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TAXES, GROWTH AND
UNEMPLOYMENT IN
THE OECD COUNTRIES
- DOES COLLECTIVE
BARGAINING MATTER?

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Abstract:

This paper analyses how collective bargaining affects the level and structure of labour and capital taxes in OECD countries by using cross-country-time-series data. Corporatist countries are found to have higher effective labor taxes on average during the 1970-1996 period. Effective capital taxes, in turn, are higher in the countries where union membership is higher. Estimation results suggest that reduction in the effective labor taxes decreases unemployment only in the unionized countries with decentralized wage bargaining. The capital taxes have only a small distorting effect on per-capita GDP growth, but there is no conclusive evidence on neither direct or indirect effect of the labor taxes on growth. Small or non-existent distortionary effects of capital and labour taxes on growth can be due to the potential efficiency gains arising from redistributive taxation. Potential efficiency gains of redistribution are supported by the finding that inequality seem to have a negative effect on per-capita GDP growth.

Key words: Taxes, Growth, Unemployment, Unions

JEL: E62, J51

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Tiivistelmä: Tässä tutkimuksessa analysoidaan työmarkkinoiden palkkaneuvottelujärjestelmän vaikutusta työ- ja pääomatuloverotuksen tasoon, sekä näiden verojen vaikutusta kasvuun ja työllisyyteen OECD maissa periodilla 1970-1996. Paneeliaineiston estimointitulokset osoittavat että efektiivinen työtulovero on korporatistisissa maissa keskimäärin korkeammalla tasolla. Efektiivinen pääomavero on puolestaan keskimääräistä korkeampi maissa, joissa työvoiman järjestäytymisaste on korkea. Tulosten mukaan työtulovero vaikuttaa työttömyysasteeseen merkitsevästi vain maissa, joissa on liittotason palkkaneuvottelujärjestelmä. Pääomaverolla on pieni, mutta tilastollisesti merkitsevä vaikutus kasvuun. Työtuloveron suuruudella sen sijaan ei ole tilastollisesti merkitsevää vaikutusta kasvuun.

Asiasanat: Verotus, kasvu, työllisyys, ammattiliitot

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1 Introduction

In their seminal paper, Summers Gruber and Vergara (1993) suggest that labor market institutions, a degree of corporatism especially, explains a large part of variation in government collected tax revenues in 14 OECD countries during the period of 1955-1988. They argued in line with Olson (1965) that corporatist labor institutions recognize the linkage between the taxes that workers pay and benefits they receive in terms of public goods. In other words, corporatist labor unions see "beyond the budget constraint of the government". Consequently, labor taxes will have smaller distortionary effects on labor supply than they have in situations where individual workers make labor supply decisions. More corporatist countries, then, also prefer higher levels of labor taxation. Empirical analysis of Summers et. al. (1993) suggested a linear positive relationship between labor tax revenues as a percentage of GDP and the degree of corporatism.

This paper extends this discussion with political economy and tests two explanations as to why high labor taxes and high capital taxes are preferred in the countries with more centralized wage bargaining. We then estimate the effect of labor and capital taxes on growth and unemployment during the period of 1970-1996 in 17 OECD countries. Our results with extended data set and different tax variables are in line with Summers, Gruber and Vergara (1993). We use effective labor tax rates¹, which measure better the overall burden of labor taxes and demonstrate with simple causal test that the degree of centralization in wage bargaining actually Granger causes higher labor tax rates. Our results reveal also that this empirical relationship has remained surprisingly robust across time.

We discuss in some detail the political economy of taxation and redistribution. The theoretical literature suggests that in the countries with highly organized labor, decisive voter belongs to the group where taxation is biased towards benefitting the poor and/or to the group who does not own the capital. It is therefore not necessarily the centralization of wage bargaining as such, but the influence that unions have on the political decision making of taxation that drives the determination of taxes. This political economy argument can most easily be reconciled in the relationship between the union membership rates and effective capital taxes. Our results suggest that the countries where the union membership has been higher, have also had higher effective capital taxes.

After studying the determination of taxes, our study proceeds by discussing and evaluating the economic impacts of taxation on growth and unemployment. The recent empirical studies of European unemployment and growth suggest that the size of the distortionary effects of labor taxes on unemployment and growth depend

⁰The views expressed in this paper are those of the author and do not necessarily reflect the views of the Government Institute for Economic Research and Bank of Finland

¹See Data Appendix for details. However, notice that measurement and international comparisons of effective tax rates are not without problems. Carey et al. (2000) notes that while effective tax rates represent more informative indicator of the burden and impact of tax systems than a simple reliance on nominal (statutory) tax rates or tax revenue as a share of GDP, their calculation raises several potentially significant methodological problems.

upon labor market institutions, in line with the arguments of Summers, Gruber and Vergara (1993). In more corporatist countries, labor taxes tend to have less distortionary effect on unemployment than in the countries where wage bargaining is more decentralized. In particular, distortionary effect of labor taxes on unemployment is largest in the countries with industrial level wage bargaining systems. Daveri and Tabellini (2000) find that the observed rise of about 14 percentage points in the labor tax rate corresponds to a rise in unemployment of about 4 percentage points in continental Europe during the last 25 year period. Also Nickell and Layard (1999) report that overall tax burden on labor has a clear positive impact on unemployment and labor supply. Daveri and Tabellini (2000) found that effects of capital taxes on growth, instead, are negligible in all countries. OECD (1997) suggests that increase in the average tax rate of about 10 percentage points over the past 35 years may have reduced OECD annual growth rates around .5 percentage points.²

Our results support in general the earlier findings of Daveri and Tabellini (2000) and Nickell and Layard (1997) regarding labor taxes and unemployment. We found out that labor taxes have statistically significant effect on unemployment in the countries with industry level bargaining system. However, our results do not confirm the empirical regularity between unemployment and growth as found in Daveri and Tabellini (2000). Econometrics show that the relationship between unemployment and growth estimated in Daveri and Tabellini (2000) might be contaminated by a larger outlier of Finland in the regression. After controlling for the effect of Finland's dramatic and exceptional recession in the early 1990s from the cross-section-time-series model yields no statistically significant relationship between growth and unemployment for the rest of selected OECD countries³. Our results regarding the relationship between capital taxes and output growth are somewhat sensitive to different specifications of the model, but if anything, capital taxes seem to have small distorting effect on output growth. Moreover, our results seems to suggest that inequality is harmful for growth, supporting the view that redistribution can potentially improve productive efficiency and growth. Daveri and Tabellini (2000) used somewhat different specification of the growth model, but did not find clear evidence on statistically significant effect of capital taxes on growth.

The rest of the paper is organized as follows. Section 2 discusses the theoretical hypothesis as to why taxes are higher in the countries with more centralized wage bargaining. Section 3 discusses primarily the theories that link labor and capital income taxes on growth and unemployment. Sections 4 present empirical results and section 5 concludes.

²Empirical evidence on the effects of taxes on growth is inconclusive, sometimes even opposite to the plausible predictions of economic theory. See for instance Easterly and Rebelo (1993) and Perotti (1996).

³Our empirical model, estimation period and the data is also somewhat different to that used in Tabellini and Daveri (2000) and might also contribute to our different result.

2 Unions and determination of taxes

2.1 Internalizing externality

Unions can play an important role in the determination of taxes, basically in two different ways. In the first case, unions maybe considered as principal actors, behaving monopolistically or negotiating wages with firms. In the monopoly union models a higher degree of centralization in wage bargaining leads into least tax distortions, because of simple externality explanation: If unions are large enough, they recognize a linkage between taxes and benefits received, internalizing the aggregate consequences of their actions.⁴ In the simple efficient bargaining model of Summers, Gruber and Vergara (1993) the bargaining game between unions and employers suggests that when unions are more encompassing, the distorting effects of labor taxes declines, encouraging the use of labor taxes as means of redistribution. Essentially their encompassing argument exploits the assumption that corporatist unions recognize that their members represent a significant group of tax-payers and hence bear the costs of reductions in the size of the tax base. In this way, large enough unions internalize the government budget constraint in choosing wage and labor input levels. We show in appendix B how this same effect can be rationalized in a simple wage setting model with utilitarian unions. It is shown that corporatist unions prefer higher labor taxes, but they distort the labor supply choice of the individuals less when compared to case where wage bargaining is decentralized among monopolistically behaving unions. Moreover, if the government maximizes labor tax revenues, it is shown that public spending is higher in the corporatist economies when compared to countries with monopolistic wage setting.

2.2 The political economy

In the second approach, the mode of corporatism or unionism is included into the model through political economy considerations. The idea is simple. When taxes are assumed to be determined through political process, the political process leads to the formation of tax financed social security systems that benefit lower income workers. Formal models where the taxes are determined through political process typically use one vote, one person idea, where the decisive voter belongs to 50th percentile in the wealth distribution. Since it is typical that unions represent workers with wealth lower than the average of all tax-payers and voters, powerful labor can pursue its objectives through the political process, resulting the so called "negative wealth bias". In such a situation the society would appear maximizing the welfare of an individual, who belongs at lower than 50th percentile in wealth distribution. Abstracting from many important dynamic considerations and trade-offs between growth, optimal accumulation of capital and employment, such a simple idea would suggest that taxes are higher and more redistributive on average in the countries

⁴This has been discussed extensively by Calmfors (1994) and Rama (1994).

with more powerful unions.⁵⁶

Similar kind of political-economy interaction arises between the agents who differ in terms of sources of their income, rather than the initial level of wealth, as emphasized in Bertola (1993). Political support for distributional policies, aimed at enhancing investment led growth, depends crucially on the distribution of political power across owners of accumulated (capital) and non-accumulated (physical labor, land) factors of production, as well as a menu of policy instruments available. Similarly, welfare effects of growth-oriented policies differ between those who own accumulated or non-accumulated factors of production. If non-accumulated factor of production is identified as "labor" and the government redistributive instrument was limited to direct factor income tax and subsidy, the stylized model of Bertola (1993) would predict that the countries where political system would be biased towards "labor" would exhibit lower growth. The median voter would purportedly support low labor income tax and low capital income subsidy. On the contrary, if the government could effectively use indirect consumption tax intended to increase the rate of investment through investment subsidy, similar "labor bias" may lead to support the redistributive scheme where investment led growth would be enhanced by high consumption tax.

Whilst these theoretical results are model specific and cannot not be generalized, Bertola's (1993) model emphasizes importance of dynamic linkages between consumption decisions and growth in the political-economy setup. Factors that determine empirical regularity between the wage bargaining institutions, labor taxes and capital taxes are likely to be much more complicated than those based on simple labor supply arguments given in Summers et.al. (1993). Whilst a simple externality argument quite convincingly suggests that more corporatist countries with more powerful labor exhibit higher labor income taxes, this same simple "static" argument should not be applied to capital taxation. When the dynamic linkages between savings, capital accumulation and growth are correctly modeled in a more realistic political-economy models with endogenous growth, there is necessarily a trade-off between consumption today and growth tomorrow. Consequently, extent to which capital tax distorts private investment decisions and thereby growth is likely to make capital taxes less appropriate instrument of redistribution, even in the countries with powerful labor.⁷ Moreover, globalization and free movements of capital can

⁵See for instance Benabou (1999).

⁶Another plausible explanation why corporatism may lead into higher labour taxes and wage compression is related to the insurance role of wage compression. Income protection programs financed by redistributive taxation may produce welfare gains for risk averse individuals, by reducing the variance of disposable income (Diamond et.al. (1980) Eaton and Rosen (1980), Varian (1980)). Agell and Lommerud (1992) have shown that such insurance benefits from small compression of the wage structure will outweigh any efficiency losses imposed on the economy. When workers are more uncertain about their future position in the wage distribution, the insurance demand for wage compression is likely to increase. As the unions' bargaining power becomes so large that they can effectively affect wage distribution, union members prefer "more egalitarian" wage policy and vote for higher labour taxes that reduce variance of disposable income through different income protection programs.

⁷However, Persson and Tabellini (1999) suggest also that since capital is more concentrated

effectively prevent significant differences in capital taxes across developed countries. The same internal political economy forces that drive the determination of labor taxes may therefore be weaker in the case of capital taxes. This seems evident from the fact that even in the countries with fairly competitive labor markets, such as the US, the U.K. and Canada capital taxes are not significantly lower compared with European countries on average.

than labor income, a majority of the voters gain from shifting a larger share of the tax burden to capital, despite the potential efficiency losses.

3 Economic effects of taxation

3.1 Depressed incentives, growth and unemployment

Institutions and economic mechanisms that contribute to the rate of economic growth and unemployment rate have become increasingly active areas of research and debate. The recent theoretical analysis relies primarily on endogenous growth models where accumulation of human capital and its externalities are seen as central driving forces of steady state growth. The contrast between the predictions of the models based on representative agent and complete markets and the models with heterogeneous agents and incomplete markets is sharp. Competitive models emphasize the distortionary effects of taxation, while the models with missing markets emphasize the potential efficiency gains arising from redistributive taxation.

For instance, in the model proposed by Lucas (1988), the human capital is accumulated in the same manner as physical capital. In that model, the economy needs to devote a certain fraction of investment to the accumulation of physical capital. The steady state growth of output then coincides with the growth rate of physical capital. Consequently, economic policy can actually affect the steady state growth of the economy. Simply, any economic policy that influences savings decisions, or allocation of consumption and investments of the individuals, also affects the steady state growth. In particular, these models demonstrate that direct capital tax distorts the individuals' savings decision and therefore leads into a slower steady state growth of the economy. These theoretical implications, then, have motivated a common view that capital taxes should be avoided.⁸

Similarly, effects of labor tax on labor supply decisions, unemployment and growth can easily be reconciled in the growth models with frictions in the labor markets. A tax wedge between wages paid and received can lead into equilibrium unemployment, as long as wages are not allowed to adjust accordingly. When labor income taxes affect on unemployment, they can potentially influence also steady-state growth. For instance, in the two period overlapping-generations-model with monopolistic wage setting, as studied in Daveri and Tabellini (2000), higher equilibrium level of unemployment implies higher capital-labor ratio and hence a less productive capital stock. Consequently, lower rates of returns from capital yield lower savings and hence lower growth rate per capita output. As a result, any factor that increases equilibrium rate of unemployment, such as tax on labor, leads also into a lower equilibrium growth rate of per capita output.⁹ Their model also suggest a negative relationship between output growth, investment and unemployment.

Taxes are usually used to finance social insurance programs and their intertemporal disincentive effects through social security system need to be considered from the viewpoint of individuals maximizing their life-time utilities. When benefits of social insurance are tied to the contributions there exist a social insurance sys-

⁸See for instance Feldstein (1995).

⁹These results rely of course critically on the presumed positive impact of interest rate on savings. It has been noted e.g. by Nickell and Layard (1997) that empirical evidence on the positive impact of interest rates on savings is inconclusive.

tem, where present discounted value of individual's contributions equals present discounted value of individual's benefits. Consequently, payroll taxes that are used to finance earnings related social security in such an optimal system should have little or no detrimental effect on labor supply and unemployment.

However, if social insurance system financed by the income or payroll taxes "forces" individuals to save more than they otherwise would done, then the social insurance program will have effects on the labor market, even if the present discounted value of benefits equals that of contributions (Stiglitz (1999)). This distortion makes individuals worse off and the income effect of the distortion leads to increased labor supply and therefore unemployment.

Simple endogenous growth models based on complete markets are based on representative agent framework where redistribution through social security programs does not play a role. Typically, predictions of these models oversimplify the effects of taxes since they do not recognize the consequences of redistribution, recently emphasized in the literature of growth, inequality and coordination failures.

3.2 Redistribution, growth and unemployment

As discussed above, distortionary effects of taxation are due to depressed incentives on savings and/or labor supply. However, the literature on growth and inequality, initiated by Loury (1981), emphasizes the role of redistribution and potential efficiency gains of redistributive taxation. Indirect evidence on the potential benefits of redistribution has been obtained from cross-country growth studies. Many empirical studies suggest a negative relationship between inequality and growth, challenging the old theories according to which wealth inequality should be growth enhancing (Aghion (1999)).¹⁰ Empirical results are somewhat sensitive to different specifications of the estimated model and measurement of inequality. However, one can at least say that it has become extremely difficult to build a case that inequality is good for growth. The negative relationship between inequality and growth has led many economists to study the likely mechanisms behind this relationship.

Alesina and Rodrik (1994) and Persson and Tabellini (1994) suggested that inequality effects taxation through political process and individual voting behavior. They suggest that individuals in more unequal societies would prefer more redistribution. If inequality determines the extent of redistribution, inequality will have indirect negative effect on the rate of growth of the economy, since redistribution reduces incentives to save and invest. Therefore, the negative relationship between inequality and growth would arise from interaction of political and economic factors. However, there are two empirical objections to this argument. First, empirical evidence from cross-country regressions, surveyed for instance in Bènabou (1999), does not support the hypothesis on direct negative effects of redistribution (shares of var-

¹⁰The traditional view argues that there is a fundamental trade-off between productive efficiency/growth and or social justice. Redistribution has both direct and indirect effect on growth. On the one hand, it is thought to reduce differences in income and wealth, hence lowering the growth. On the other hand, redistribution financed through income taxes diminishes the incentives to accumulate wealth.

ious transfers in GDP, average and marginal tax rates) on national investment rates and growth. Second, empirical evidence does not support the political-economy argument that more unequal societies would be more redistributive. The effect of income distribution on transfers and taxes is rarely significant. Moreover, indirect forms of redistribution tend to be lowest in United States, which has greatest pre-tax inequality, and much more extensive in continental Europe or Japan (Benabou (1999)).

Lourey (1981) suggested that credit constraints prevent the poor households from undertaking the efficient amount of investment. With decreasing returns their marginal product is higher and consequently, to the extent that redistribution releases these credit constraints and that this effective is stronger than adverse effect of taxation, taxes can contribute positively on total output or growth. Although in the theoretical models the trade-off between relaxing and depressive nature of taxation depends on technological assumptions of the production process, timing of taxation, availability of redistributive instruments, the degree of inequality of initial resources etc. it is not difficult to construct an example where redistribution through taxation contributes positively on growth. Aghion (1999) summarizes much of the subsequent literature and suggest three main reasons why inequality may have also direct negative effect on growth: Inequality reduces investment opportunities, makes borrowers incentives worse and generates macroeconomic volatility.¹¹

Benabou (1999) suggests that with missing credit markets representative agent of the economy may fail to choose the most efficient tax policy. Representative agent in the economy is represented by the one with mean initial resources. Since such agent is not interested in lending or borrowing –even if the capital markets existed– he is not interested in potentially efficient redistribution. Consequently, average agent in the economy may fail to internalize the social losses arising from liquidity constraints and may therefore choose too low level of redistribution from the society’s point of view. Perotti (1992) provides some empirical evidence on the role of credit frictions. Using the loan-to-value ratio for domestic mortgages as a proxy for credit availability he finds that greater credit availability has a positive and significant effect on output growth . Similarly, the negative effect of inequality on physical capital investment is enhanced by credit frictions.

When taxation is used to finance social security systems and redistribution is an issue, its effect on labor supply and therefore on equilibrium unemployment is not that simple. Indeed, higher absolute levels of payroll taxes in Europe are mostly due to higher level of social insurance. Stiglitz (1999) argues that the economic effects of social insurance system financed by payroll tax do not arise from the system per se, but from society’s desire to redistribute. Redistribution drives a wedge between present discounted value of contributions and benefits. If the worker received no benefit from the social insurance system the payroll tax drives a wedge between the wage paid and the wage received. Therefore, high payroll tax would lead to high

¹¹Another theory that links the growth and inequality suggests that when the gap between rich and poor widens, the latter have a greater temptation to engage in rent-seeking or predatory activities at the expense of the former. This can discourage accumulation and thereby growth (see for instance Grossman (1991), Acemoglu (1995), Benhabib and Rustichini (1996)).

levels of equilibrium unemployment in the competitive equilibrium.

Therefore, while redistribution in incomplete markets can be growth enhancing when it effectively corrects market failures, the redistributive objective can also generate intratemporal distortion and distort the labor supply decisions of the agents in competitive markets¹² Indeed, some of the empirical evidence on the regularity between unemployment and/or employment rates and generosity of social security seem to suggest that individual and family employment rates are negatively and rather significantly correlated with the generosity of welfare state in general (see for instance Bertola et. al. (2000)).¹³ In particular, redistribution achieved through progressive payroll taxation should decrease labor supply incentives for high-paid workers. Whether this translates into worse growth performance depends then on various technical assumption of the model and in particular, the assumed relationship between unemployment and production efficiency/growth.

3.3 The role of bargaining institutions

Bargaining institutions may have an important role in the pursuit of redistributive goals and social policy of the government as well as their economic effects. Bargaining institutions influence on the effectiveness of government intervention through the wage determination process directly, but also indirectly through interactions of economic and political factors. Corporatist unions may internalize the effects of payroll taxes on labor costs and employment and the trade-off between contributions and benefits from tax financed public goods. This can potentially reduce the intratemporal distortion arising from tax financed social security (Calmfors, 1994).

To the extent that more centralized wage bargaining systems/corporatist systems lead into redistributive scheme which internalizes social losses from liquidity constraint and/or reduces inequality, corporatist countries may have higher taxes, but they appear less distorting due to the efficiency gains arising from redistribution. Moreover, in the corporatist countries, governments can devise income policy arrangements that allow efficient negotiation of wages, taxes and social security simultaneously. Corporatism may then bring along better targeted social security, education and labor market programs that efficiently correct market failures. These may then result in efficiency gains for the whole economy and show up as less distortionary effects of labor taxation or in more general, better growth and employment performance.¹⁴

¹²In the efficiency wage theory, redistributive taxation generates implications very different from the basic competitive model however. If the government provides public goods which are valuable to low income workers and taxation is progressive, it will reduce the discrepancy between the expected utilities of being unemployed and those of being employed in high wage jobs. This reduces the incentive not to shirk. Moreover, if the wages in the high productivity sector are determined efficiently, the sole effect of tax is to shift workers from the high productivity efficiency wage sector into the low productivity competitive sector.(Stiglitz (1999)).

¹³However, there are also countries with generous welfare state and high employment rates like Sweden and Denmark. In these countries, the welfare programs and redistributive systems are designed to support labour market participation (Lindbeck, 1997).

¹⁴Distortionary effects of taxation interact also with other features of labor markets. For instance,

Under the assumption of frictionless labor markets, competitive wage bargaining would also yield favorable employment outcomes, as wages would adjust so as to ensure that total labor costs are consistent with full employment. In principal, the political system could design social policy interventions that would efficiently correct those market failures, that had no immediate consequences on the labor markets. Consequently, social policy interventions can be compatible with high employment, growth and wage restraint in widely different labor market circumstances.

The familiar argument of Calmfors-Driffill (1988), that industry level bargaining systems are detrimental to wage restraint and overall macroeconomic performance, can be applied to social policy interventions as well. Small decentralized unions that negotiate wages at industry level are strong enough to resist adverse changes in their members take-home pay, but unable to collectively internalize the trade-off between contributions and benefits from tax financed public goods. Open economy considerations may of course flatten the Calmfors-Driffill curve, but it might still not be implausible to expect that social policy interventions and therefore taxes, were most distorting in the countries with industry level unions (Bertola et. al. (2000)).

imposition of social insurance system program financed by payroll tax necessitates a fall in the before-tax wage. If there is a minimum wage in effect in low paid sector, that fall is not possible. Hence, a payroll tax can potentiall result in an increase in unemployment if there is a minimum wage (Stiglitz (1999)). With regard to growth dynamics, minimum wage laws can also be considered as an indirect forms of redistribution.

4 Econometric evidence

4.1 Determination of taxes

4.1.1 Labor taxes

After the theoretical discussion above, we turn to econometric analysis. The data set covers slightly different time periods and countries when compared to that used by Daveri and Tabellini (2000). Daveri and Tabellini studied years 1965-1995 with 14 countries. This study concentrates on years 1970-1996 and uses a 5 year-average periods, except for the last period where the averages have been calculated from the 2 years period only (1995-96). We have updated the data set for effective tax rates from OECD (1999) following the method of Mendoza, Razin and Tesar (1994) and own calculations from revenue statistics and national accounts. Our dataset includes 18 OECD countries, while Daveri and Tabellini (2000) used 14 OECD countries. Also Nickell and Layard (1999) study the role of taxes and labor market institutions on economic performance in 18 OECD countries with the cross-section that covers periods 1983-1988 and 1989-1994. Daveri and Tabellini (2000) relied primarily on the same method of calculating the tax burden on labor and capital, while Nickell and Layard used Centre for Economic Performance (LSE) OECD data set for payroll tax rate, total tax wedge and marginal tax wedge (OECD Jobs study (1994)). Summers et. al. evaluated the relationship between corporatism and labor tax revenues over GDP, rather than that between corporatism and effective labor tax rates. Summers et. al. relied primarily on the original Calmfors-Driffill (1988) index of corporatism. We use primarily the updated index of the degree of centralisation of wage bargaining from OECD (1997) as well as the union density rates to characterise labor market status of different countries.

As suggested by Summers et. al. (1993) effective labor taxes tend to be higher in the countries with more centralized or corporatist wage setting. Our simple estimation results indicate that this seems to be true. The results are also robust do different measures of centralization. Table 1. below presents OLS estimates on regression explaining 5 year average effective labor tax rates by the degree of centralization in different time periods for 17 OECD countries¹⁵. Inevitably a number of observations in these regressions is too small to obtain very efficient parameter estimates and we do not exploit across country correlation structure of the errors in estimation. These caveats in mind, however, it seems that the relationship between effective labor taxes and the degree of centralization has remained robust over the different periods. Degree of centralization alone explains nearly 40% of the variation in effective labor tax rates between the countries over the whole sample of 1970-1996.

¹⁵Due to few outliers, we estimated the equation also with outlier-robust estimation. Results remained qualitatively the same.

Table 1
Labor Taxes and the Degree of Centralization
 Estimated Model

$$\tau_{i,l} = \alpha + \theta C_i + \epsilon_i$$

Table of Results				
Period	α	θ	R^2	N
1970-1974	11.42	9.14	.28	16
1975-1979	8.18	12.917	.44	16
1980-1984	11.98	12.02	.37	18
1985-1989	12.83	12.87	.34	18
1990-1994	12.59	13.94	.30	18
1995-1996	16.47	12.48 ^(a)	.30	17
1970-1996	13.35	11.25	.24	105

Notes: $\tau_{i,l}$ is effective labor tax in country i . See appendix for details. C_i is a measure for the degree of centralization in wage bargaining and ϵ_i error term. OLS with robust standard errors was used. a) Significant at 5% level. Otherwise, θ is always significant at 1% level. b) This is between regression.

Simple regressions above do not prove a causal relationship between the degree of centralization and labor taxes. However, the so called difference-in-differences (*DD*) strategy ¹⁶ offers a simple way to estimate causal effects in panel data when certain groups of observations are exposed to potential causing variable. This approach is particularly well suited to estimate the effect of sharp changes in economic environment. This DD -estimator can be obtained from an estimate of the following equation based on pooled observations for all countries and all years.

$$\tau_{it} = \gamma_t + \alpha_i + \delta D + \epsilon_{it} \tag{1}$$

τ_{it} is effective labor tax, γ_t is fixed time effects, α_i are the fixed country effects and ϵ_{it} are *iid* disturbances. D identifies the countries and times where the degree of centralization in wage bargaining has changed. This indicator variable has been defined as

$$D = \begin{cases} 0, & \text{if there are no changes} \\ 1, & \text{if there is an increase in the degree of centralisation} \\ -1, & \text{if there is a decrease in the degree of centralisation} \end{cases} \tag{2}$$

Parameter δ identifies the causal effect of centralization on labor taxes under the assumption that changes in the effective labor taxes over time and across countries

¹⁶This method has been used for instance in Card and Sullivan (1988).

are identical, unless there is a change in the degree of centralization. This assumption is of course rather restrictive, as there may be many other factors that could contribute diverging time patterns of the tax rates across countries.

Expected sign of this indicator variable is positive. Estimating this regression yields a significant and positive coefficient for the indicator variable D at 5% significance level. As it is well acknowledged in many other studies of the kind, outliers contaminate the data and can yield spurious relationship between the variables. When this same regression is repeated with outlier robust estimation¹⁷, significance and magnitude of the indicator variable D is even larger. Significance of the indicator variable is somewhat sensitive to assumed correlation structure of the errors, but remains always significant at 10% level.

Table 2
Granger Causality between Labor Taxes and the Degree of Centralization

$$\begin{aligned}\tau_{it} &= \gamma_t + \alpha_i + \frac{1.97D}{(0.94)} \\ N &= 18, \bar{T} = 4.9\end{aligned}$$

Notes: Estimation was done with fixed effects estimation. OLS standard errors are in parenthesis. γ_t and α_i indicates that common time effects and fixed country effects were regression respectively.

4.1.2 Capital taxes

As argued in section 2, the relationship between labor market institutions and capital taxes is likely to more complex due to the apparent dynamic linkages between savings, growth and investment and political economy forces and globalization. Indeed, we did not find statistically significant relationship between centralization and capital taxes. However, our results give some evidence that capital taxes and density rates are positively related. High density rates do not necessarily imply "high corporatism", nor do the low density rates imply competitive labor markets. Higher density may rates proxy more closely the "political" power of labor, rather than unions' organizational capacity to co-ordinate their wage demands. Countries where the density rates are higher and therefore could be expected to have political systems with negative wealth bias, have also had higher capital tax rates on average. The estimated simple linear relationship between capital tax rates and density rates, however, is not as robust and significant as that between the labor taxes and centralization discussed above.

¹⁷We used STATA in all estimations. STATA's outlier robust estimation procedure (rreg) was used also for outlier robust estimation.

Table 3
Estimated Model

$$\tau_i = \alpha + \theta D_i + \epsilon_i$$

Table of Results				
Period	α	θ	R^2	N
1970-1974	20.97	.17	.03	17
1975-1979	19.63	.31*	.1	17
1980-1984	25.50	.21*	.13	18
1985-1989	23.81	.30**	.24	18
1990-1994	27.31	.23*	.28	18
1995-1996	30.60	.12	.19	17
1970-1996 ^(b)	24.62	.22*	.27	105

Notes: τ_i is effective capital tax rate in country i and D_i is density rate. * and ** indicate that the coefficient is significant at 10% level and 5% level respectively. b) This is between countries regression, which averages over the whole sample.

We used again DD -strategy to see whether density rate Granger causes the capital tax ratio. Again, we defined the indicator variable as

$$D = \begin{cases} 0, & \text{if there are no changes in density rates} \\ 1, & \text{if there is an increase in the density rate} \\ -1, & \text{if there is a decrease in the density rate} \end{cases} \quad (3)$$

We obtained the following regression.

Table 4.
Granger Causality between Capital Taxes and Density Rates

$$\tau_{it,c} = \gamma_t + \alpha_i + \frac{1.88}{(0.732)} D$$

$$N = 18, \bar{T} = 4.9$$

Notes: Estimation was done with fixed effects estimation. Standard errors in parenthesis. γ_t and α_i indicate that both fixed effects and country effects were included in the regression.

Indicator variable is statistically significant at 5% significance level, implying that increases (decreases) in density rates have contributed to higher (lower) capital tax rates. Assuming that density rates would proxy the "negative wealth bias" our results can be seen to give some evidence for the simple politico-economy hypothesis that capital taxes are higher in the countries with higher unionization rates and hence stronger unions.

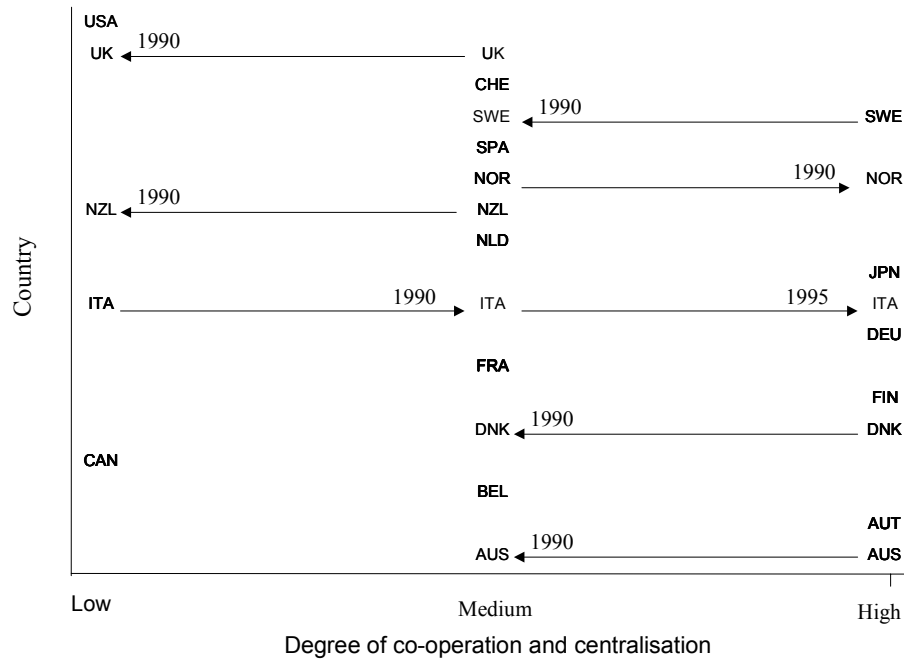


Figure 1: Degree of Co-operation and Centralisation in some OECD countries.
Source: OECD (1997)

4.2 Economic effects of taxation

4.2.1 Labor taxes and unemployment

After studying the determination of taxes in detail, we turn to analyze the economic effects of taxation. We are primarily interested in how, and through which channel taxes effect on growth and unemployment and what is the role of bargaining structure.

In order to focus on widely different wage bargaining systems determining the economic effects of taxation, we group the countries according to the degree of coordination and centralization and use the density rate to characterize politico-economic aspect of wage bargaining. Figure 1 below classifies the countries in 3 different groups according to OECD estimates of the prominent level of wage bargaining and the degree of coordination in wage bargaining. The same figure also indicates the changes that have occurred in the selected OECD countries towards 1995¹⁸. We have combined these two measures of collective bargaining into one single measure, which generically measures the degree of corporatism.

Following the discussion above we classify the counties in two different groups. First group contains the countries where wage bargaining is either corporatist or competitive (low, medium) and the second group includes the countries with medium

¹⁸For more detailed discussion of these changes, see OECD (1997).

or industry level bargaining system as indicated in figure 1. The figure 1 clearly indicates that there have been changes in some countries during the 1990s.¹⁹ As discussed above, we expect that labor taxes are more distorting in the industry level bargaining systems, when compared to the first group. Grouping countries only in two groups allows us to have relatively large number of observations in both groups.

We start from a very simple regression for unemployment and estimate the model for both groups in first differences as follows

$$\Delta u_{it} = \alpha + \gamma_t + \beta_1 \Delta \tau_{it-1}^l + \beta_2 \Delta \rho_{it-1} + \epsilon_{it} \quad (4)$$

where α is constant, γ_t are common time effects, $\Delta \tau_{it}^l$ is effective labor tax rate lagged one period and $\Delta \rho_{it-1}$ is replacement ratio of unemployment benefits lagged one period. Replacement ratio in the unemployment equation proxies the generosity of unemployment insurance systems in different countries. It is expected that more generous unemployment insurance systems generate efficiency costs for the economy due to their wage effects and disincentive effect to job search. Also, with generous unemployment insurance, unemployment is not as costly, so unions are expected to push for higher wages, resulting higher unemployment. Estimating the relationship between unemployment, labor taxes and replacement ratio in the first differences allows us to abstract from other fixed country effects that have been found important in the previous studies of labor market institutions and level of unemployment. Moreover, estimating the model in the first differences allows us to avoid a possible spurious relationship arising from the possible common time trend between the variables. Efficient labor tax rates are also likely to be endogenous at least partly with respect to unemployment because of measurement method, which is based on aggregate data. In order to avoid, at least partially, bias of the estimated coefficients, we therefore estimate the model with one period lag in tax rates and replacement ratios. Results from the OLS regression without time lags are not very different from those reported below.

Assumed covariance structure of ϵ_{it} in the cross-section-time-series model often significantly affects their standard errors. More efficient parameter estimates can be obtained by using Feasible Generalized Least Squares estimation method, which corrects for panel-heteroskedasticity, possible serial correlation of the errors and contemporaneous correlation across panels. However, Beck and Katz (1995) show by Monte Carlo simulations that FGLS standard errors are massively overconfident when the time series dimension (T) is small relative to cross section dimension (N). This biases inference since null hypothesis is rejected too often. An alternative method, provided by Beck and Katz (1995) and implemented for instance in STATA 6.0 uses Ordinary Least Squares (OLS) parameter estimates and reconstructs variance-covariance matrix from OLS residuals by using repeated observations of contemporaneous correlations across time. This procedure yields estimate of the variance-covariance matrix, which is closer to its true value when T to N ratio

¹⁹For more detailed discussion of these changes, see for instance OECD (1997)

is small. Compared to traditional fixed effects and random effects estimators the Beck and Katz method yields variance-covariance matrix which reaches its asymptotic properties as T approaches infinity. On the contrary, fixed effects and random effects estimators reach their asymptotic properties as N approaches infinity. Since in our data $N > T$ and both of them relatively small, however, fixed effect or random effects estimators are likely to yield the standard errors that are closest to true values.

Tables 5 and 6 provide estimated regression results from random effects model for the two country groups. Our simple regressions clearly suggest that labor taxes are more distortionary in the countries with medium or industry level bargaining when compared to countries with competitive or corporatist wage bargaining. The coefficient for effective labor tax rates is not statistically significant in the countries with competitive or corporatist labor markets. This is in sharp contrast to positive and statistically significant coefficient in the countries with industry level bargaining systems, as shown in table 6. While the coefficient for replacement ratio is positive in both country groups, implying that higher replacement ratio would yield higher unemployment, the coefficient is statistically significant only in the countries with competitive or corporatist countries.

Table 5.
Changes in Unemployment Rates and Effective Labor Taxes in the
Countries with Competitive or Corporatist Labor Markets

$$\Delta u_{it} = \gamma_t + \underset{(.824)}{.76} + \underset{(0.155)}{.12} \Delta \tau_{it-1}^l + \underset{(0.051)}{.15} \Delta \rho_{it-1} + \epsilon_{it}$$

$$R^2 = .32$$

$$\chi_H^2(5) = 3.18$$

$$\chi_{P-B}^2(1) = 0.07$$

$$\bar{T} = 3.7, N = 12$$

Notes: R^2 refers to overall fit of the regression $\chi_H^2(\cdot)$ refers to Hausman (1978) test and $\chi_{P-B}^2(\cdot)$ to Breusch and Pagan (1980) test for constant variance. \bar{T} is average number of observations per panel (country) and N is number of countries in regression. OLS estimation method with semi-robust standard errors was used. γ_t refers to the fact that common time effects were also included in the regression.

The panel is slightly unbalanced and there are few outliers that may bias the results. In order to check for the seriousness of the outlier problem we estimated the same model by using outlier-robust estimation²⁰. Estimated coefficient for labor tax rate remained insignificant, but so did the estimated parameter for replacement ratio. Estimating the same model without time effects does not significantly change the basic results, but yields marginally significant coefficient for replacement ratio also in the outlier-robust estimation.

²⁰Outlier robust estimation was implemented by STATA with the estimation command `reg`.

When the same model is repeated for the countries with industry level wage bargaining structure, the results change significantly. This is evident from the table 6. The results reported below are based on the regression with common time effects and semi-robust standard errors. The results are somewhat sensitive to inclusion or exclusion of time effects and assumed correlation structure of the errors, but nevertheless, estimated coefficient for labor taxes is always higher and more significant than the one reported above.

Within this group of countries, Spain is obvious outlier with very high unemployment rate. We therefore estimated the model with outlier-robust estimation. Estimated coefficient for labor tax dropped down to .23, and it remained significant only at 12% significance level. We estimated the model below also by directly controlling for Spain with the dummy variable. Results remained closely similar to those reported below. Although the results below can be somewhat contaminated by outliers and measurement biases, our results support the view that rather significant reductions in unemployment can be achieved by reducing labor taxes in countries with industry level wage bargaining systems.

Table 6.
Changes in Unemployment Rates and Effective Labor Taxes in the
Countries with Industry Level Bargaining Structure

$$\Delta u_{it} = \gamma_t + \frac{1.79}{(.571)} + \frac{.29}{(0.143)} \Delta \tau_{it-1,l} + \frac{.13}{(0.096)} \Delta \rho_{it-1} + \epsilon_{it}$$

$$\begin{aligned} R^2 &= .32 \\ \chi_H^2(6) &= 2.89 \\ \chi_{P-B}^2(1) &= 3.47 \\ \bar{T} &= 3.3, N = 11 \end{aligned}$$

Notes: R^2 refers to overall fit of the regression $\chi_H^2(1)$ is Hausman misspecification test and $\chi_{P-B}^2(1)$ is Breusch and Pagan test for constant variance of the error component. \bar{T} is average number of observations in the panel (country) and N is number of countries in regression. OLS method with semi-robust standard errors was used. This method corrects for within-panel correlation and heteroskedasticity in the errors and is closely similar to random effects model.

Classification of the countries according to degree of centralization and cooperation is of course somewhat arbitrary. We therefore estimated the same regression for all countries, but included interaction term between density rates and changes in labor tax rates. When both parameters for changes in labor taxes and replacement ratio were allowed to vary with density rates, the interaction terms did not become significant, however. On the contrary, if we allow only the replacement ratio vary with density rates, changes in labor tax rates become significant in all countries at 5% significance level. However, the random effects model does not pass the Breusch-Pagan test for constant variance of the error component, implying that random effects model is misspecified. Estimated parameters for replacement ratios are also very badly determined in these regressions.

4.2.2 Growth and taxes

Let us now turn to the relationship between growth and taxes. Modelling growth within cross-country regression is more complex than the previous analysis of unemployment. Many cross-country growth regressions estimated in the literature have been criticized due to their ad hoc nature²¹ and sensitivity of the results to various specifications and different samples of countries. We make no exception regarding ad hoc nature of our regression.

We started from following specification of the growth equation

$$\Delta y_{it} = \alpha + \gamma_t + \beta_1 \tau_{it}^c + \beta_2 \tau_{it}^l + \beta_3 \Delta u_{it} + \beta_4 y_{i70} + \beta_5 \Delta_{it}^{50-10} + \epsilon_{it} \quad (5)$$

where Δy_{it} is output growth in country i at time t , α is constant γ_t are common time effects, Δu_{it} is change in unemployment rate, y_{i70} is initial per capita output in 1970 and Δ_{it}^{50-10} is decile ratio, based on income of 50th and 10% percentile. Inclusion of initial per capita income captures the convergence hypothesis implied by many formulations of neo-classical growth models. Decile ratio proxies the differences in income distribution. Introducing inequality into growth regression captures the direct effect of inequality on growth as discussed above.²²

τ_{it}^c and τ_{it}^l are capital and labor tax rates respectively. Introducing both labor and capital tax rates into growth regression enables us to assess the direct effect of these two tax rates on output growth. According to traditional view, capital taxes should contribute negatively on growth. However, higher capital taxes subsume the redistributive objectives of the government and may therefore partially mitigate the distorting effect on growth as discussed in section 3.²³

Capital and labor taxes are likely to suffer from measurement errors and endogeneity. In order to at least partially avoid endogeneity bias, we use directly instrumental variable estimation and treat tax rates and unemployment endogenous. We use lagged changes in unemployment, taxes and replacement ratios as instruments.

We choose to include unemployment into the growth regression in differences, while leave tax rates in levels. When taxes are introduced into growth regression in levels, it allows us to directly test the hypothesis whether output growth has been distorted by higher taxes. This specification seems to work better than keeping both tax rates and unemployment rates in levels. Introducing unemployment in levels into growth equations induces more serious serial correlation of the errors than using first differences. In addition to taxes and unemployment, we control for differences in initial per capita output and cross-country differences in income distribution.

²¹For a good general discussion, see for instance Temple (2000).

²²Gottschalk and Smeeding (1997) provides a good discussion on the trends in Earnings and Income Inequality, as well as problems associated with cross-national comparisons.

²³Our growth equation is different from that estimated by Daveri and Tabellini (2000). Daveri and Tabellini controlled for initial schooling, while we control for inequality. Moreover, they included only capital tax rate in their equation and used either levels or first differences of the right hand side variables.

Estimating the above general model with instrumental variable method yields following regression

Table 7
Growth Regression
-Initial Specification

$$\Delta y_{it} = \gamma_t - \frac{.01}{(.188)} \tau_{it}^c - \frac{.01}{(.017)} \tau_{it}^l - \frac{.37}{(.157)} \Delta u_{it} - \frac{.52}{(.388)} y_{i70} - \frac{1.74}{(.555)} \Delta_{it}^{50-10} + \epsilon_{it}$$

$$R^2 = .36$$

$$F(3, 46)_{D-M} = 1.81 (.159)$$

$$\chi^2(2)_{OIR} = 2.70 (.260)$$

$$NT = 58$$

Notes: Robust standard errors are in parenthesis $F(\cdot)_{D-M}$ is Davidson-MacKinnon test for unbiasedness of OLS estimated parameters. $\chi^2(\cdot)_{OIR}$ is Sargan test for validity of instruments and NT is total number of observations. γ_t refers to the fact that time effects were included into regression. Tax rates and change in unemployment rate were instrumented with their one period lagged values and lagged changes in the replacement ratios. Constant not reported.

Our main interest is in the statistical significance and magnitude of effective tax rate variables. Fit of the growth regression as specified above is rather poor and estimated coefficients for tax rates are of expected sign, but never statistically significant in the instrumental variable regression. In the first specification, estimated coefficient for changes in unemployment rate is negative and statistically significant from zero. However, closer inspection reveals that this results is contaminated by large outlier of Finland in the regression. Excluding Finland from the regression or controlling for the dramatic drop in output in Finland during the 1990-1994 period makes the coefficient for the change in unemployment insignificant. Estimated coefficient for initial per capita output is negative²⁴ but not significantly different from zero, while decile ratio, that measures income inequality is negative and statistically significant. In order to check the sensitivity of this result to different measures of inequality, we used also decile ratio between 90th and 10th percentile as well as Theil's measure of inequality. Estimated coefficients were always negative, but they were somewhat less significant. It seems that the model estimated above is not well specified, since after controlling for outlier of Finland, only inequality remains significant. We therefore proceed towards more parsimonious model.

²⁴Assuming that countries are technologically the same, the negative coefficient implies that the poorer countries will grow faster during transitional period. The reason for this is that relatively poor economy has higher marginal product of extra capital and therefore, for a given rate of investment, its growth will be faster.

4.3 Parsimonious model and alternative specifications

We next experimented with sequential dropping of the insignificant variables. We first dropped the changes in unemployment from the regression²⁵. This resulted significant coefficient for the capital taxes at 5% significance level and its coefficient went down to -0.03 . Inequality measure remained significant and negative at 1% significance level, while initial level of output became insignificant. We next dropped the labor tax variable. Initial level of output became significant and the coefficient for capital tax rates remained significant and its value changed to -0.02 . Compared to our initial regression given in table 7²⁶, this specification seems to work better. We report this regression below

Table 8
Growth Regression
-Parsimonious Specification

$$\Delta y_{it} = \gamma_t - \frac{.02}{(.008)} \tau_{it}^c - \frac{.69}{(.392)} y_{i70} - \frac{1.17}{(.435)} \Delta_{it}^{50-10} + \epsilon_{it}$$

$$R^2 = .45$$

$$F(3, 46)_{D-M} = .94 (.335)$$

$$NT = 73$$

Notes: Robust standard errors are in parenthesis $F(\cdot)_{D-M}$ is Davidson-MacKinnon test for unbiasedness of OLS estimated parameters. NT is total number of observations. γ_t refers to the fact that time effects were included into regression. Capital tax rates were instrumented with one period lagged values and all the exogenous variables. Step dummy variable for Finland during the period of 1990-94 was included into regression but not reported. Also, constant not reported.

This regression would suggest that labor taxes are not harmful for growth neither through the unemployment channel or directly. One of the potential reasons why high labor tax does not dampen growth may be the strong substitutability between labor and capital. Higher labor taxes would only shift the production technology towards more capital-intensive methods, leading into higher average labor productive and same output. Another potential reason is that labor taxes are born by labor and they do not affect the gross labor costs of the firms (see eg. Kruger (2000)). Notice, however, that insignificant relationship between growth and unemployment found in this regression does not imply that such a relationship could not exist in business cycle frequencies. It merely suggests that the cross-country differences in growth

²⁵We experimented also by dropping first the inequality from the regression to see whether this would affect the significance and magnitude of the changes in unemployment. Changes in unemployment remained insignificant.

²⁶Davidson and MacKinnon test suggests that OLS would nevertheless yield consistent estimates. Ignoring endogeneity problem and estimating the same model with contemporaneous tax rates and changes in unemployment rates yields highly significant coefficient for capital tax rates. Its magnitude (-0.04) is also higher than the one estimated in instrumental variable method. Labor tax rates remain negative, but insignificant, but so does change in unemployment rate when we control for the outlier of Finland.

rates cannot be explained by the cross-country differences in unemployment rates and labor income taxes.

Assuming that the taxes and unemployment affect on growth with lag would suggest that the same model could be estimated with OLS, but using lagged values of capital taxes and unemployment as explanatory variables. In such a specification, the estimated coefficient for capital tax rate remains fairly close to those estimated by the instrumental variable method. Estimated coefficient depends on whether labor tax rates and/or change in the unemployment were included in the model. However, in all cases, estimated coefficient remains insignificant even at 10% significance level.

In summary, we are left with somewhat inconclusive evidence on the significance and magnitude of the distorting effect of taxes on growth. Whilst labor taxes do not seem to matter directly for growth performance, there is some evidence that capital taxes would be harmful for growth in all countries. Our different specifications would suggest that this parameter remains between -0.01 and -0.04 . Moreover, there is certainly no robust evidence that changes in unemployment rate and growth would be negatively correlated.

These results are somewhat in contrast to those reported in Daveri and Tabellini (2000), who suggested negative and significant relationship between unemployment and growth, but no relationship between growth and capital taxes.

5 Conclusions

According to our results, collective bargaining affects the level and structure of labor and capital taxes in OECD countries. Corporatist countries were found to have higher labor taxes on average during the 1970-1996 period, while capital taxes were suggested to be higher in the countries where union membership is higher.

Labor taxes were found to be correlated with unemployment only in the countries with industry level bargaining system. In the countries with competitive or corporatist wage bargaining, labor taxes had no statistically significant effect on unemployment. This would imply that reductions in labor taxes would improve unemployment performance only in the unionized countries with decentralized wage bargaining. Evidence on the relationship between effective capital taxes and growth remained somewhat inconclusive, although some support was found for the negative relation. Our results would not suggest a robust relationship between unemployment and growth in cross-section model either. However, if anything, capital taxes contribute negatively to growth, but there is no conclusive evidence on neither direct or indirect effect of labor taxes on growth. According to our estimates, 10 percentage point reduction in capital income tax would imply 0.1- 0.4 percentage point increase in per-capita GDP growth, while 10 percentage point reduction in labour income tax would imply around 2-3 percentage point decrease in unemployment rate in the countries with industry level bargaining system.

Whilst our results provide more support on the distorting nature of labor taxes on unemployment and emphasizes the role of wage bargaining institutions on the causes and consequences of labor income taxation, further empirical studies are in need. Surprisingly sensitive results regarding the empirical regularity between capital taxes and growth can be due to many reasons and certainly are worth further research. In spite of the several econometric and measurement problems, we believe our results cast some doubt to simple endogenous growth models with complete markets. Small or non-existent distortionary effects of labour and capital taxes can be due to the potential efficiency effects of redistributive taxation. Potential efficiency gains of redistribution are also supported by the finding that inequality was found to be harmful for growth. From purely growth enhancing perspective, however, our result would suggest that labor taxes might be more appropriate instrument of redistribution than capital taxes. Labor taxes seem to lead into higher unemployment in the countries with industry level bargaining system, but they did not appear to have direct or indirect effect on growth. Based on this, it seems that consequences of taxation on growth and unemployment need to be considered within richer theoretical and empirical models that account for both direct and indirect effects of redistribution. Such a theoretical work has been pursued further for instance in Bénabou [1999], but rigorous empirical work remains to be done.

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A Data Appendix

Our data set covers periods from 1970-1996 and 18 OECD countries. In all regressions, we used 5 year averages, except for the last period, where average was calculated only from the last 2 years period. Effective tax rates²⁷ have been calculated by following the method of Mendoza, Razin and Tesar (1994). Calculation of effective labor and capital tax rates is based on following formulas

$$\begin{aligned}\tau_{per} &= \frac{1100}{W + PEI + OSPUE} \\ \tau_l &= \frac{\tau_{per} \times W + 2000 + 3000}{W + 2200} \\ \tau_c &= \frac{\tau_{per} \times (OSPUE + PEI) + 1200 + 4100 + 4400}{OS}\end{aligned}$$

where classification is according to OECD revenue and national accounts statistics

CODE	OECD REVENUE STATISTICS
1100	Taxes on income, profits and capital gains on individuals
1200	Taxes on income, profits and capital gains on corporations
2000	Social security contributions
2200	Social security contributions of employers
3000	Taxes on payroll and workforce
4100	Recurrent taxes on net wealth
4400	Taxes on financial and capital transactions

CODE	OECD NATIONAL ACCOUNTS
OS	Operating surplus of corporate and quasi-corporate enterprises
OSPUE	Operating surplus of private unincorporated enterprises
W	Wages and salaries
PEI	Property and entrepreneurial income

- The personal income tax (τ_{per}) is defined as the ratio of revenues from taxes on income, profits and capital gains of individuals (1100) to the tax base that consists of wages and salaries (W), the operating surplus of unincorporated enterprises (OSPUE) and the property and entrepreneurial income of households(PEI)
- The labor tax (τ_l) is defined as the product of the personal income tax ratio (τ_{per}) and wages and salaries (W) plus total social security contributions (2000) and taxes on payroll and workforce (3000) over the sum of wages and salaries plus employers' social security contributions (2200).

²⁷OECD (1999) and Carey and Tchilingirian (2000) provide a fruitful discussion on the problems of measuring effective tax rates in international comparisons and suggest some new methods.

- The capital tax ratio (τ_c) is defined as the product of the personal income tax ratio (τ_{per}) and the sum of the operating surplus of private unincorporated enterprises (OSPUE) and property and entrepreneurial income (PEI) plus taxes on income, profits and capital gains of corporations (1200) plus taxes on property (4100) and taxes on financial and capital transactions (4400) over the operating surplus of the economy (OS).
- Unemployment rate is standardized unemployment rate from OECD National Accounts
- Replacement rate is gross replacement ratio calculated as average of the gross unemployment benefit replacement rates for two earnings levels, three family situations and the three durations of unemployment as in OECD database for benefit entitlements and replacement rates
- Growth rate of per capita GDP is calculated from OECD National accounts, adjusted with dollar exchange rates and 1990 price levels.
- Indices of centralization and co-operation of wage bargaining are based on OECD estimates of prominent bargaining level. Primary sources are OECD (1994, 1997)
- Density rates are from OECD Employment Outlook 1997.
- Primary source of the decile ratios is OECD Employment Outlook 1996, table 3.1. The original data is extrapolated to cover periods from 1975-1995.
- Theil index is obtained from <http://utip.gov.utexas.edu/>

B The model

B.1 Preliminaries

This appendix outlines a simple wage setting model, which demonstrates analytically the externality argument arising from the ability of corporatist unions internalize aggregate consequences of its actions. Assume that workers utility is quasilinear with respect to disposable income and public services. Assume that employed worker derives utility (V_E) according to

$$V_E = W(1 - \tau) + V(G) \quad (6)$$

and unemployed worker derives utility (V_U) according to

$$V_U = W_u + V(G) \quad (7)$$

W is wage, W_u is unemployment benefit, τ is labour income tax, G is public expenditure and $V(\cdot)$ is some concave utility function associated with public expenditure. Assume that the unemployment benefit is not taxable income and assume that the government collects revenues only from labor. Government budget constraint can be written as

$$G \leq \tau_l W N(K, W) - (1 - N(K, W))W_u \quad (8)$$

where $N(K, W)$ denotes number of employed (labour demand) as a function of wage (W) and capital (K).

Normalise total number of employed to 1, and assume that utilitarian trade union maximizes Benthamian utility function (U) such that

$$\begin{aligned} U &= N V_E + (1 - N) V_U \\ &= N W(1 - \tau) + N V(G) + (1 - N) (W_u + V(G)) \end{aligned} \quad (9)$$

where $(1 - N)$ denotes number of unemployed. We assume that $V_G = \frac{\partial V}{\partial G} \leq 1$ and that public good is a normal good ($V_G > 0$).

B.2 Production

Assume the following concave production function (Y)

$$Y = Y(K, N) \quad (10)$$

where

$$Y(K, N) = \theta(K)N^{1-\alpha} \quad (11)$$

for some concave function $\theta(K)$, $\theta_K > 0$, $\theta_{KK} < 0$, $\alpha < 1$ and where K denotes capital. Let prices be normalized to unity. Firms labor demand is then

$$N = \left(\frac{(1-\alpha)\theta(K)}{W} \right)^{\frac{1}{\alpha}} \quad (12)$$

Let us express labor demand such that

$$N \equiv N(K, W), \quad N_W = \frac{\partial N}{\partial W} < 0 \quad (13)$$

B.3 Utilitarian monopoly union

Utilitarian labor union takes G and W_u and K as given and solves the following problem

$$\begin{aligned} \max_W & NW(1-\tau) + (1-N)W_u + V(G) \\ \text{s.t.} & \end{aligned} \quad (14)$$

$$N \equiv N(K, W) \quad (15)$$

First order condition yields

$$\begin{aligned} N_w W(1-\tau) + (1-\tau_l)N - N_w W_u &= 0 \quad (16) \\ \Rightarrow \\ W^M &= \frac{W_u}{1-\tau} - \frac{N}{N_w} \end{aligned}$$

Using labor demand function $N = \left(\frac{(1-\alpha)\theta(K)}{W} \right)^{\frac{1}{\alpha}}$, we can express this as

$$W^M = \frac{W_u}{(1-\alpha)(1-\tau)} \quad (17)$$

Equilibrium employment is then

$$N^M = \left(\frac{(1-\alpha)^2(1-\tau)\theta(K)}{W_u} \right)^{\frac{1}{\alpha}} \quad (18)$$

Notice then immediately that,

$$\frac{\partial N^M}{\partial \tau_l} = -\frac{N^M}{\alpha(1-\tau)} < 0 \quad (19)$$

B.4 Corporatist union

Corporatist union sees beyond the budget constraint of the government and solves the following problem

$$\begin{aligned} & \max_W NW(1 - \tau_l) + (1 - N)W_u + V(G) \\ & s.t. \\ N & = N(K, W) \\ G & \leq \tau WN(K, W) - (1 - N(K, W))W_u \end{aligned} \quad (20)$$

Maximization yields, after some manipulations

$$W^C = \frac{W_u(1 - V_G)}{1 - \tau(1 - V_G)} - \frac{N}{N_w} \quad (21)$$

As in the case of monopolistic unions we use the labor demand function to express the equilibrium wage as

$$W^C = \frac{W_u(1 - V_G)}{(1 - \tau(1 - V_G))(1 - \alpha)} \quad (22)$$

since

$$\frac{N}{N_w} = -\alpha W \quad (23)$$

In order for wage rate to be positive we assume that

$$V_G \leq 1$$

That is, marginal utility from public good must be less than marginal utility from private consumption. Equilibrium employment is then

$$N^C = \left(\frac{(1 - \tau(1 - V_G))(1 - \alpha)^2 \theta(K)}{W_u(1 - V_G)} \right)^{\frac{1}{\alpha}} \quad (24)$$

Notice then that

$$\frac{\partial N^C}{\partial \tau} = -\frac{N^C(1 - V_G)}{\alpha(1 - (1 - V_G)\tau)} \leq 0 \quad \forall 0 < V_G \leq 1 \quad (25)$$

and that

$$W_\tau^C = \frac{(1 - \gamma V_G)^2 W_u}{(1 - \tau(1 - \gamma V_G))^2 (1 - \alpha)} > 0 \quad (26)$$

Two important propositions now be established

Proposition 1 *Monopolistic union sets always the wage higher than corporatist union, when public good is a normal good.*

Proof. It is easy to see that

$$\begin{aligned}
W^C &< W^M \\
&\Leftrightarrow \\
\frac{W_u(1-V_G)}{(1-\tau(1-V_G))(1-\alpha)} &< \frac{W_u}{(1-\alpha)(1-\tau)} \\
\frac{(1-V_G)(1-\tau)}{1-\tau(1-V_G)} &< 1 \\
&\Leftrightarrow \\
-V_G &< 0, \forall 0 < V_G < 1
\end{aligned}$$

■

Proposition 2 *Labor tax elasticity is smaller in corporatist economies than in economies with monopolistically competing labor markets*

Proof. It is easy to see that

$$\begin{aligned}
\left| \frac{\partial N^C}{\partial \tau} \frac{\tau}{N^C} \right| &< \left| \frac{\partial N^M}{\partial \tau} \frac{N^M}{\tau} \right| \\
&\Leftrightarrow \\
\frac{(1-V_G)}{1-(1-V_G)} &< \frac{1}{1-\tau} \\
&\Leftrightarrow \\
\frac{(1-V_G)(1-\tau)}{1-(1-V_G)} &< 1 \\
&\Leftrightarrow \\
-V_G &< 0, \forall 0 < V_G < 1
\end{aligned}$$

as above. ■

B.5 Optimal size of the public sector

B.5.1 Utilitarian monopoly union

Assume that the government maximize size of tax revenues. Substituting W^M into the government's budget constraint gives a wage augmented budget constraint, such that

$$\begin{aligned}
G &= \tau_l W N(K, W) - (1 - N(K, W)) W_u \\
&= \left(\frac{N^M (1 - \alpha (1 - \tau))}{(1 - \alpha) (1 - \tau)} - 1 \right) W_u
\end{aligned} \tag{27}$$

where $N^M = \left(\frac{(1-\alpha)^2(1-\tau)\theta(K)}{W_u} \right)^{\frac{1}{\alpha}}$

The revenue maximizing government would collect labor taxes until

$$G_\tau = 0$$

Taking the derivative from above yields

$$G_\tau = \frac{(\alpha(2-\tau) - 1) N^M W_u}{(1-\alpha)(\tau-1)^2 \alpha} \quad (28)$$

A revenue maximizing level of labor income tax can then be solved then from above by setting $G_\tau = 0$. This yields

$$\tau^{GM} = 1 - \frac{1-\alpha}{\alpha} \quad (29)$$

B.5.2 Corporatist union

In the corporatist labor markets, instead, wage augmented government budget constraint is

$$G = \left(N \frac{\alpha - 1 - \alpha\tau(1 - V_G)}{(1 - \tau + \tau V_G)(\alpha - 1)} - 1 \right) W_u \quad (30)$$

Derivative with respect to labour income tax yields

$$G_\tau = \frac{N(1 - V_G) W_u (2\alpha - 1 - \alpha\tau(1 - V_G))}{(1 - \tau(1 - V_G))^2 (1 - \alpha) \alpha} \quad (31)$$

Solution to

$$G_\tau = 0$$

yields then

$$\tau^{GC} = \frac{2\alpha - 1}{\alpha(1 - V_G)} \quad (32)$$

It is necessary to assume here that

$$\begin{aligned} \alpha &> \frac{1}{2} \\ V_G &< \frac{1-\alpha}{\alpha} \end{aligned}$$

in order for

$$0 < \tau^{GC} < 1$$

Following proposition can then easily be established

Proposition 3 *Government's revenue maximizing labor tax is higher in corporatist system when compared with monopolistically competing labor markets, as long as $\alpha > .5$*

Proof. It is easy to see that

$$\begin{aligned}\tau^{GC} &> \tau^{GM} \\ &\Leftrightarrow \\ V_G \frac{2\alpha - 1}{\alpha(1 - V_G)} &> 0, \forall \alpha > \frac{1}{2} \text{ and } V_G < 1\end{aligned}$$

■