufacturing wages. We find, controlling for macroeconomic variables that have been found in the literature to influence wages, statistically significant evidence that wage rates are not responsive to median or average income tax rates. We find that wages are significantly responsive to corporate taxation, and that the responsiveness of wages to corporate taxation is larger in smaller countries. We also find that tax and wage characteristics of neighboring countries, whether geographic or economic, have a significant effect on domestic wages. These results are consistent with the frequently employed assumptions in the public finance literature that capital is highly mobile, but labor is not. Under these conditions labor will bear the burden of labor taxes, and bear or share the burden of capital taxes.

Our baseline estimates indicate that the elasticity of wages with respect to top national corporate tax rates is on average (negative) 0.85. However, using other measures of corporate taxation such as effective average and effective marginal tax rates (which account for depreciation allowances, inflation and discount rates), the estimated elasticity is close to 0.50. As we show in the paper, these estimates are in line with those predicted by the Solow wage equation using conventional estimates of the elasticity of investment with respect to corporate taxation.

JEL Codes: F21, H2, J3, C3

I. Introduction

Taxes distort incentives for economic agents. Corporate taxes raise the cost of capital for the business owner, thus reducing the demand for capital.[3] However, the incidence of the corporate tax need not fall solely on capital. Lower investment in capital may lead to lower capital per worker, lower worker productivity, and lower real wages. [4] Similarly, personal income taxes distort the work-leisure decision for workers. High personal taxes may discourage participation in the labor market, thus reducing the supply of labor. However, if labor supply is sufficiently elastic, workers may pass on a share of the tax to capital in the form of higher wages. Hence both corporate taxes and personal income taxes may affect wages, through their impact on labor. While there have been some studies relating personal income taxes and wage rates, this is the first study that sets out to empirically determine whether any part of the corporate income tax burden is shifted from firms to workers in the form of lower wages.

There is ample evidence linking national corporate tax rates to investment levels. Cummins, Hassett and Hubbard (1994) have documented the negative correlation between effective *marginal* corporate tax rates and investment across a large panel of countries. If investment and capital formation are a function of corporate tax rates, then worker productivity and wages may be as well. To date, this link has not been the subject of detailed econometric analysis. This paper fills that gap in the literature, and explores the relationship between corporate tax rates and wage rates.

[3] Corporate taxes have other distorting effects as well. They distort choices related to organizational form of the business, lead to reliance on debt financing of firms and discourage dividend payouts (Hines, 2001)
[4] See Auerbach (2005) for a more recent analysis of who bears the burden of the corporate tax.

Capital taxation does not occur in a vacuum. Accordingly, it is important to explore not only the impact of levels of tax variables, but also the impact of *relative* tax variables for competing countries. Hence our analysis extends existing studies on wage determination by allowing for tax "competition" to influence wages i.e we allow taxes in competitive neighbor countries to influence domestic wage levels.[5]

The effect of personal income taxes on work activity has been extensively studied in the literature. Davis and Henrekson (2004), among others, find that higher tax rates reduce work time in the market sector. However, to our knowledge, there are no studies linking personal income tax rates and manufacturing wage rates using cross-country data.[6] Taken in this context, our paper fits into the larger public finance literature relating the tax on a commodity to its price. Poterba (1996) and Besley and Rosen (1994) examine the impact of sales and local taxes on prices of commodities, in order to analyze how much of the price increase due to the tax is actually shifted to consumers. If retail prices rise by exactly the amount of the tax, there is evidence of full tax shifting. Along the same lines, we aim to study the effect of an increase in labor income taxes on the price of labor, and whether there is any evidence to suggest that tax increases are shifted to capital through higher wages, thus transferring some of the burden from labor to capital.

Accordingly, the paper addresses two main questions: Do tax rates, corporate and personal income, systematically affect wage rates? Are wages in the domestic economy

[5] Note that tax competition has been traditionally modeled as countries responding to other countries corporate tax rates by lowering their own, to attract investment. Our notion of tax competition refers to the flow of capital across countries in response to *existing* differences in tax levels. Such mobility is implicitly, rather than explicitly, modeled since we're studying wage determination in mostly open economies.

[6] For individual country or state-level studies see Gauthier and Paul (2002), Feldstein and Vaillant (1998) and Gruber (1997). Also see Nunziata (2001) for a review of cross-country studies linking taxation and wages. These studies consider only OECD countries and are not specific to the manufacturing sector.

affected by taxes and wages in competing economies? These questions are addressed using a sample of developing and developed economies. Our empirical results indicate that domestic corporate taxes are negatively and significantly related to wage rates across countries. We also find that higher average wages in a country's neighbors leads to higher domestic wages. Further, high corporate taxes in competing countries also lead to higher domestic wages. Taken together, our results suggest that capital moves from high tax to low tax countries, and affects wages.

Our results for personal income taxes are surprising. We find that tax rates do not significantly impact wage rates. This is consistent with a model wherein no part of the increase in labor taxes is passed onto wages. In such a model, labor bears the entire burden of the tax.

Section II provides a brief theoretical background and literature survey. Section III discusses the data and presents summary statistics. Section IV discusses regression results. Section V concludes.

II. The Linkage Between Capital Taxation and Wages

Since the theoretical linkage between labor taxes and the supply of labor (and hence wage rates) is fairly straightforward, we will focus the discussion in this section on capital taxes and wages. There are many *ex ante* reasons to expect that the linkages between capital taxation and the welfare of workers could be significant. Relying, for example, on the Solow model with a Cobb-Douglas production function with labor-augmenting technology, we can show that wages are affected by k, the capital stock per worker and A

the level of technology.[7] The more capital per worker (the greater the value of *k*), the greater is the wage. Therefore, a lower corporate tax may lead to a larger capital stock, which may benefit those people at the lower end of the income distribution, who only earn labor income.

The effect might be immediate if there were no capital adjustment costs, but these are likely to be important in practice. It is not plausible that enough capital could flow into a country in a single year to dramatically alter the marginal product of labor, although the effect could be quite large in a very small and undeveloped country. Accordingly, we will look for these effects over longer time horizons, giving the capital stock time to adjust to the lower tax rates. We will also separately study the effects for small economies.

Capital and wage linkages can, in theory, be quite significant, and can lead to counterintuitive results. Mankiw (2001), for example, develops a simple model wherein a union that can dictatorially set taxes on capital and labor chooses optimally to set the capital tax to zero, even though its objective is simply the maximization of wages. In Mankiw's (2001) model, there are two distinct types of agents: workers and capitalists, and two types of taxes: capital taxes and labor taxes. Since workers outnumber capitalists, and the hypothesized economy is a democracy, workers effectively get to dictate the tax on capital and labor to maximize their own welfare. Mankiw shows that even in this context workers would optimally choose to set the capital tax to zero. The intuition is that workers would be better off with a higher capital stock, since that would

---

[7] $w = \frac{\partial Y}{\partial L} = (1-\alpha)A^{1-\alpha}k^{\alpha}$

increase worker productivity and feed through to wages. The theoretical case for zero capital taxes is explored in great detail in two recent reviews (Auerbach and Hines, 2000; Judd 2001).

Of course, the link would not be interesting if capital flows were unresponsive to tax variables, but the opposite appears to be the case. Indeed, as mentioned earlier, there are numerous studies linking corporate tax rates to investment levels, both at a domestic and at an international level. The empirical literature discussed in Hassett and Hubbard (2002), has generally found that effective marginal tax rates significantly impact capital formation.

In addition, relative treatment across countries changes significantly over time. After large reductions in statutory corporate tax rates by Ireland, UK and USA in the mid 1980's, other OECD countries also cut their rates perhaps out of a concern that they would lose investments.[8] The international tax literature, recently summarized by Gordon and Hines (2002) and Devereux and Griffiths (1998) finds that mobile capital may often flow to low tax jurisdictions. Cross-sectional studies such as Grubert and Mutti (1991) and Hines and Rice (1994) estimate the effect of national tax rates on the distribution of aggregate American-owned property, plant and equipment in 1982. They report a negative elasticity with respect to local tax rates. If there is a drop in investment in relatively high-tax countries, this would reduce the amount of capital available to workers and thus reduce real wages in that country. Hence if tax competition is prevalent, then investment may not only be influenced by the level of rates but also by relative rates.

To move to an empirical model of wages, one needs to model the linkage between specific corporate tax variables and capital formation. The literature suggests that

[8] "Corporate Income Tax Rates: International Comparisons", November 2005, CBO

marginal tax rates may not be the only relevant variable. Corporate income taxes may also distort the incentives for *international* investment and create opportunities for international tax planning. If firms locate plants in low-tax jurisdictions, and plant location is the decision at the margin, then average tax rates may play an important role in determining international capital flows, and wages. Devereux and Griffiths (1998) concludes that the effective *average* tax rate plays an important role in the choice of investment location within Europe. However, they do not find a significant role for effective marginal tax rates.

Tables 2 and 3 report the top statutory corporate tax rates and average hourly wage rates for a subset of the countries in our sample. There is considerable variation in corporate tax rates across countries. For example, in 1981, Australia had a top corporate tax rate of 45 percent, while Bolivia's highest rate was 30 percent. Also, there has been considerable variation in corporate tax rates over time; corporate tax rates have tended to decline over the last twenty years. For instance, among the OECD economies, Australia experienced a decline in corporate tax rates from 46 percent in 1985 to 30 percent in 2001. Over the same period, among non-OECD economies, Chile experienced a drop from 46 percent to 16 percent. These movements are also apparent in effective average and effective marginal tax rates (Figure 1).[9]

At the same time, average hourly wage rates, which are affected by many things in addition to tax rates, have generally increased over time for most countries (Figure 2). In Australia, the average dollar wage per hour went up by 17.5 percent over this period, while in Chile, the corresponding increase was 18.75 percent. Figure 2 also shows a

[9] An effective marginal tax rate is the percentage of the income from a marginal investment that must be paid as corporate income taxes. These rates are affected by rules for depreciation of productive assets and other features of the tax code.

downward trend in average personal income tax rates. The decline has been steeper for the OECD economies, but the OECD economies, on average, experienced higher rates of personal taxation than non-OECD economies.[10]

To date, studies seeking to explain the cross-country variation in wage growth have not focused on the role of capital taxation. Rodrik (1999) finds that there is a robust and statistically significant association between the extent of democracy and the level of manufacturing wages in a country. This holds even after controlling for labor productivity and per capita incomes. Freeman and Ostendorp (2000) explain cross-country differences in terms of the level of gross domestic product per capita and unionization and wage setting institutions. Rama (2003) concludes that in the short run, wages fall with openness to trade and rise with foreign direct investment, but after a few years the effect of trade on wages is reversed. At a micro level, the widening wage distribution in the United States has been explained in terms of de-unionization and the erosion of the real value of the minimum wage (DiNardo, Fortin and Lemieux, 1996). Card, Kramarz and Lemieux (1996) similarly emphasize labor market rigidities as important factors. Katz (1999) points to the increasing use of computers and computer based technologies as affecting the relative demand for skilled workers, and wage inequality. Other papers, such as Davis and Henrekson (2004) study the effect of high personal income tax rates on hours worked in the market sector and other labor market outcomes. Some papers also study the effect of foreign direct investment on wage determination in a spatial setting. Feenstra and Hanson (1995) find that increased foreign direct investment in Mexico, just across the US border, caused an increase in the relative

[10] More recent data on wages and tax rates are missing for certain countries.

wages of skilled workers, in *both* countries along the border. They, however, did not explicitly model or estimate this relationship using regression analysis or spatial econometrics techniques.

III. Data and Empirical Model

The data cover the period 1981-2005 and include 72 countries.

Our regression specification is guided by Rodrik (1999) and the standard labor literature mentioned earlier on wage determination, but we introduce several modifications that are relevant for our study. [11] To enable cross-country comparisons, we estimate a fixed effects model with the (five year average) Log wage rate per hour (in manufacturing) as the dependent variable, and (unlike Rodrik) beginning of period values of other variables such as Log Corporate Tax Rates, Log Value Added (per worker in manufacturing) and Log consumer price index as the independent variables. We use beginning of period (or lagged) values of the independent variables since in our model corporate taxes only indirectly affect wages, by first affecting the capital-labor (K/L) ratio. Thus the response of wages to corporate taxation depends first on the speed with which capital-labor ratios adjust to corporate taxation, and second, the speed with which wages adjust to changes in productivity as a result of changes in K/L. Domestic firms may respond to lower corporate taxes by increasing their stock of capital and theory suggests that this adjustment may not be instantaneous. Global capital may be more flexible, but will only gradually flow into the low-tax country thereby increasing the stock of domestic capital. Wages will respond to this increase in capital-labor ratios with some lag as firms observe

[11] We discuss later why we do not include democracy as an explanatory variable, which Rodrik (1999) does.

productivity gains and workers renegotiate fixed wage contracts. Hence we look for changes over long periods of time.

We also include fixed year effects which capture the contemporaneous correlation across countries. Following Devereux et al. (1999) we present results with different measures of the corporate tax rates, such as the top national corporate tax rate, the effective marginal (EMTR) and the effective average corporate tax rate (EATR). The EMTR equates the net present value of the income stream generated by a particular investment to the net present value of the cost of the investment. The EATR summarizes the distribution of tax rates for an investment project over a range of profitability, with the EMTR representing the special case of a marginal investment. We computed the EATR and the EMTR for all countries in the sample and for each time period using the methodology outlined in Devereux et al (1999), assuming fixed parameter values for the economic depreciation rates, the inflation rate and the annual discount rate. [12]

In addition, we present results with the spatial variables included in the analysis, such as weighted average tax rates and weighted average wage rates. These capture the effect of spatial tax competition and spatial wage effects across countries.

The dependent variable in the empirical analysis is the average dollar wage earned in manufacturing per hour. The main source of data on wages is the Labor Statistics database available from the International Labor Organization (http://laborsta.ilo.org/). This source provides information on wages for a broad sample of countries, for the period 1981-2005. These figures are provided in local currency terms and we have converted

[12] To calculate EATR and EMTR, we assume an economic depreciation rate of 12.25%, a real annual discount rate of 10% and an expected annual inflation rate of 3.5% for all countries and all years. These are the assumptions made by Devereux, Griffith and Klemm (2002b). Author calculations are available upon request.

them to US dollars using exchange rates provided by the Penn World Tables. (For a detailed explanation of the wage data, see Appendix) The dependent data are therefore in nominal terms, although a price deflator is also included in the regression. That is, we take a specification for the real wage, and rearrange it so that the deflator is an explanatory variable. We tried specifications with the real wage as the dependent variable i.e the nominal wage deflated by the CPI. Results were similar.

International comparability of the data is made possible through use of various controls for differences in coverage and definitions. In most countries, the statistics on wages refer to "wages and salaries" which include direct wages and salaries, bonuses and gratuities, etc whereas in some countries they refer to "earnings", which include, more broadly, all compensation such as paid leave, pension and insurance schemes. We then converted these total wage payments to hourly wage payments by dividing by the total number of hours worked, data for which was again obtained from the ILO.[13] We check for the robustness of empirical results when controls for differences in coverage are included. Average wages have been rising over the period 1981-2005 for all countries, though there is wide variation in countries both cross-sectionally and over time.[14]

The other key variables in this paper are the tax rate variables. For these we draw on a new source, the AEI International Tax Database. The AEI tax database has been

[13] Solon et al. (1994) suggest that aggregate wage statistics may be subject to severe composition bias. The aggregate wage statistic is a weighted average of earnings for different groups of workers, such as high-wage or low-wage workers. Since hours of work of low-wage workers tend to be procyclical, this gives greater weight to low-skill workers in expansions, rather than recessions. Thus cyclically shifting weights may be a source of measurement error in aggregate wage data. We believe that our measure of wages is less subject to this criticism since we average the wage data for each country over five year periods, removing much of the cyclicality.

[14] Typically, real and nominal wage data are highly serially correlated (Nuniziata, 2001). However, since we use five year averages, this is less of a concern for us. In later specifications, we do use GLS estimation allowing for autocorrelation in the residuals, however the estimated autocorrelation coefficient is not significant and results do not change.

compiled over a number of years and includes information on several tax variables, such as (national and local) corporate taxes, personal income taxes, VAT, employer and employee payroll taxes, etc for about 128 countries starting in 1981. The main source for the corporate and personal income tax data has been the PriceWaterhouse Coopers "Corporate Taxes Worldwide Summaries" and "Individual Taxes Worldwide Summaries", however several other sources (detailed in the Appendix) have been used to validate the numbers. An attempt has been made as far as possible to standardize the definition of the tax rate used across countries, and to incorporate all the information available in the corporate tax summaries. [15] For details on comparability issues, see Appendix.

We control for differences in personal income taxation as well. To do this, we use average and median personal income tax rates from the AEI International Tax Database. The tax database has information on the number of tax brackets and the corresponding tax rate for each country. We constructed average and median tax rates using these.

Other variables include the value added per worker (in manufacturing, constant 1990 dollars) and trade as a fraction of GDP (available from the ILO KILM database) to measure openness. To control for the effect of prices, we include the log of the consumer price index. This variable captures cost-of-living differences not captured by exchange rate conversions. We also experiment with additional variables such as the level of schooling, computerization and urbanization, highlighted by other papers in the literature.

To allow for the effect of labor market institutions, we use two variables. One of these measures the percentage of workers in a country covered by collective bargaining agreements, as a percent of total salaried or dependent workers. The second is a broader

[15] Access to the AEI International Tax Database can be provided by writing to the authors.

measure which is a count of the cumulative number of ILO conventions ratified by the country. The ILO conventions include ratification of conventions on child labor, forced or compulsory labor, discrimination, the right to organize and the right to bargain collectively. Thus the greater the number of ratified conventions, the greater the protection of workers rights. Information on these variables is available from the Fraser Institute's Economic Freedom of the World dataset and the World Bank Labor Market Database (WBLMD), (Rama, 1996), respectively.

Following Rodrik (1999), ideally we would like to include both the level of gross domestic product (GDP) per capita (available from Penn World Tables) and manufacturing Value Added (MVA) per worker (constant dollars) in the same regression. In case all changes in productivity are not captured by MVA, some should show in the estimated coefficient on aggregate GDP. However, our measure of MVA is noisy. We obtained MVA data from three sources: Key Indicators of the Labor Market (ILO), WBLMD (Rama, 1996) and UNIDO. The problem we faced was one of missing data for our sample of countries and years. The ILO database has more information on total Value Added across all sectors, rather than Value Added only in Manufacturing. The World Bank database provided information for selected countries only uptil 1993, while the UNIDO database again had lots of missing values for the countries in our sample.[16] Thus our best option was to use the ILO total Value Added data as a proxy for MVA. For the countries that do report MVA, we have included that data. The correlation between this

[16]Rodrik (1999) uses two samples. The BLS sample covers the period 1975-1994, while the WBLMD/UNIDO sample covers the period 1960-1994. Therefore he does not face a similar problem. The number of observations in the UNIDO data for our sample is 754, in WBLMD, 725 and in ILO 1305. Even though the sample size drops by a lot when we consider the UNIDO data (after taking five year averages and including other variables in the regression), it is comforting to note that we are able to reproduce our main results discussed later.

variable and the GDP variable is high, above 0.70. Hence while we get similar results with the two variables, we report results using the Value Added variable to measure productivity.[17]

Finally, we include in the regression analysis weighted averages of tax rates and wage rates in competing countries, following the standard spatial regression literature as summarized by Anselin (1999). To our knowledge, this is the first paper to explicitly include spatial variables in a wage regression. The spatial weights matrix takes the form, $W_t=[W'_{1t.},\ldots\ldots\ldots,W'_{Nt.}]'$. At any time t, the ith row of this matrix is given by W_{it}, which specifies "neighborhood sets" for each observation i. The ij-th element of W_t, namely, $w_{ij,t}$, is positive if j is a "neighbor" of i, and is zero otherwise. In our model, we consider many forms of the weighting matrix. One is based on regional economic weights. In this, the countries are assigned to be "neighbors" if they are in the same region as country i. For example, Zambia would have as its neighbors, Zimbabwe, Malawi and Mauritius since they are all in the East African region, but would not include Bolivia, Australia etc since they are in other regions. Countries within the same region would then be weighted by their GDP. A second form of the weighting matrix is based on Income weights i.e. countries within the same income group, such as high income, low income, or upper middle income etc are classified as neighbors. These countries are then weighted by their GDP. The third kind of weighting we used was to assign distance weights to countries within the same income group.

[17] The coefficient on corporate taxes is negative and significant, even when we include *both* GDP and MVA in the analysis. Also, if we use only the countries with manufacturing value added data in the ILO sample, and use 3-year averages (to increase sample size), we are still able to reproduce our results.

These weighting matrices were used to create weighted averages of corporate tax rates and wage rates in "neighbor" countries. In somewhat more detail, the *ijth* element of the weighting matrix at time *t*, is,

$$w_{ijt} = \frac{GDP_{ijt}}{\sum_{k} GDP_{ikt}}$$ where k is the number of "neighbor" countries for country i.

The weighting matrix based on distance is defined in a similar manner. By convention, a cross sectional unit is not a neighbor to itself, so that the diagonal elements of W_t are all zero i.e $w_{ii,t}=0$.

III.B. Summary Statistics

Summary statistics for the core variables are presented in Table 1. The average wage for the OECD economies for this period was nearly $10 per hour, whereas for Non-OECD economies it was $2.50. Surprisingly, however, the mean top corporate tax rate was similar-around 35 percent-for both sets of countries. Average personal income taxes were larger for the OECD economies (.31) than for the non-OECD economies (.23). Average wage nearly doubled for both OECD and Non-OECD economies over this period, and corporate tax rates declined by slightly less than half. As shown in Figures 1 and 2, on average for all countries, corporate and personal income taxes have been declining over the sample period 1981-2005. This is true for the top national corporate tax rate, as well as the effective marginal and average tax rates. At the same time, average hourly wage rates have been rising over time. The average corporate tax rate for all countries went down from 42 percent in 1981 to around 25 percent in 2005. For the same period, average wage rates increased from 3.5 dollars per hour to 7 dollars per hour. The

correlation between these two variables was larger for the OECD countries (.355) than for the non-OECD countries. This is also reflected in the large negative coefficient on tax rates in a regression of average wages on tax rates for OECD countries (Figure 3).

IV. Regression Results

For purposes of the empirical analysis, we have grouped the data into nonoverlapping five year periods covering five sub-periods over 1981-2005.[18] The average wage is a five year average of each of the sub-periods. Note that the average wage is in nominal dollar terms. For the right hand side variables, we use the beginning of period values.

Table 4A presents the first set of regression results. All the regressions, unless otherwise stated, are estimated using fixed effects. All specifications also control for period (time) dummies. The main variables of interest in this paper are the corporate tax rate and the personal income tax rate. Regressions in Table 4A use the top national corporate tax rate as the explanatory variable. Results with other measures of corporate taxes, such as effective average and marginal corporate tax rates are presented in Table 5. The corporate tax rate variable is negative and highly significant (p=.005) in the wage equation. This result is fairly stable across different specifications, and declines in significance only marginally when the number of observations is reduced in columns (4)-(5). The point estimates suggest that a one percent increase in corporate tax rates is associated with nearly a 0.8 percent decrease in wage rates according to the regression in Column (1), and on average about 0.85 percent decrease across different specifications. In Figure 3 we present scatter plots of corporate tax rates and wage rates for OECD and

[18] The sub-periods are 1981-1985, 1986-1990, 1991-1995, 1996-2000,2001-2005

Non-OECD countries. In general, countries with high tax rates tend to have lower wages rates. A univariate linear regression of average wages on corporate tax rates in different sub-samples of OECD and non-OECD economies yields a larger slope coefficient in the case of OECD countries, suggesting that on average over this period, capital-wage links have been stronger for the OECD countries.[19]

The elasticity of wages with respect to corporate tax rates appears to be high at first glance. To check our results and in order to put bounds on the estimated coefficients, we next turned to the investment literature.[20] Since our assumption is that corporate taxes affect investment in capital, we surveyed the recent literature on the elasticity of investment with respect to corporate tax rates. De Mooij and Ederveen (2003) concludes that the median value of the tax rate elasticity is around -3.3. Thus a 1 percent increase in corporate tax rates, on average, leads to a lowering of foreign direct investment by about 3 percent. They also report that the elasticities have increased over time, from 2.4 in 1987 to 3.7 by 2002. The elasticity with respect to domestic investment is lower at around 1. If investment responds to corporate taxation, this will lead to changes in the capital stock over a period of time (and the capital-labor ratio for a given level of employment). Hence it's possible that the large reductions in corporate taxation in the period under study, combined with the increased mobility of capital, are driving our results. Taking derivatives with respect to corporate taxes in the wage equation in the Solow model and using the widely accepted calibrated value of α (the share of capital) as 0.33, these

[19] Several countries impose additional local taxes on corporate income, such as the U.S. and Germany. The Tax database includes information on the average local corporate tax rate for each country for every year. We experimented with using the sum of the local corporate tax rates and the national rates as our explanatory corporate tax variable. In this case, the coefficient drops to approximately 0.74. However, since sub-national rates only affect location of capital *within* a country but not capital mobility across countries, we present our analysis with the national rates.

[20] The 95 percent confidence interval for the corporate tax rate variable is [-1.39, -0.25]

elasticities for foreign and domestic investment suggest that in the long-run, a lowering of corporate tax rates by 1 percent could cause wages to increase by 0.3-0.9 percent. Hence our estimate of the elasticity is in the range predicted by the Solow wage equation, though it's at the higher end of that range. Our estimates could be biased upwards due to omission of relevant variables and measurement issues, and we address these concerns in the discussion that follows through various robustness checks. In the next section, we also discuss our results with the effective average and marginal tax rates. These rates more accurately capture the cost of investment by accounting for different tax depreciation allowances, inflation rates, discounting rules etc. Interestingly, in this case, the estimated coefficient is in the range 0.3-0.6.

Perhaps, surprisingly, we find that average personal income tax rates are insignificant in all specifications. Labor taxes do not systematically affect wages. This result holds even when we drop other variables, including the corporate tax variables, from the regression (Column (3)). This suggests that labor bears the entire burden of labor taxes. There is no shifting of the tax to capital in the form of higher wages. This result is in line with Davis and Henrekson (2004). They conclude that the manufacturing sector is relatively insensitive to personal tax rates, because manufacturing production is highly capital intensive, larger firms and establishments predominate, and the workforce is highly specialized. They find in cross-country data a statistically insignificant effect of labor tax rates on manufacturing's share of total employment. Thus it is likely that manufacturing wages too are unresponsive to personal tax rates, as a result of inelastic labor supply. We re-ran the regressions using *median* personal income tax rates as an alternative measure of the typical income tax paid by the typical manufacturing

employee, but the results did not change. Median personal taxes were insignificant in all specifications.[21]

The regressions in columns (1)-(5) also reveal that MVA per worker is a significant determinant of wage levels. Not surprisingly, higher labor productivity is associated with higher wages. When Log wages are regressed on Log Value Added per worker alone, the coefficient is significant and positive with a coefficient of 2.3 and a t-statistic of 17.74. If instead of MVA per worker we substitute Log (GDP per capita) in the regression in Column (1), the results are similar. Therefore, we do not present them separately, and our analysis will be entirely in terms of MVA per worker.[22]

We tested for robustness of the coefficient on tax rates, by including additional variables. These include the level of schooling (measured by enrollment at different levels of schooling, such as primary, secondary and tertiary (ILO)), labor market regulations (as measured by the number of ILO conventions ratified by the country or the percent of workers covered by collective bargaining agreements), extent of computerization (measured as the estimated number of personal computers in use as a fraction of the population, available from ILO) and openness (measured by share of total trade in GDP). None of these enters significantly, since we control for labor productivity directly.[23] The estimated coefficient on corporate tax rates remains fairly similar across

[21] Davis and Henrekson (2004) study the effect of labor taxes on substitution away from market activities towards non-market activities within a country. They find that this kind of substitution is much lower in the manufacturing sector.

[22] As mentioned before, we are able to reproduce these results in the smaller UNIDO sample using a RE GLS model and a simple OLS regression with region dummies, both of which impose fewer restrictions on the degrees of freedom.

[23] An OLS regression of average wages on corporate taxes, schooling and (trade/GDP) (controlling for region effects and time dummies) alone yields significant and positive coefficients on schooling and (trade/GDP), while still yielding a negative and significant coefficient on corporate taxes. A regression of average wages on computerization or number of ILO conventions alone yields a positive and statistically significant impact of these variables.

different specifications, and is significant at either the 95 or 99 percent level of significance. Note that the use of the fixed effects methodology eliminates country-specific idiosyncrasies regarding the type of coverage provided on wages and salaries. Following Alesina and Perotti (1997), we also interacted the personal income tax variable with the labor market institution variables. In their survey of 14 OECD countries the authors found that labor taxation induces a labor cost increase in countries with some level of centralized bargaining. However, we do not find any significant effects on wages after allowing for these interactions.

We controlled for the effect of consumer prices. In general, higher prices may cause workers to bargain for higher wages. This variable remains positive and significant in all specifications. We also experimented with other variables such as the share of government enterprises in all enterprises, number of employees in service industry or agriculture. However, none of these variables were significant while the sign on the corporate tax coefficient continued to be negative and significant.

In other regressions (not shown here), we defined the dependent variable as the PPP-adjusted wage, rather than the nominal wage. We also defined the real wage by deflating the nominal dollar adjusted wage using the U.S. CPI. Results were similar. The coefficient on corporate tax rates was in the same range as in other specifications. Personal taxes, median and average, were not significant.

As a final specification check for our baseline regression, (in unreported regressions) we divided countries into different regions and then re-estimated the equations in Table 4A with a set of region dummies, time dummies and the interaction of the two i.e region-specific time trends. This allows for common shocks across countries

within a region and over time. For instance, many East European countries faced common economic and political shocks in the aftermath of the collapse of the Soviet Union which may have affected labor markets, productivity and wage levels. This was also true of the East Asian economies in the wake of the currency crisis in the late 1990s. Adding these controls did not significantly change our estimates of the elasticity. The coefficient on corporate tax rates was -0.90 and significant at 95 percent level of significance. In another specification, we interacted the corporate tax rate variable with the time and region dummies to see if corporate taxes had a different impact on wages in certain regions and time periods. This did not change the results-the coefficient on the corporate tax variable remained in the same range as in previous regressions (-0.839).

IV.A.1. Instrumental Variable Estimation

Our results could be biased due to omission of relevant variables. In cross-country regressions it is especially difficult to control for all unobservables, such as policy related and institutional variables that may be correlated with corporate tax rates and vary systematically across countries and over time. For instance, developing countries with poor tax administration capabilities may rely on corporate taxation for a larger share of revenues than do richer countries, since it may be easier to tax large corporations (Gordon and Li, 2005). Thus corporate taxes may be serving partly as a proxy for being a developing country with poor administrative capabilities, and this may feed through to wages as well. To instrument for corporate tax rates, we used information on country capital gains tax rates available in the AEI International Tax Database. The two rates are likely to be highly correlated since attitudes towards capital taxation should be reflected

in both corporate as well as capital gains tax rates. At the same time, capital gains taxation is unlikely to be correlated with wages.

Columns 1 and 2 in Table 4C present results of a 2SLS estimation with the top capital gains tax rate used as an instrument for the top corporate tax rate in the country. In the first stage regression, the coefficient on capital gains is highly significant and positive, as we may expect. In the second stage regression, the instrumented corporate tax variable enters negatively and is highly significant at 1 percent. The magnitude of the coefficient is also larger than in earlier regressions. It is possible that the relatively limited number of observations on capital gains tax rates prevent a precise estimation of the coefficient.

To further check the validity of the instrument, we included capital gains tax rates as an additional explanatory variable in the average wage regression. As Column 3 in Table 4C shows, this variable has no significance in explaining average wages.

IV.B. Testing the Mechanism

If we accept the results in Table 4A that corporate taxes affect wages, the natural next step is to question the mechanism by which they do so. Our hypothesis, derived from the neoclassical Solow growth model, is that corporate tax rates affect wages through their impact on capital-labor ratios. To test for this, we obtained information on capital-labor ratios from the extended Penn World Tables (Version 2.1, April 2006).[24] These data are not specific to the manufacturing sector and are not as extensive as for the

[24] http://homepage.newschool.edu/~foleyd/epwt/ . This data has been compiled by Adalmir Marquetti from the Penn World Table and other sources.

tax variables in our model.[25] However, there does not appear to be systematic under-reporting of data across countries. In fact, surprisingly there is equally good coverage of OECD and Non-OECD countries hence we are not worried about biases arising out of selection of countries in the database.

Table 4B presents various tests of our hypothesis. In specification (1), we include in our standard wage equation both the corporate tax rate as well as the Log (capital-labor ratio). The fixed effects methodology is not followed since we would lose too many degrees of freedom given the data constraint. However, we do allow for region effects and time dummies. If corporate tax rates have an independent effect on wages, they should be significant in a regression including the capital-labor ratio (K/L) variable. However, as the results show, the coefficient on corporate taxes becomes insignificant once we control for the effect of Log (K/L) in the regression. The coefficient on Log (K/L) implies a value of the elasticity of close to 0.4. This is close to the calibrated value of α of 0.33. Also, including this variable in the regression makes the coefficient on Value Added insignificant as well, which is as we would expect since capital-labor ratios directly affect productivity. Hence this regression shows that corporate taxes affect wages through their impact on capital-labor ratios.

In specification (2) in table 4B, we estimate a capital-labor regression using corporate tax rates as an explanatory variable. Theory suggests that capital-labor ratios are a function of the relative prices of labor and capital.[26] Hence to estimate the model,

[25] This is not ideal since manufacturing is more capital intensive than other sectors, and therefore may be more responsive to capital costs than other sectors. However, we are unaware of a cross-country data source for manufacturing capital-labor ratios.

[26] Assuming a Cobb-Douglas production function, output in period t can be expressed as
$Y=K^{\alpha}(AL)^{1-\alpha}$
Constrained optimization then yields (setting A =1 for convenience)
$Log(K/L)=Log(\alpha/1-\alpha)+Log(w/r)$, where w and r are the wage and rental rates respectively.

ideally we would like to have information on the price of capital across countries. As a proxy for that, we instead use different measures of the corporate tax rate, since high taxes on capital affect investment and therefore the capital stock by raising the user cost of capital. The user cost of capital is defined as the minimum return a firm needs to cover depreciation, taxes and the opportunity cost of funds (Jorgenson (1963), Hall and Jorgenson (1967), Auerbach (1983b)). Typically studies have found that high taxes lead to high user costs.[27] Hence we use as explanatory variables the corporate tax rate and the wage rate per hour. Since the data are limited, we artificially increase our sample size by taking three year averages of the capital-labor ratio instead of five year averages. If anything, this may understate the true effect of taxation since changes in capital stock may take place over longer periods of time. We continue to allow for country fixed effects and time dummies. The regression results show that corporate taxes significantly, negatively affect capital-labor ratios. This result is even stronger for effective average tax rates which take into account depreciation allowances, inflation and interest rates and other factors that affect capital formation through the user cost of capital and holds for effective marginal tax rates as well (specifications 3 and 4). The estimated elasticity is close to (negative) 0.1 across all specifications. Other studies, using micro data and the actual user cost (not only the tax rate) estimate elasticities that are higher than this. Balistreri, McDaniel and Wong (2002) using industry data from the Bureau of Economic

[27] The classic studies of user costs and investment are Jorgenson (1963) and Hall and Jorgenson (1967), which develop a simplified user cost equation given by:

$c = (\frac{r - \pi + \delta}{1 - u})(1 - uz)$ where c is the user cost, r is the nominal after corporate-tax discount rate that the firm must earn to attract investors, Π is the rate of inflation, δ is the rate of economic depreciation, u is the statutory corporate tax rate and z is the present value of depreciation deductions on a dollar of investment. . More recent studies include Auerbach (1983a, 1989), Auerbach and Hassett (1992, 2003).

Analysis estimate elasticities in the range of 1-1.22, using different weighting schemes. Leung and Yuen (2005) using industry-level data on Canadian manufacturing estimate an elasticity of 0.33. While our coefficient estimate is likely to be heavily biased due to aggregation, measurement issues and data constraints, we present these results simply to show that different measures of corporate taxation can significantly and negatively affect capital-labor ratios.[28]

In a recent paper, Gordon and Lee (2005) find that corporate taxation negatively affected country growth rates between 1970-1997. Our results suggest that these slower GDP per capita growth rates in the 1980s and 1990s may have also translated into slower wage growth, hence workers must be bearing some of the burden of corporate taxes.

IV.C. Effective Marginal And Average Tax Rates

In Table 5, we test to see if the above results carry over to other measures of the corporate tax rate, such as the Effective Marginal Tax Rate and the Effective Average Tax Rate. The coefficient on the effective marginal tax rate variable is negative and significant only at 90 percent level of significance in Column (1), while on the effective average tax rate variable is significant at 95 percent. In Columns (3) and (4) we present these results for the case when our sample includes only non-OECD economies. In this case, we do find that effective average taxes matter more than effective marginal tax rates. This supports weakly the results of Devereux and Griffiths (1998) and Hassett and Hubbard (2002) of the impact of tax rates on investment for effective average and

[28] While most studies of corporate taxation have focused on its impact on capital investment, it's likely that firms respond to high corporate taxation by adjusting labor. To check for employment effects, we collected data on manufacturing employment across countries and over time from the ILO KILM database. The data series is limited with even fewer observations than for K/L. However, preliminary regressions using changes in the employment-population ratio for 3 year periods as the dependent variable, suggest that corporate tax rates may have significant employment effects as well. This is an area that we intend to explore in further research.

marginal tax rates, respectively. Results for the other variables are similar to those in Table 4A.

IV. D. Spatial Regressions

Table 6 incorporates measures of average tax rates and average wage rates in "neighbor" countries in the regression analysis. The domestic economy corporate tax rate variables continue to be significant in these specifications. Since personal taxes are found to be insignificant in all specifications, we do not include them in the specifications shown in Table 6. Interestingly, we find significant results for the spatial variables. Column (1) defines a weighted average of top corporate tax rates and wage rates in "neighbor" countries. The choice of weights is guided by previous literature using spatial econometrics techniques, but we also experiment with different weighting schemes that are relevant to our analysis.[29] "Neighbor" countries here are defined as all those countries that are in the *same region*, as described before.[30] The weights that we use for these countries are GDP weights. Thus every country is weighted by its economic strength in the region. In this specification, the weighted average wage in the region turns out to be positive and significant. There could be at least two reasons for this result. An increase in wages in neighboring countries may increase capital outflow from these regions to relatively lower wage neighbor countries, which in turn may increase the demand for labor, and hence the wage rate. Secondly, high wages in neighboring countries may cause workers to move to the high wage country. This would cause a decrease in supply of workers in the relatively low wage country, which could cause an increase in wages in

[29] See Bloningen et al (2005) and Franzese and Hays (2005) for an application of different spatial weighting matrices.

[30] Immigration and trade flow linkages are likely to be better captured by using within region income weights rather than across regions, since geographic distance increases the costs of labor mobility and transportation of goods.

the low wage country as well. For the weighted average tax rate, the coefficient is positive, but not significant.

In Column (2), we change the spatial neighbors by defining as neighbors those countries that are in the same *income* group (rather than in the same region). Countries within the same income group are then weighted by their respective GDP. This specification would be justified if workers are more likely to move between countries with the same per capita income than from very high to very low or vice-versa. In this specification, the weighted wage variable is again positive and significant. In this case, the weighted (top corporate) tax variable is positive, but not significant.[31]

Column (3) presents results with a different weighting scheme. While neighbors continue to be defined in terms of income groups, the countries within the group are now weighted using (inverse) distance weights.[32] Thus the farther the country, the lower the weight it receives within the group. In this specification both the own region wage and the own region (top corporate) tax rates are positive and significant.[33]

Finally, in Column (4), we re-ran the regression using as a measure of the domestic and international tax rates, the effective marginal tax rates, instead of the top corporate tax rates. In this specification, the income weighted tax rates are positive and significant at 90 percent level of significance. In Column (5), we use the GDP-weighted

[31] While we use beginning of period values to ensure exogeneity of right-hand side regressors, we also use 2SLS estimation to test for this. It's possible that beginning of period average neighbor wages may be correlated with the left-hand side dependent variable. We therefore instrument for this variable in the standard way suggested in the spatial econometrics literature (Anselin, 1999). If our regression model has Y as the dependent variable and X, WX and WY as the right-hand side regressors, we instrument for WY using X, WX and W^2X, where W is the weighting matrix. Results did not change in the 2SLS specification.
[32] Distances are calculated as the physical distance between two capital cities.
[33] Gordon and Lee (2005) estimate the impact of corporate taxes on economic growth. They use neighbor tax rates as instruments for the domestic tax rate. We believe this is incorrect since both variables may have independent effects on growth and wages, and both therefore need to be included in the regression. Further, they do not consider different measures of the corporate tax rate, such as the effective average and marginal tax rates.

average of the effective average tax rates in neighbor countries to capture spatial tax competition. These results suggest that tax competition exists among "neighbor" countries, whether we consider the top corporate tax rate, effective marginal tax rates, or effective average tax rates. Competition could result from being geographic neighbors i.e countries within the same region, or from "economic" neighbors i.e countries in the same income group.

IV.E. Other Tax Variables

Table 7 presents results with the democracy variable included in Rodrik (1999), and other forms of taxes such as VAT and payroll taxes. Following Rodrik, we construct our measure of democracy using Freedom House's classification of countries based on political rights and civil liberties.[34] Column (1) shows that in a regression including the democracy variable, along with our tax rate variable, the coefficient on the democracy variable is insignificant, while the estimated coefficient on tax rates and MVA per worker continue to be significant as before. Unlike Rodrik (1999), we do not include democracy as an explanatory variable in our baseline specification since a variable like democracy is difficult to measure, and is highly likely to be correlated with other unobservables in cross-country regressions. Persson and Tabellini (2005) suggest that democracies are correlated with other features of the economic system, such as liberalization and trade openness, form of government and type of electoral rule. A VAR analysis of democracy and corporate tax rates suggests that democracy may granger-cause corporate tax rates. In the political science literature, Hays (2003), finds that international capital tax

[34] Freedom House rates countries on a scale of 1 to 7 with higher ratings signifying less freedom. We combine the two ratings into a single index that varies from 0 to 1 (with higher values indicating greater democracy) by using the transformation [(14-civillib-polrights)/12].

competition has the greatest negative impact in majoritarian democracies with closed economies. The paper uses a different measure of democracy, and distinguishes between majoritarian and consensus democracies.

In Columns (2) and (3), we test to see if other forms of taxes, such as value-added or sales tax (VAT) and (employer and employee) payroll taxes affect average wages, and find an insignificant effect. In Column (4), we address the question whether social security contributions by employers may be driving our results on personal taxes. In general, the ILO wage measure excludes social security contributions by employers. However, some countries that include it, do report it separately. Thus we exclude those countries where the wage measure includes contributions to social security by employers. As we can see from the table, this does not change our results.

IV.F. Small Economy Results

Table 8 presents results for the case when the large economies (selected on the basis of GDP) are excluded from the sample. The intuition for this is that relatively small economies are much more likely to experience a sudden spurt in productivity and wages as a result of increased capital investment as compared to the richer economies have capital stocks that are large relative to the world supply of investment. Hence we should expect to see a larger impact of capital taxes on wages in these small economies, in terms of a larger size estimate of the coefficient on tax rates. Therefore Column (1) first presents results with the entire sample which serves as a basis of comparison. Column (2) presents results with the top 10 richest economies excluded from the sample. As we predicted, the coefficient on corporate tax rates increases to 1.07 from its value of 0.84 in Column (1).

Column (3) focuses specifically on the small or poor economies. We re-ran the regression including only the lowest GDP economies in the sample. In this case, the coefficient on corporate tax rates increases significantly to 1.54. It nearly doubles in magnitude compared to Column (1). These results suggest that at least in the short-run (in the five year period used in the sample) smaller economies are significantly more likely to respond to corporate tax rates and see visible changes in productivity and wage rates.

IV.G. GLS and OLS Estimation

Finally, a Hausman test revealed no significant differences in fixed vs. random effects estimates. In Table 9 we present results using random effects and fixed effects GLS estimation and OLS estimation, allowing for region dummies in the latter specification. Column (1) presents the random effects estimates. The coefficient on top corporate tax rates is negative and highly significant with a t-statistic of 3.55. The coefficient on Value added per worker in manufacturing is positive and significant at 95 percent level of significance. The coefficient on Log (CPI) is positive and significant, while that on personal taxes is again insignificant. Column (2) finds similar results with OLS. Some of the region dummies are significant. Finally, we tested for heteroskedasticity and serial correlation in the wage data. Column (3) presents results using a fixed effects feasible GLS specification allowing for AR(1) autocorrelation in the residuals for each country. The estimated autocorrelation coefficient is not significant and results are similar to those mentioned for the specification in Columns (1).

To summarize, our results indicate that while personal income tax rates do not systematically affect wages, corporate taxes are significantly related to wage rates across

countries. Our coefficient estimates are large, ranging from 0.83 to almost 1-thus a 1 percent increase in corporate tax rates leads to an almost equivalent decrease in wage rates (in percentage terms). If we set all variables to their average values, an increase in corporate tax rates from a mean value of .35 to a 1-standard deviation increase of .10, would cause wage rates to decline by more than 25 percent (depending on the regression specification). Thus a low wage-high tax economy, like Mexico (average wage over the period=$1.67 and average tax rate=.37), could raise wage levels if it could lower its corporate tax rate to that of Canada's (.22). A 40 percent drop in corporate tax rates could raise wages by nearly 35 percent, up to $2.25.

These results also hold for effective marginal and average tax rates. The coefficient estimate is (on average) close to 0.5, though the level of significance is lower. This suggests that wages are as likely to be influenced by the top statutory corporate tax rate, as by the effective marginal and average tax rates. Hence corporate tax cuts in the form of large allowances for depreciation of equipment and structures which reduce effective marginal rates could effectively influence wage levels as well.

We find evidence of international tax and wage competition in the data. Country wage rates are affected not only by domestic tax rates, but also tax rates in competing economies. The coefficient estimates for the spatial wage and tax variables range from 0.39 to 0.56 for average neighbor wages and 0.51 to 0.55 for the average neighbor tax variable, suggesting significant quantitative impacts. A 1 percent increase in wages (taxes) in competing countries could raise domestic wages by 0.4 percent (0.5 percent). Comparing different weighting schemes, the effects are largest when "neighbors" are defined as countries within the same *income* group, rather than within the same region.

This suggests that tax competition is most intense among, say, high income countries such as Canada, France and Italy, rather than between geographic neighbors. This makes sense intuitively since there do not appear to be large transport costs associated with moving capital across large distances, so capital can easily flow to the most remunerative locations.

V. Conclusion

The results in this paper suggest that corporate tax rates affect wage levels across countries. Higher corporate taxes lead to lower wages. A 1 percent *increase* in corporate tax rates is associated with nearly a 1 percent *drop* in wage rates. The intuition for this comes from a simple analysis of the Solow model that reveals that higher capital labor ratios lead to higher wages, by enhancing worker productivity.

We find no effect of personal income tax rates on wage rates. This could be because we are focusing on manufacturing wages, and this sector is highly capital intensive and as suggested by other authors (Davis et al.2004) unresponsive to tax rates. Thus a possible area of exploration in future research is to see if this result generalizes to other sectors.

We find evidence for international tax competition. In particular, there appears to be a link between high tax "neighbors" and high domestic wages. Presumably, as capital flows out of high tax "neighbor" countries to low tax countries, this increases worker productivity and hence wages, in the low tax country. Thus countries try to compete for capital with other countries by lowering their relative tax rates. We also find strong

evidence to suggest that high wages in neighboring countries lead to high wages in the domestic economy. Again, a possible reason for this is capital flight. As capital moves to relatively low wage destinations, it increases worker productivity in these regions which in turn, causes wages to rise. The results for international tax competition are strongest in the case of countries within the same income group.

References

Alesina, A. and Perotti, R. (1997), "The Welfare State and Competitiveness", American Economic Review, December

Anselin, L. (1999), "Spatial Econometrics", http://www.csiss.org/learning_resources/content/papers/baltchap.pdf

Auerbach, A (1983a), "Corporate Taxation in the United States." Brookings Papers on Economic Activity. 2 pp. 451-513.

Auerbach, A. (1983b), "Taxation, Corporate Financial Policy and the Cost of Capital" Journal of Economic Literature. 21:3 pp. 905-940.

Auerbach, A. (1989) "Tax Reform and Adjustment Costs: The Impact on Investment and Market Value" International Economic Review 30:4 pp. 939-962.

Auerbach, A. (2005), "Who Bears the Corporate Tax?", *NBER Working Paper No. W11686*

Auerbach, A. and Hassett, K. (1991), "Recent US Investment Behavior and The Tax Reform Act of 1986: A Disaggregate View", Carnegie Rochester Conference series on Public Policy 35: 185-215

Auerbach, A. and Hassett, K. (1992) "Tax Policy and Business Fixed Investment in the United States" Journal of Public Economics 47, pp.141-170.

Auerbach, A. and Hassett, K.(2003) "On the Marginal Source of Investment Funds." Journal of Public Economics. 87:1 (January) pp. 205-232.

Auerbach, A. and Hines, J. (2000), "Taxation and Economic Efficiency", in Handbook of Public Economics, edited by Alan J. Auerbach and Martin Feldstein. Amsterdam: Elsevier Press

Balistreri, E., McDaniel, C. and Wong, E. (2002), "An Estimation of U.S. Industry –Level Capital-Labor Substitution Elasticities: Cobb-Douglas as a Reasonable Starting Point?", mimeo

Besley, T. and Harvey,R. (1994) "Sales Tax and Prices: An Empirical Analysis." Princeton University Economics Department. Mimeo

Bingley, P. and Gauthier, L. (2002), "The incidence of Income Tax on Wages and Labor Supply", Journal of Public Economics, Vol. 83, issue 2,pp. 173-94.

Bloningen, B. , Davies, R., Waddell, G. and Naughton, H. (2005), "FDI in Space: Spatial Autoregressive Relationships in Foreign Direct Investment" http://darkwing.uoregon.edu/~bruceb/BDWN-2005-10-03.pdf#search=%22spatial%20distance%20GDP%20weights%22

Card, D., Kramarz, F. and Lemieux, T. (1996), "Changes in the Relative Structure of Wages and Employment: A Comparison of the United States, Canada and France", NBER Working Paper No.5487

Carroll, R., Holtz-Eakin, D. Rider, M. and Rosen, H. (2000), "Entrepreneurs, Income Taxes and Investment", in Joel Slemrod, ed., Does Atlas Shrug? The Economic Consequences of Taxing the Rich (MIT Press Cambridge) pp 427-455

Chirinko, R.S., Fazzari, S.M and A.P. Meyer,A.P (1999), "How Responsive is Business Capital Formation to Its User Cost?: An Exploration with Micro Data", *Journal of Public Economics* 74(1) pp. 53–80.

Corporate Income Tax Rates: International Comparisons, CBO, November 2005 http://www.cbo.gov/ftpdocs/69xx/doc6902/11-28-CorporateTax.pdf

Cummins, J.G., Hassett, K. and Hubbard, G. (1994), "A Reconsideration of Investment Behavior using Tax Reforms as Natural Experiments", Brookings Papers on Economic Activity 2: 1-74

Davis, S and Henrekson, M. (2004), "Tax Effects on Work Activity, Industry Mix and Shadow Economy Size: Evidence from Rich-Country Comparisons", Published in

Labour Supply and Incentives to Work in Europe, Gómez-Salvador, R., Lamo, A., Petrongolo, B., Ward, M., Wasmer, E. (eds.), 2005, chapter 2, pages 44-104, Edward Elgar.

De Mooij, R. and Ederveen, S. (2003), "Taxation and Foreign Direct Investment: a synthesis of empirical research, *International Tax and Public Finance*, 10, pages 673-693

Devereux, M. and Griffith, Rachel (1998), "Taxes and the Location of Production: Evidence from a Panel of US Multinationals", Journal of Public Economics 68, pages 335-367

Devereux, M. and Griffith, Rachel (1999), "The Taxation Of Discrete Investment Choices", The Institute For Fiscal Studies, Working Paper Series No. W98/16.

Devereux, M. and Griffith, Rachel (2002a), "The Impact of Corporate Taxation on the Location of Capital: A Review" , Swedish Economic Policy Review 9, pages 9-33

Devereux, M., Griffith, Rachel and Klemm, A. (2002b), "Corporate Income Tax Reforms and International Tax Competition", Economic Policy, Vol. 35, pp. 451-495.

Dinardo, J., Fortin, N. and Lemieux, T. (1996), "Labor Market Institutions and the Distribution of Wages, 1973-1992: A Semi-parametric Approach", Econometrica, LXIV, p.1001-1044.

Feldstein, M. and Vaillant, W. (19980, "Can State Taxes Redistribute Income?" Journal of Public Economics, Vol. 68 issue 3, pp. 369-96.

Franzese, R. and Hays, J. (2005), "Modelling Spatial Interdependence in Comparative and Internaitonal Political Economy with an Application to Capital Taxation"

http://www-personal.umich.edu/~franzese/FranzeseHays_MWPSA05.pdf#search=%22spatial%20weighting%20matrix%20FDI%22

Freeman, R. (1994), *A Global Labor Market? Differences in Wages Among countries in the 1980s*, Washington D.C, World Bank.

Freeman, R. and Oostendorp, R. (2000), "Wages Around the World: Pay Across Occupations and Countries", NBER WP 8058.

Gordon, R. and Hines, J. (2002), "International Taxation", NBER WP 8854 http://www.nber.org/papers/w8854.

Gordon, R. and Lee, Y. (2005), "Tax Structure and Economic Growth", Journal of Public Economics, Vol 89, issue 5-6, pp 1027-1043.

Gordon, R. and Li, W. (2005), "Tax Structure in Developing Countries: Many Puzzles and a Possible Explanation", NBER Working Paper No. 11267.

Gruber, J. (1997), "The Incidence of Payroll Taxation: Evidence from Chile", Journal of Labor Economics, Part 2, Vol. 15, issue 3, pp. 72-101.

Grubert, H. and Mutti, J. (1996), "Do Taxes influence where US Multinational Corporations Invest?" Mimeo, National Tax Journal, December 2000, p. 825.

Gwartney, J. and Lawson, R. (2005), Economic Freedom of the World: 2005 Annual Report, Vancouver: The Fraser Institute. Data retrieved from www.freetheworld.com.

Gwartney, J., Lawson, R. and Holcombe, R. (1998), "The Scope of Government and the Wealth of Nations", Cato Journal, Vol. 18, No.2

Hanson, G. and Feenstra, R. (1995), "Foreign Investment, Outsourcing and RelativeWages", in Robert C. Feenstra, Gene M. Grossman, and Douglas A. Irwin, eds., *Political Economy of Trade Policy: Essays in Honor of Jagdish Bhagwati*, MIT Press, 1996,pp.89-127.

Harberger, A. (1962), "The Incidence of the Corporation Income Tax", Journal of Political Economy 70(3), p. 215-240.

Hassett, K. and Hubbard, G. (2002), "Tax Policy And Business Investment", Handbook of Public Economics, Vol 3, Edited by A. Auerbach and M. Feldstein.

Hays, J. (2003), "Globalization and Capital Taxation in Consensus and Majoritarian Democracies", World Politics, 56, p. 79-113.

Hines, J. (1999), "Lessons from Behavioral Responses to International Taxation", National Tax Journal, Vol.52 (2),p. 305-322.

Hines, J. and Rice. E.(1994), "Fiscal Paradise: Foreign Tax Havens and American Business." Quarterly Journal of Economics, vol. 109, no. 1 (February), 149-182.

Hines, J. (2001), "Corporate Taxation", University of Michigan

http://unpan1.un.org/intradoc/groups/public/documents/UNPAN/UNPAN002493.pdf#search=%22hines%20%22corporate%20taxation%22%22

Jorgenson, D.W.(1963), "Capital Theory and Investment Behavior", American Economic Review 53(2) pp. 247–59.

Judd, K. (2001), "The Impact of Tax Reform in Modern Dynamic Economies." *In Transition Costs of Fundamental Tax Reform,* edited by K. A. Hassett and R. G.Hubbard. Washington, D.C.: AEI.

Katz, L. (1999), "Technological Change, Computerization and the Wage Structure", Harvard University.

Link: http://post.economics.harvard.edu/faculty/katz/papers/lkdig2.pdf

Koester, R. and Kormendi, R. (1989), " Taxation, Aggregate Activity and Economic Growth: Cross-Country Evidence on Some Supply-Side Hypotheses", *Economic Inquiry* 27: 367–86.

Leung, D. and Yuen, T. (2005), "Do Exchange Rates Affect the Capital-Labor ratio? Evidence from Canadian Manufacturing Industries" Bank of Canada Working Paper, http://www.bankofcanada.ca/en/res/wp/2005/wp05-12.pdf.

Mankiw, G (2001), "Commentary: Balanced-Budget Restraint in Taxing Income From Wealth in the Ramsey Model", In *Inequality and Tax Policy*, edited by K. A. Hassett and R. G. Hubbard. Washington, DC: AEI.

Mitchell, D. (2005), "The Impact of Government Spending on Economic Growth" *http://www.heritage.org/Research/Budget/bg1831.cfm*.

Nunziata, L. (2001), "Institutions and Wage Determination: A Multi-Country Approach", working paper

http://ideas.repec.org/p/nuf/econwp/0129.html

Poterba, J. (1996), "Retail Price reactions to Changes in State and Local Sales Taxes", National Tax Journal Vol.49, No.2, p. 165-176.

Rama, M (2003), "Globalization And The Labor Market", The World Bank Research Observer, Vol. 18, No.2, pp 159-186.

Rama, M. (1996), "A Labor Market Cross-Country Database", World Bank, Washington DC.

Rodrik, D. (1999), "Democracies Pay Higher Wages", Quarterly Journal of Economics, Vol. 114, No.3, pp.707-738.

Solon, G., Barsky, R. and Parker, J. (1994), "Measuring the Cyclicality of Real Wages: How Important is Composition Bias", Quarterly Journal of Economics, Vol. 109, No.1, pp.1-25

Tabellini, G. and Persson,T. (2005), "Democracy and Development: Devil in the Details", http://www.aeaweb.org/annual_mtg_papers/2006/0106_1015_1402.pdf.

United Nations Industrial Development Organization (UNIDO), Yearbook of Labor Statistics, various editions.

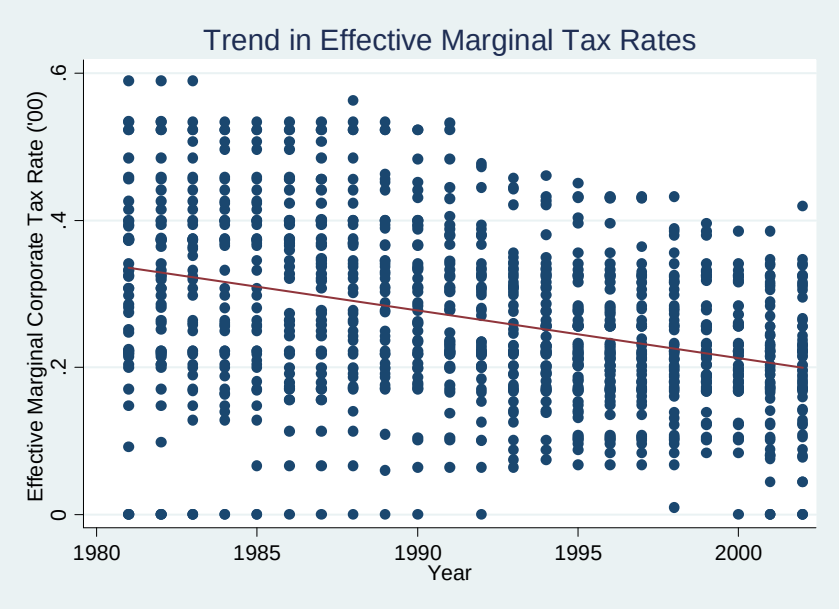
Table 1

Descriptive Statistics for Core Variables

Variable	N	Mean	Std. Dev
Average Wage Per Hour	1432	5.58	7.61
OECD		10.12	9.01
Non-OECD		2.52	4.39
Top Corporate Tax Rate	1467	.34	.10
OECD	602	.35	.09
Non-OECD	865	.33	.10
Log Top Corporate Tax Rate	1277	-1.09	.39
Log Effective Average Tax Rate	1071	-1.24	.34
Log Effective Marginal tax Rate	1048	-1.40	.46
Average Personal Income Tax Rate	1047	26.32	9.90
OECD		31.17	8.68
Non-OECD		23.22	9.37
Median Personal Income Tax	1145	27.15	10.38
Log (Value Added Per Worker)	1291	9.31	1.52
Log GDP per capita	1449	8.14	1.33
Log (Trade/GDP)	1412	4.15	.52
Schooling	1190	3.84	.60
Log consumer price level	1606	4.89	.20

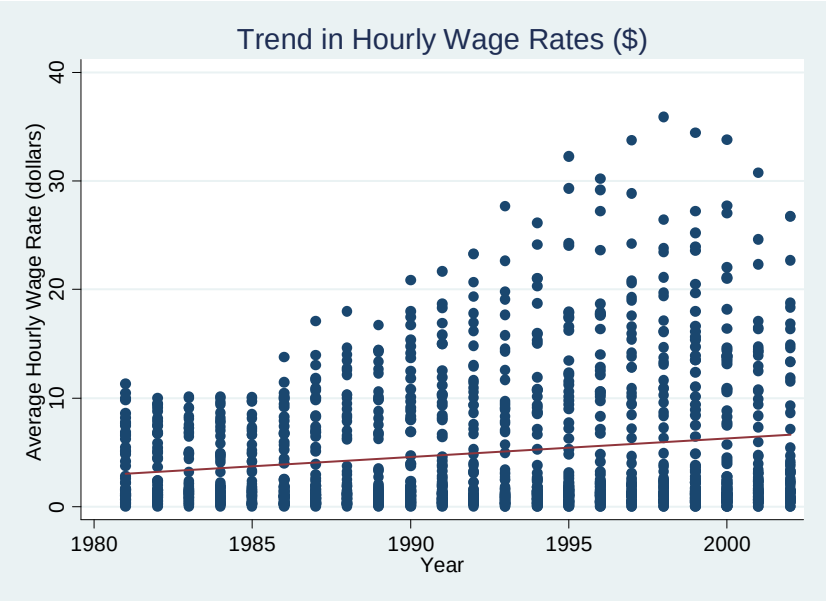
Figure 1: Trends in Corporate Tax Rates

A. Top National Corporate Tax Rate

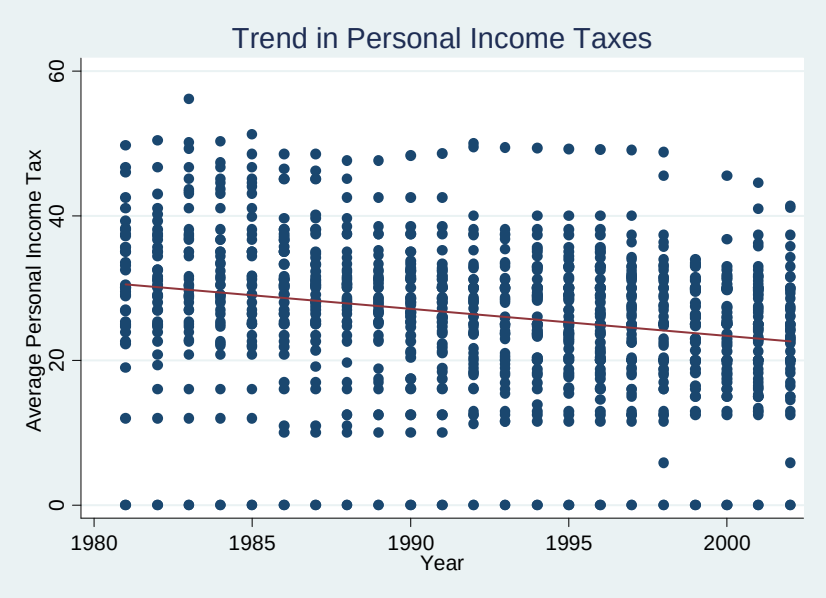


B. Effective Marginal Tax Rate

Figure 2:Wages and Income Taxes

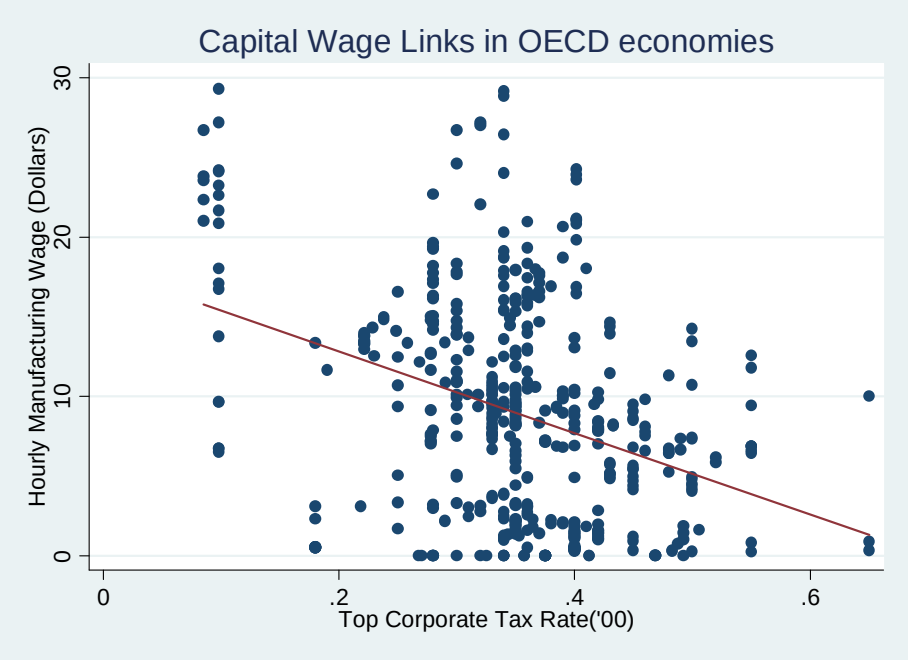


A. Trend in Average Hourly Wage Rates

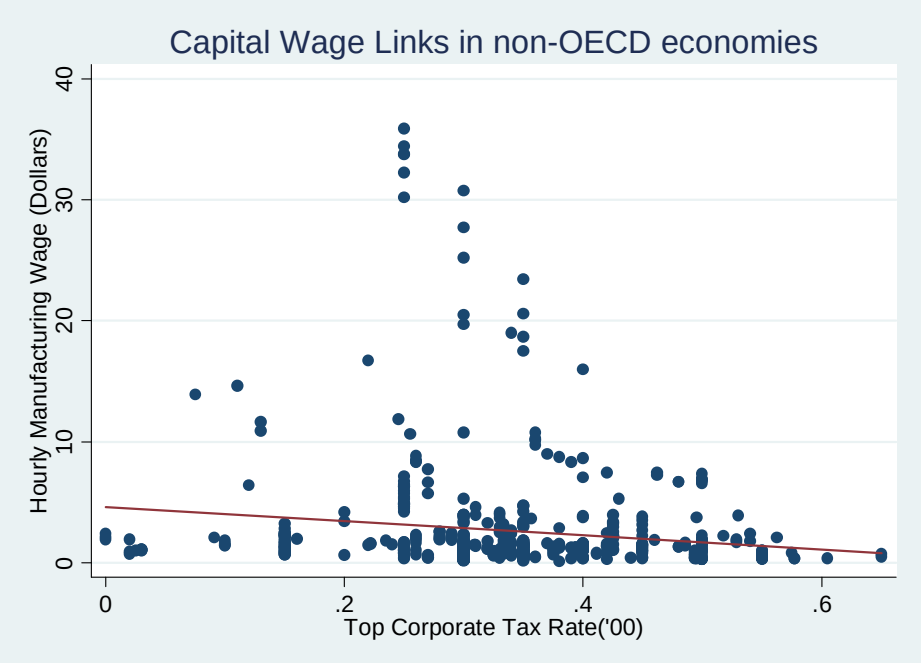


B. Trend in Average Personal Income Tax Rates

Figure 3: Capital Wage Links in OECD and Non-OECD Economies



OECD: Slope coefficient=-25.76



Non-OECD: Slope coefficient =-5.88

Table 2: Variation In Top Corporate Tax Rates (’00)

	Australia	Austria	Bolivia	Chile	Colombia
1981	0.46	0.55	0.30	0.48	0.40
1982	0.46	0.55	0.30	0.48	0.40
1983	0.46	0.55	0.30	0.46	0.40
1984	0.46	0.55	0.30	0.23	0.40
1985	0.46	0.55	0.30	0.10	0.40
1986	0.49	0.55	0.02	0.10	0.40
1987	0.49	0.55	0.02	0.10	0.30
1988	0.39	0.55	0.02	0.10	0.30
1989	0.39	0.30	0.02	0.09	0.30
1990	0.39	0.30	0.03	0.15	0.30
1991	0.39	0.30	0.03	0.15	0.30
1992	0.39	0.30	0.03	0.15	0.30
1993	0.33	0.30	0.03	0.15	0.37
1994	0.33	0.34	0.25	0.15	0.37
1995	0.36	0.34	0.25	0.15	0.35
1996	0.36	0.34	0.25	0.15	0.35
1997	0.36	0.34	0.25	0.15	0.35
1998	0.36	0.34	0.25	0.15	0.35
1999	0.36	0.34	0.25	0.15	0.35
2000	0.34	0.34	0.25	0.15	0.35
2001	0.30	0.34	0.25	0.15	0.35
2002	0.30	0.34	0.25	0.16	0.35
2003	0.30	0.34	0.25	-	0.35
2004	0.30	0.34	0.25	-	0.35
2005	0.30	0.25	0.25	-	0.35

Table 3: Variation in Wage Rates (US $ per hour)

	Australia	Austria	Bolivia	Chile	Colombia
1981	9.8	6.87	1.2	1.64	1.15
1982	8.12	6.86	1.09	1.43	1.29
1983	7.51	6.85	1.5	1.90	1.34
1984	7.77	6.46	0.82	1.85	1.31
1985	6.59	6.63	1	1.43	1.11
1986	6.65	9.42	1.91	1.49	1.02
1987	7.36	11.80	0.73	1.62	0.82
1988	8.96	12.56	0.93	1.82	1.03
1989	9.84	12.28	0.98	2.05	1.11
1990	10.06	15.36	1.00	2.34	1.07
1991	10.33	15.81	1.10	2.78	0.84
1992	10.04	17.80	1.06	3.23	1.29
1993	9.53	17.65	1.08	1.60	0.93
1994	10.75	18.72	1.11	1.79	1.31
1995	11.55	17.87	1.11	2.15	1.32
1996	12.83	17.57	0.84	2.32	1.44
1997	16.58	15.41	0.94	2.48	1.55
1998	10.91	16.05	1.02	2.41	1.71
1999	15.66	15.36	1.07	2.24	1.45
2000	10.52	13.60	1.09	2.20	1.59
2001	9.40	12.49	1.22	1.99	1.60
2002	11.55	18.75	1.30	1.97	1.46
2003	-	-	-	2.00	0.92
2004	16.74	-	-	2.35	1.04
2005	-	-	-	2.70	1.24

Table 4A: Regression Results

	(1)	(2)	(3)	(4)	(5)
Dependent Variable: Log (Average Hourly Wage) (5 year average)					
Log(TopCorpTax)	-0.822	-0.824		-0.805	-0.920
	(2.83)***	(2.76)***		(2.66)***	(2.14)**
Log(ValueAdded)	0.511	0.518	0.722	0.552	0.407
	(2.08)**	(2.03)**	(2.90)***	(2.03)**	(1.18)
Log(CPI)	0.487	0.454	0.359	0.257	0.658
	(2.32)**	(1.73)*	(1.36)	(0.93)	(1.98)*
Log(PersonalTax)	-0.154	-0.117	-0.274	0.025	-0.119
	(0.60)	(0.44)	(1.03)	(0.10)	(0.29)
Log(Trade/GDP)		-0.043	-0.022	-0.354	-0.129
		(0.15)	(0.08)	(1.11)	(0.34)
LaborMktReg				0.044	-0.041
				(0.08)	(1.46)
Computerization					0.002
					(0.23)
Constant	-6.39	-6.29	-6.45	-5.13	-3.59
	(2.44)**	(2.14)**	(2.16)**	(1.50)	(0.91)
Observations	219	215	216	190	128
Overall R-squared	0.25	0.26	0.19	0.24	0.26

Absolute value of t statistics in parentheses
***significant at 1%; **significant at 5%;*significant at 10%

1. All specifications include country fixed effects and period dummies.
2. The dependent variable is the 5 year average of the wage rate over sub-periods: 1981-1985, 1986-1990, 1991-1995, 1996-2000,2001-2005. The independent variables are the beginning of period values of these variables.

Table 4B: Capital-Labor Ratios, Taxes and Wages

	(1) Log(Wage)	(2) Log (K/L)	(3) Log(K/L)	(4) Log(K/L)
Log(K/L)	0.393			
	(1.98)**			
Log(TopCorpTax)	-0.304	-0.093		
	(0.96)	(2.05)**		
Log(ValueAdded)	0.104			
	(0.57)			
Log(CPI)	0.805			
	(2.30)**			
Log(Wages)		0.039	0.032	0.028
		(2.04)**	(1.59)	(1.41)
Log(EffAvgTaxrt)			-0.142	
			(2.42)**	
Log(EffMargTaxrt)				-0.085
				(1.87)*
Time Dummies	Yes	Yes	Yes	Yes
Observations	145	361	327	320
R-Squared	0.55	0.21	0.19	0.21

Absolute value of t statistics in parentheses
***significant at 1%; **significant at 5%;*significant at 10%

1.In specification (1)the dependent variable is the 5 year average of the wage rate over sub-periods: 1981-1985, 1986-1990, 1991-1995, 1996-2000,2001-2005. The independent variables are the beginning of period values of these variables. Estimation is via OLS allowing for country fixed effects and time dummies.
2. Specifications (2),(3) and (4) use the 3 year average of the dependent variable. The independent variables are the beginning of period values of these variables. Estimation is via fixed effects and includes time dummies.

Table 4C: Instrumental Variable Estimation

	(1)	(2)	(3)
	First-Stage	*Second Stage*	
Dependent Variable:	Log(TopCorpTax)	Log(Average Wage)	Log(Average Wage)
Log(CapGains Tax)	0.354		0.163
	(0.075)***		(0.274)
Log(TopNatCorpTax)		-2.231	-0.874
		(0.853)***	(0.355)**
Log(ValueAdded)	-0.037	-0.209	0.513
	(0.035)	(0.152)	(0.286)*
Log(CPI)	0.212	0.814	0.468
	(0.067)***	(0.367)**	(0.238)*
Constant	-2.800	-3.613	-7.570
	(0.451)***	(1.999)*	(2.993)**
Observations	174	174	174

Absolute value of t statistics in parentheses
***significant at 1%; **significant at 5%;*significant at 10%

1. All specifications include country fixed effects and period dummies.
2. The dependent variable is the 5 year average of the wage rate over sub-periods: 1981-1985, 1986-1990, 1991-1995, 1996-2000,2001-2005. The independent variables are the beginning of period values of these variables.

Table 5: Other Tax Measures

	(1)	(2)	(3)	(4)
Dependent variable: Log(Average hourly wage) (5 year average)				
Log(Eff.Mrg.Tax)	-0.363		-0.304	
	(1.65)*		(1.43)	
Log(Eff.Avg.Tax)		-0.662		-0.525
		(2.04)**		(1.76)*
Log(ValueAdded)	0.523	0.464	0.555	0.517
	(2.04)**	(1.79)*	(2.20)**	(2.09)**
Log(PersonalTax)	-0.203	-0.193	-0.336	-0.323
	(0.77)	(0.75)	(1.14)	(1.15)
Log(CPI)	0.593	0.629	0.400	0.419
	(2.47)**	(2.65)***	(1.77)*	(1.92)*
Constant	-6.378	-6.325	-5.315	-5.348
	(2.25)**	(2.27)**	(2.12)**	(2.19)**
Observations	196	200	95	98
Sample	All	All	Non-OECD	Non-OECD
R-squared	0.23	0.24	0.18	0.20

Absolute value of t statistics in parentheses
***significant at 1%; ** significant at 5%;*significant at 10%

1. All specifications include country fixed effects and period dummies.
2. The dependent variable is the 5 year average of the wage rate over sub-periods: 1981-1985, 1986-1990, 1991-1995, 1996-2000,2001-2005. The independent variables are the beginning of period values of these variables.

Table 6: Regressions with Spatial Variables

	(1)	(2)	(3)	(4)	(5)
Dependent Variable: Log(Average Hourly Wage) (5 year average)					
Log(TopCorpTax)	-0.826	-0.856	-0.928		
	(2.84)***	(2.86)***	(3.05)***		
Log(Eff.Marg.Tax)				-0.312	
				(1.39)	
Log(Eff.Avg.Tax)					-0.752
					(2.36)**
Log(ValueAdded)	0.237	0.426	0.499	0.358	0.223
	(0.92)	(1.54)	(1.89)*	(1.19)	(0.82)
Log(CPI)	0.402	0.321	0.344	0.396	0.495
	(1.99)**	(1.49)	(1.67)*	(1.49)	(2.09)**
Wgt.OwnRegWage	0.385				0.426
	(2.16)**				(2.42)**
Wgt.OwnRegTax	0.002				0.436
	(0.01)				(1.70)*
Incwt.NeighborWage		0.495		0.557	
		(1.75)**		(1.87)*	
Incwt.NeighborTax		0.433			
		(1.30)			
Incwt.NeighborEffMargTax				0.548	
				(1.71)*	
Dist*incwt.NeighborWage			0.391		
			(1.92)*		
Dist*incwt.NeighborTax			0.484		
			(1.72)*		
Constant	-4.216	-5.398	-6.152	-4.51	-4.06
	(1.70)*	(2.02)**	(2.41)**	(1.49)	(1.53)
Observations	223	223	223	197	202
R-squared	0.29	0.25	0.26	0.22	0.20

Absolute value of t statistics in parentheses
***significant at 1%; ** significant at 5%;*significant at 10%

1. All specifications include country fixed effects and period dummies.
2. The dependent variable is the 5 year average of the wage rate over sub-periods: 1981-1985, 1986-1990, 1991-1995, 1996-2000,2001-2005. The independent variables are the beginning of period values of these variables.
3. Columns (1) and (5) use GDP-weighted own region countries as neighbors. Columns (2) and (4) use GDP-weighted own Income group countries as neighbors. Column (3) uses Distance weighted own Income group countries as neighbors.

Table 7: Results with Other Explanatory Variables: Democracy, Payroll and VAT Taxes

	(1)	(2)	(3)	(4)
Dependent Variable: Log(Average Hourly Wage) (5 year average)				
Log(TopCorpTax)	-0.715	-0.579	-0.627	-0.917
	(2.35)**	(1.75)*	(1.89)*	(3.31)***
Log(ValueAdded)	0.490	0.651	0.790	0.719
	(1.97)**	(2.00)*	(2.70)***	(3.57)***
Log(CPI)	0.445	0.479	0.729	0.434
	(2.11)**	(2.07)**	(2.22)**	(2.66)**
Log(PersonalTax)	-0.166	-0.306		-0.192
	(0.65)	(0.96)		(0.91)
Democracy	0.392			
	(1.00)			
Log(Payrolltax)		-0.214		
		(1.20)		
Log(VAT)			-0.548	
			(1.40)	
Constant	-6.14	-6.55	-8.939	-7.86
	(2.32)***	(1.90)*	(2.56)**	(3.53)***
Observations	217	153	159	176
Sample	All	All	All	Exclude SS
R-squared	0.27	0.23	0.21	0.23

Absolute value of t statistics in parentheses
*** significant at 1%; ** significant at 5%;***significant at 10%

1. All specifications include country fixed effects and period dummies.
2. The dependent variable is the 5 year average of the wage rate over sub-periods: 1981-1985, 1986-1990, 1991-1995, 1996-2000,2001-2005. The independent variables are the beginning of period values of these variables.

Table 8: Small Economy Results

	(1)	(2)	(3)
Dependent Variable: Log(Average Hourly Wage) (5 year average)			
Log(TopCorpTax)	-0.824	-1.070	-1.543
	(2.85)***	(3.16)***	(1.88)*
Log(Personaltax)	-0.160	-0.045	-0.413
	(0.63)	(0.15)	(0.58)
Log(ValueAdded)	0.514	0.206	0.248
	(2.10)*	(0.62)	(1.20)
Log(CPI)	0.493	0.556	0.538
	(2.41)**	(2.33)**	(1.53)
Constant	-6.417	-4.553	-4.466
	(2.46)***	(1.23)	(2.13)**
Sample	All	All-Top 10	Smallest 12
Observations	219	178	44

Absolute value of t statistics in parentheses
*** significant at 1%; ** significant at 5%;*significant at 10%

1. All specifications include country fixed effects and period dummies.
2. The dependent variable is the 5 year average of the wage rate over sub-periods: 1981-1985, 1986-1990, 1991-1995, 1996-2000,2001-2005. The independent variables are the beginning of period values of these variables.

Table 9: Other Specifications: Fixed Effects GLS, Random Effects GLS, OLS

Dependent Variable: Log(Average Hourly Wage)

	(1) RE GLS	(2) OLS	(3) Feasible GLS
Log(TopCorpTax)	-0.919	-0.844	-0.910
	(3.55)***	(2.59)***	(3.76)***
Log(ValueAdded)	0.245	0.183	0.313
	(2.47)**	(1.49)*	(2.90)**
Log(PersonalTax)	-0.174	0.082	-0.125
	(0.76)	(0.28)	(0.58)
Log(CPI)	0.825	1.014	0.448
	(4.82)***	(4.33)***	(2.68)***
Region Dummies			
East Africa		1.241	
		(1.88)	
South Africa		1.545	
		(2.88)**	
Caribbean		2.416	
		(3.31)**	
Central America		0.995	
		(2.09)*	
South America		0.361	
		(0.84)	
South Asia		-0.374	
		(0.64)	
West Asia		-0.728	
		(1.50)	
East Europe		0.163	
		(0.38)	
North Europe		1.585	
		(4.20)**	
South Europe		1.052	
		(2.57)*	
West Europe		1.647	
		(4.22)**	
Southeast Asia		0.422	
		(1.00)	
Constant	-5.272	-5.481	-3.895
	(1.55)**	(3.22)**	(2.42)**
Period Dummies	Yes	Yes	Yes
Country Fixed Effects	-	-	Yes
Observations	218	218	212
R-squared	0.29	0.50	0.27

Absolute value of z statistics in parentheses
*** significant at 1%; ** significant at 5%;*significant at 10%

Data Appendix

A.1 AEI International Tax Database

The main sources of information for the data are: (1) The Price Waterhouse Coopers Corporate taxes – Worldwide Summaries" and "Individual taxes – Worldwide Summaries" (2) Coopers and Lybrand: "International Tax Summaries" (3) "Worldwide Corporate Tax Guide 2001" by Ernest & Young (4) The International Bureau for Fiscal Documentation's Loose-leaf Service (5) Embassies and ministries of taxation in individual countries. Historical information was gathered from Georgetown Law Library and the Library of Congress. The most recent information was purchased from the PWC website: (http://www.pwcglobal.com/extweb/pwcpublications.nsf/DocID/2823C13DCC401BF0852567200063EE25) or printed out from the E&Y website.

The Database consists of a number of spreadsheets containing information on a specific tax rate, the number of income tax brackets and the upper limit of each bracket (in local currency) and the tax rate in each bracket for about 128 countries. We chose countries based on data availability and to ensure a mix of developing and developed economies.

The database contains information on the following tax variables: (1) Personal Income Taxes (2) Deductions to Personal Income Taxes (3) Personal Dividend Taxes (4) Local Personal Taxes (5) Capital Gains Taxes (6) Corporate Taxes (manufacturing are reported separately)[35] (7) Local Corporate Taxes (8) Corporate Dividend Taxes (9) Corporate Capital Gains Taxes (10) Employer Payroll Taxes (11) Employee Payroll Taxes (12) VAT (13) Inheritance and Gift Taxes. It also provides information on the tax depreciation rules followed by countries. Depreciation rules are broadly based on the straight line method or the declining balance method or a combination of both. These rates vary across countries and were used in the calculation of the effective average and effective marginal corporate tax rates.

Cross-country comparability issues

The main differences across countries in corporate taxation arise due to various surcharges and additional contributions that are either (1) added to the base tax rates or (2) are imposed as a proportion of taxes payable. For instance, Barbados in 1991 added a 1.5 percent stabilization tax to all marginal tax rates. Brazil in 2005 imposed an additional 'social contribution' of 10 percent. The assumption we have made is that if the surcharge applies to all tax brackets, it is added to all the corresponding tax rates. In other cases, the surcharge is applied to all tax payable. In this case, all tax rates are multiplied by (1+surcharge%). For instance, Belgium in 2005 imposed a crisis tax of 3 percent, raising its total corporate tax rate to 33.99 percent from 33 percent. Canada in 1987 imposed a temporary 3% surtax on tax payable. All marginal tax rates were multiplied by 1.03. However, in some cases this is not possible since the surcharge applies only if the

[35] The corporate tax information is for corporations organized or created in the specific country or under the law of the country. A domestic corporation is a resident corporation even though it does no business or owns no property in the specific country.

tax liability is above a certain level. In such cases, the marginal tax rate would vary for the high income and the low income groups depending upon the actual tax payments (net of deductions etc). If no further information is provided, in such cases the surtax is not included. For example, in Korea 1981-1990, there is a 10% defense tax on tax payable, which is increased to 20% for higher tax payers. The 20% surtax is not included in this database, while the 10% surtax is applied to all income levels.

Apart from the various surcharges and additional contributions imposed on the marginal tax rates, we have had to make certain assumptions while dealing with the data. Some of these are listed here. For more detailed notes, we would refer you to the AEI International Tax Database.

In Saudi Arabia, Saudi owned enterprises and the Saudi portion of joint enterprises are not subject to the corporate income tax. We have used the tax rate applicable to foreign firms.

In Thailand for certain years, the tax rate for companies listed on the stock exchange was lower than for those companies not listed on the exchange. We have used the rate for companies listed on the stock exchange. This is also true of Pakistan, where different rates apply to publicly listed companies compared to non-publicly listed companies. We have used the rate for the former.

In Canada, the national corporate tax rate is reduced by 10% to allow the provinces and territories room to impose corporate taxes. In general, whenever a country allows deductions of the local corporate tax from the national tax, these deductions are taken into account.

In Spain, there is a reduced rate for qualifying small businesses who earn uptil a certain level of income (the actual number varies across years). This is not taken into account since it is not possible to distinguish between types of businesses or the number of years they are in operation.

A.2 International Wage Data

The statistics on wages are obtained from the ILO's Key Indicators of the Labor Market (KILM). The ILO reports *average earnings* per worker or, in some cases, *average wage rates*. Some of the series cover wage earners (i.e. manual or production workers) only, while others refer to salaried employees (i.e. non-manual workers), or all employees (i.e. wage earners and salaried employees). The series cover workers of both sexes, irrespective of age.

Earnings: The concept of earnings relates to remuneration in cash and in kind paid to employees, as a rule at regular intervals, for time worked or work done together with remuneration for time not worked, such as for annual vacation, other paid leave or holidays. In general, earnings exclude employers' contributions in respect of their employees paid to social security and pension schemes and also the benefits received by employees under these schemes. However, some countries report any such payments made. Earnings also exclude severance and termination pay.

Statistics of earnings should relate to employees' gross remuneration, i.e. the total before any deductions are made by the employer in respect of taxes, contributions of

employees to social security and pension schemes, life insurance premiums, union dues and other obligations of employees.

Earnings include: direct wages and salaries, remuneration for time not worked (excluding severance and termination pay), bonuses and gratuities and housing and family allowances paid by the employer directly to this employee. (a)Direct wages and salaries for time worked, or work done, cover: (i) straight time pay of time-rated workers; (ii) incentive pay of time-rated workers; (iii) earnings of piece workers (excluding overtime premiums); (iv) premium pay for overtime, shift, night and holiday work; (v) commissions paid to sales and other personnel. Included are: premiums for seniority and special skills, geographical zone differentials, responsibility premiums, dirt, danger and discomfort allowances, payments under guaranteed wage systems, cost-of-living allowances and other regular allowances. (b) Remuneration for time not worked comprises direct payments to employees in respect of public holidays, annual vacations and other time off with pay granted by the employer. (c) Bonuses and gratuities cover seasonal and end-of-year bonuses, additional payments in respect of vacation period (supplementary to normal pay) and profit-sharing bonuses. (ii) Statistics of earnings should distinguish cash earnings from payments in kind.
Wage rates: These include basic wages, cost-of-living allowances and other guaranteed and regularly paid allowances, but exclude overtime payments, bonuses and gratuities, family allowances and other social security payments made by employers. *Ex gratia* payments in kind, supplementary to normal wage rates, are also excluded.

Thus broadly country coverage differs due to the following reasons: (1) whether the reported statistic is wages or earnings (2) whether it covers employees, wage earners or salaried employees (3) whether it includes social security contributions by employer. When we studied the descriptions more closely, we found that certain countries like Chile, Turkey, Colombia, Ecuador, Kenya, Kyrgyzstan, Mexico, Malaysia, Panama and Ukraine included social security contributions by employers in the earnings data. Another difference arises because the industrial classification changed during this period. Since the beginning of the 1990s an increasing number of countries have made a switchover in their data reporting systems for industrial statistics from Revision 2 to Revision 3 of the International Standard Classification of All Economic Activities (ISIC).

Including dummies to allow for all these differences in coverage in a panel regression (without country fixed effects) yielded a highly significant negative sign on corporate tax rates, and no change in results for the other variables.