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TAX STRUCTURE AND MACROECONOMIC PERFORMANCE

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Tax structure and macroeconomic performance

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Abstract

The goal of this paper is that of re-assessing the relationship between tax structure and growth, using a new series of fiscal variables based on the methodology developed in Mendoza et al. 1997 as proxies of the tax system, adopting a dynamic panel estimation strategy, and explicitly allowing for changes in the economic and institutional structure of the countries involved. We find some evidence that consumption taxes are more growth friendly than taxes on labour, which appear in turn to be less harmful for growth than taxes on capital income.

1. Introduction

This paper analyses the impact of the tax structure as measured by implicit tax rates on GDP growth in 20 OECD countries in the period 1965-2011.

The academic and policy debate on how taxes and their structure affect economic performance is a long standing one. The global downturn brought about by the 2008 financial crisis renewed the interest on a specific issue, namely the link between the tax system and growth. In particular, Arnold et al. (2011) have recently argued that there is strong empirical evidence of a 'tax and growth ranking', with recurrent taxes on immovable property being the least harmful (or most beneficial) in terms of their effect on long-run GDP per capita, followed by consumption taxes (and other property taxes), personal income taxes and corporate income taxes.

These findings had a significant impact on the recent policy debate in Europe on the desirability of carrying out a tax shift from labour income taxation, and especially from social security contributions, to broad base general consumption taxes, in particular VAT (D'Antoni and Zanardi, 2011). The OECD has recently issued many recommendations on the opportunity to introduce growth-oriented tax reforms, e.g. OECD (2008 and 2010), and a tax shift towards consumption is part of the reform package. A similar prescription is proposed by the European Commission (European Commission, 2013).

Previous literature does not deliver clear-cut results on the effects of taxes on macroeconomic performance. Mendoza et al. (1997) argued that both theoretical and empirical evidence corroborates the so called "Harberger's conjecture": changes in tax policy may affect investment rates and improve welfare through efficiency gains, but do not affect growth. They analysed an OECD country panel of 5-year averaged data and found modest effects of capital and labour income taxes on investment, and negligible effects on GDP growth. Subsequent research questioned several features of the Mendoza et al. (1997) approach but did not find clear evidence of adverse effects of different types of taxes on growth (Kneller et al. (1999), Bleaney et al. (2001)).

The comparison across different results in the literature and their reconciliation are quite difficult as different studies are based on different proxies for the relevant tax rates and on diverse empirical strategies.

With respect to the tax rates, most of the literature relies on aggregate measures of the average tax burden as measured by the ratio between tax revenue and GDP (Kneller et al. (1999), Bleaney et al. (2001)) or by the share of one type of tax in total revenue (Arnold et al. 2011). An obvious weakness of this approach is the potential endogeneity of the tax ratios. Mendoza et al. (1997) proposed an alternative methodology. Following Mendoza et al. (1994), they calculated macro-level effective tax rates (also named "implicit tax rates" by the European Commission 2013) by taking the ratio between the revenue derived from a particular type of tax and its potential tax base estimated from national accounts. The advantage of this approach is twofold. First, implicit tax rates can be immediately interpreted as they represent the wedge distorting optimizing behaviour in a representative agent setting. The implicit tax rate on consumption measures the percentage difference between post-tax consumer prices and the pre-tax prices at which firms supply consumer goods, whereas the implicit tax rate on labour and capital corresponds to the percentage difference between post and pre-tax income. Second, they are not directly affected by the development of GDP and factor shares. Some studies (Gemmell et al., 2013 and Sonedda, 2009) suggested also the need to distinguish between average and marginal tax rates.

The differences in the empirical strategies are instead motivated by the adoption of diverse approaches to distinguish between long-run and transitory effects of taxes on GDP. As noticed by Arnold et al. (2011), it is possible that tax changes that encourage innovation and entrepreneurship have persistent long-run growth effects, whereas those that affect investment can have effects on growth that fade out in the long run. The same applies to tax changes affecting labour supply.

Early literature (Mendoza et al. 1997, Kneller et al. 1999) has usually tried to extract long run information from annual data by taking averages over a five-year period to wash out cyclical fluctuations and it has only estimated current-period effects in a static panel. Bleany et al. (2001) argued that this approach is inadequate as they find evidence

that fiscal variables in a five-year period have a significant effect in the subsequent five-year period. More recently, Arnold et al. (2011) relied on an error correction representation that makes full use of the available time-series information and provides estimates of both long- and short-run parameters without the need for long lag structures. However, Xing (2012) showed that the results are highly sensitive to the method used for estimating the error correction model. She finds evidence that the homogeneity restriction imposed by the PMG estimator is invalid for some of the long-run coefficients, and shows that the tax ranking established by Arnold et al. (2011) cannot be detected in the data once such restriction is removed.

Besides the heterogeneity of proxies and estimation methods used, the existing literature suffers several additional weaknesses.

First, all empirical tests implicitly assume that countries are closed economies. When international trade and factor mobility are taken into account, the relationship between taxes and growth becomes more complex. The basic reason is that taxes may affect not only the wedge between domestic consumers and producers but also between domestic consumers (producers) and foreign producers (consumers) (Arachi, 2001). For example, income from capital can be taxed according to two different principles. A tax can be levied either where the income is produced (source-based taxation) or where the recipient is located (residence-based taxation). Source-based taxes create a wedge between the remuneration paid by domestic producers and the remuneration, net of foreign taxes, that a domestic consumer can receive when he offers savings abroad. Residence-based taxes insert a wedge between the remuneration at which capital is traded on world markets and the remuneration received by savers. Source-based taxes thus reduce the return earned by foreign investors and affect investment in the country. In contrast, residence-based taxes reduce the return earned by domestic savers, thus affecting savings. As a consequence, in an open economy, taxes levied on the same type of income (e.g. capital income) may have different effects on GDP depending on whether they are source or residence based. As an exception to the general reliance on a closed-economy set-up, Gemmell et al. (2013) point out that corporate taxes may be more harmful to growth as they are more frequently source-based.

By focusing on the closed economy paradigm, the literature has also neglected the interaction between tax policies of different countries, which may also be strategic, as highlighted by the tax competition literature.

The second major weakness of existing studies is that they usually assume an invariant economic environment over a very long period of time (the last 30-40 years). During this period all countries have experienced fundamental changes in their economic environment (e.g. a switch from fixed to flexible exchange rates or vice versa, the participation to a free trade area) and in their institutional and regulatory framework (changes in the relationship between the government and the central bank, changes in antitrust policies and regulation of the labour market). Further, there have been fundamental innovations in tax policies (e.g. the introduction of VAT and the use of tax withholding). It seems highly plausible that these innovations have shaped the relationship between taxes and economic performance.

The goal of this paper is that of re-assessing the relationship between tax structure and growth, using a new series of fiscal variables based on the methodology developed in Mendoza et al. 1997 as proxies of the tax system, adopting a dynamic panel estimation strategy, similar to Arnold et al. (2011), and explicitly allowing for changes in the economic and institutional structure of the countries involved.

The next section describes the data and the model specification, Section 3 discusses the regression results and Section 4 provides some concluding remarks.

2. Data and empirical model specification

Following Arnold et al. (2011) and Xing (2012), the empirical analysis is performed by estimating an Error Correction Model (ECM) specified as:

$$\Delta lny_{it} = -\varphi_i\left(lny_{it-1} - \sum \beta_j X_{it}^j - \sum \beta_m T_{it}^m\right) + \sum b_j \Delta X_{it}^j + \sum b_m \Delta T_{it}^m + \gamma_i n_t + \delta_i + \varepsilon_{it}$$

where y_{it} is the log of GDP per capita calculated as the ratio between GDP at constant prices and constant PPPs (in millions of US dollars) and the level of working age population (in thousands), n_t is a time effect, δ_i is the country-specific intercept and ε_{it} is

the error term. The vector of non-fiscal variables, $\mathbf{X}^j$, includes physical capital investment, human capital and population growth. In particular, the physical capital investment is the total gross fixed capital formation as a percentage of GDP; human capital represents the average years of schooling of the working age population; population growth is the annual growth rate of the working age population.

The vector of fiscal variables T^m includes total revenue over GDP and the implicit tax rates as proxies of the tax wedges on consumption, labour and capital. The implicit tax rate on consumption (T_c) is computed as the sum of revenues from consumption taxes on goods and services divided by the sum of private and government consumption. The implicit tax rate on capital (T_k) includes corporate profit taxes, taxes on household capital income and various property taxes. The implicit tax rate on labour (T_l) is computed as the sum of taxes on labour income, revenues from social security contributions and revenues from payroll taxes divided by labour income. Data on potential tax bases are taken from OECD Annual National Accounts and OECD Labour Force Statistics, whereas revenue data are from the OECD Tax Revenue Statistics.

The implicit tax rates are calculated using the methodology proposed by Carey and Tchilinguirian (2000), which allows to overcome some of the shortcomings of standard calculation of implicit tax rates (e.g. European Commission 2012). In particular, the assumption that all income from self-employment is capital income is dropped in favour of assuming that the self-employed earn both labour and capital income. This adjustment is relevant when comparing countries with significant differences in the share of self-employed in total employment or when this share changes over time. Furthermore, government consumption is added to the tax base of consumption taxes. This allows us to compare countries with different dimensions of the public sector. In the computation of T_k and T_l, we take into account that in most countries[1] employees' social security contribution are deductible from household taxable income. We also made some specific adjustments to take into account some peculiar taxes that the OECD

[1] The countries not allowing for the deductibility of social security contributions are the following: Australia, Canada, Portugal, the United Kingdom and the United States.

classifies in the residual category of "Other taxes", such as *Irap* in Italy. The resulting implicit tax rates and the method used to compute them are described in the Appendix.

We combine different data sources to obtain an unbalanced panel data set, including 20 OECD Countries[2] over the period 1965-2011.

The analysis focuses on tax structure and aims at evaluating the impact of revenue-neutral tax policy changes on long-run growth. For this reason we control for the overall tax burden and include in the regression the implicit rate on consumption and on capital divided by the implicit rate on labour. This allows us to interpret the associated coefficients as the impact on GDP produced by, respectively, a tax neutral shift from labour to consumption and from labour to capital.

3. Results

Table 1 summarizes the PMG estimates of the long- and short-run coefficients and the estimated average speed of convergence across countries under different specifications of the country-specific time dummies. To compare our results with those in Arnold et al. (2011), Gemmell (2013) and Xing (2012) we use no time effects in Column 2, a five-year period dummy in Column 3, a ten-year period dummy in Column 4 and country-specific linear trends in Column 5.[3]

The sign of the estimated long-run coefficients of the non-fiscal control variables are consistent with the findings of previous literature. The level of total revenues over GDP appears to have no effect on long-run growth. The estimates related to the other tax-variables are more sensitive to the specification of the time dummy. This is in line with the findings of Xing (2011) and suggests that country-specific time effects should be more carefully modelled by taking into account structural changes of the economy, e.g.

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[2] The 20 Countries are: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Italy, Japan, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom and United States.

[3] Given the error-correction specification, it is important to check that the residuals from the long-run equation are stationary to avoid spurious correlations. The errors of the regression equation have been tested for non-stationarity using panel unit root test based on Im et al. (2003). Non-stationarity of the residuals was rejected at the 1% level.

financial market and commodity market integration, the change of the exchange rate regime, reforms of regulation of labour markets.

Overall, the PMG estimates seem to provide some evidence that a tax shift from labour to consumption, for a given level of revenue, may have a positive effect on long-run growth: the coefficient of the ratio between the implicit tax rate on consumption and the implicit tax rate on labour is positive and strongly significant at 1% level in Columns 3 and 5. There is also some evidence of a positive effect on long-run growth of a tax shift from capital to labour (the coefficient is negative and significant at 5% level in Columns 3-6).

Xing (2012) has shown that the homogeneity restriction imposed by the pooled mean group (PMG) estimator is invalid for some of the long-run coefficients, and that inference based on the PMG estimator may be unreliable in this instance. For this reason Column 6 reports the results for the mean group (MG) estimator. The MG estimation yields country-specific long-run tax coefficients in the mean across countries which have the same sign of the PMG estimates, but with very large standard errors. We test the validity of the common long-run coefficients restriction using both the Hausman test (Hausman, 1978) and an alternative Wald test proposed by Xing (2012). The results are reported in Tables 2 and 3. The Hausman tests considering each coefficient individually does not reject the validity of these restrictions. The fact that the Hausman test statistic considering all five coefficients jointly is negative can also be interpreted as a sign of the validity of the homogeneous coefficient hypothesis. The Wald test in Table 3 confirms the Hausman test when applied to each coefficient individually. However, the joint Wald test in Table 3 strongly rejects the null hypothesis of common long-run coefficients. This result suggests some caution in the interpretation of the coefficients of the PMG estimation.

The specification used in Table 1 neglects the fact that taxes may have different effects in a closed and open economy and that these effects may also depend on the way taxes are levied on transactions with the rest of the world. One prominent example is given by capital taxation where taxes may be applied according to the residence (or worldwide) principle (which implies taxing the return of domestic savings invested abroad and

exempting the return of foreign investments) and/or according to the source (or territorial) principle (which implies exempting the return of domestic savings abroad and taxing the return of foreign investments). The theoretical literature suggests that source based taxes could be more harmful on growth as they may have a greater negative impact on investment.

We have started implementing an analysis of this issue by using the ratio between the revenue of the corporate income tax and total revenue from capital income (T_{cor}) as a proxy for the relevance of source-based taxation. Foreign individual and institutional investors usually do not receive any relief for the corporate income tax paid by the company in which they have a stake. In contrast, international treaties against double taxation usually provide some relief for other foreign taxes paid on dividends and interest. For corporate investors, the treatment of corporate taxes paid by foreign subsidiaries depends on whether their home country follows the worldwide or the territorial principle. In the first case, corporate investors receive a credit (albeit usually limited) for taxes paid abroad, whereas in the second case income net of foreign taxes is fully taxed. The last twenty years have witnessed a massive switch from the worldwide to the territorial system. In 1990 the territorial system was adopted by 9 out of 34 current OECD member countries (PWC 2013). Today territorial countries are 28 and the shift to territorial taxation is currently debated in the US. To account for the shift from worldwide to territorial taxation of multinationals, we build a dummy variable that takes value one in any year in which a country applies the territorial system. This dummy is then interacted with T_{cor}. Both T_{cor} and the interacted variable should have a negative coefficient if source-based taxes are more harmful to growth than residence-based ones.

Regression results are reported in Table 4. Surprisingly, the PMG estimator (Columns 1 and 3) reports a positive and significant coefficient for the share of corporate taxes on capital income taxation. The interacted variable has also a positive, albeit not significant, coefficient. The sign of the two coefficients is confirmed by the MG estimator (Columns 2 and 4) even if in this case they are not statistically significant.

These preliminary results can be hardly interpreted as evidence of a positive effect on growth of a shift from personal to corporate taxation of capital income. However, they suggest that the standard approach that focuses on closed economies and three fundamental tax wedges (consumption, labour and capital) may be inadequate for analysing the impact of the tax structure on long-run growth. Further research is needed to clarify the differential impact of taxes on closed and open economies and to understand the role played by different type of taxes levied on the same tax base.

4. Conclusions

In recent years many international organizations, e.g. the European Commission, the International Monetary Fund and the OECD, have strongly supported tax reforms aimed at shifting the tax burden away from capital and labour income to broad based consumption taxes or to property taxes. The existing literature does not provide clear empirical evidence supporting these policy prescriptions. Several studies have reached conflicting conclusions using different datasets and methodologies.

The results we find are mixed. There is some evidence that consumption taxes are more growth friendly than taxes on labour, which appear in turn to be less harmful for growth than taxes on capital income. However, the results rest on the assumption that the long-run coefficients are homogeneous across countries and the tests we have performed cast some doubts on the validity of such restriction.

The paper has also shown that the empirical estimates are sensitive to the specification of time country-specific effects and that not only the tax wedge but also its composition (i.e. personal vs. corporate taxation) may play a role. These preliminary results raise several issues to be investigated further.

Country-specific time effects may capture structural changes of the economy, e.g. financial market and commodity market integration, the change of the exchange rate regime, the reform of regulation of the labour market, which should be modelled more carefully. The differential effect of source- and residence-based taxes should be further investigated by explicitly taking into account the interaction between taxes levied by different countries.

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Table 1: PMG estimations in different model specifications and MG estimations with linear trends

Variables	PMG estimations					MG estimation
	(1)	(2)	(3)	(4)	(5)	(6)
Long run Coefficients						
Fixed Investments	0.549***	-0.610	0.246***	0.297***	0.263**	0.191
	(0.129)	(1.465)	(0.067)	(0.068)	(0.091)	(0.299)
Human Capital	0.843***	-3.411	0.778***	1.920***	1.803**	0.083
	(0.102)	(6.923)	(0.168)	(0.221)	(0.523)	(2.434)
Population Growth	-28.388***	-342.558	-11.539***	-8.809***	-21.667***	-28.440
	(3.699)	(424.463)	(2.424)	(1.907)	(5.246)	(19.554)
Tax Revenue/GDP		11.747	0.162	-0.662	0.524	-1.778
		(16.997)	(0.338)	(0.422)	(0.433)	(1.327)
Tc/Tl		31.690	1.533***	-0.051	1.562***	0.007
		(39.668)	(0.222)	(0.145)	(0.371)	(1.192)
Tk/Tl		-2.500	-0.024**	-0.048**	-0.081**	-0.013
		(2.970)	(0.010)	(0.015)	(0.032)	(0.163)
Short run Coefficients						
Δ ***Tc/Tl***		0.053	0.079*	0.141**	0.066	0.030
		(0.046)	(0.041)	(0.041)	(0.044)	(0.050)
Δ ***Tk/Tl***		-0.014*	-0.019***	-0.019***	-0.015**	-0.010
		(0.005)	(0.005)	(0.005)	(0.005)	(0.008)
Mean convergence rate	-0.046***	-0.003***	-0.087***	-0.093***	-0.065***	-0.262**
	(0.006)	(0.001)	(0.020)	(0.019)	(0.009)	(0.078)
Five year dummies			Yes			
Ten year dummies				Yes		
Linear Trends					Yes	Yes
Observations/Countries	810/20	675/20	675/20	675/20	675/20	675/20

Table 2: Hausman Test of equal long-run coefficients across countries

Variables	*Fixed Investments*	*Human Capital*	*Population Growth*	*Tax revenue/GDP*	*Tc/Tl*	*Tk/Tl*	*Joint test*
Difference	-0.072	-1.720	-6.773	-2.302	-1.554	0.068	
S.E.	0.392	3.236	25.807	1.734	1.561	0.217	
p.value	0.858	0.598	0.797	0.184	0.323	0.756	-8.28

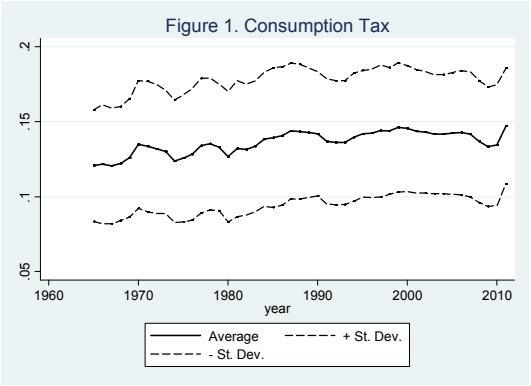
Table 3: Wald Test of equal long-run coefficients across countries

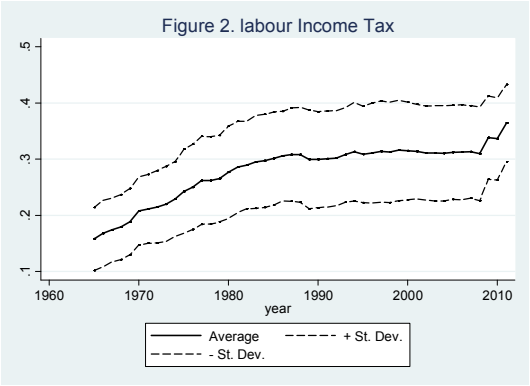
Variables	*Fixed Investments*	*Human Capital*	*Population Growth*	*Tax revenue/GDP*	*Tc/Tl*	*Tk/Tl*	*Joint test*
p.value	0.334	0.667	0.795	0.620	0.481	0.459	0.000

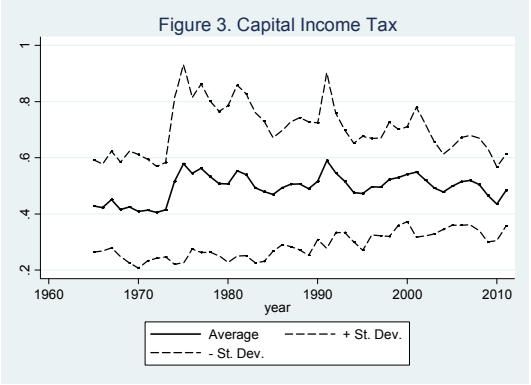
Table 4: PMG and MG estimations in different model specifications: focus on corporate taxation

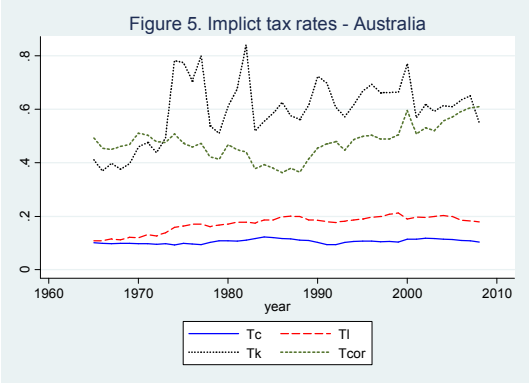
Variables	PMG	MG	PMG	MG
Long run Coefficients				
Fixed Investments	0.365***	0.419**	0.320***	0.344***
	(0.100)	(0.148)	(0.063)	(0.057)
Human Capital	1.842***	0.376	0.635**	1.084
	(0.489)	(1.021)	(0.230)	(2.290)
Population Growth	-24.476***	-15.693**	-12.732***	-14.503*
	(5.470)	(6.090)	(2.525)	(8.342)
Tax Revenue/GDP	0.572	0.003	1.150***	0.019
	(0.448)	(1.194)	(0.298)	(1.894)
Tc/Tl	1.777***	0.367	0.385**	0.568
	(0.388)	(0.534)	(0.156)	(0.561)
Tk/Tl	-0.195**	-0.165	-0.078***	-0.201**
	(0.072)	(0.124)	(0.021)	(0.085)
Tcor	0.283**	0.556	0.437**	0.481
	(0.120)	(0.460)	(0.129)	(0.304)
Tcor*TTS			0.056	0.295
			(0.047)	(0.255)
Short run Coefficients				
Δ ***Tc/Tl***	0.042	0.136	0.095**	-0.015
	(0.040)	(0.099)	(0.043)	(0.057)
Δ ***Tk/Tl***	-0.024***	-0.036**	-0.020***	-0.001
	(0.004)	(0.014)	(0.004)	(0.017)
Tcor	0.078**	-0.098	0.058**	0.041*
	(0.025)	(0.130)	(0.024)	(0.024)
Tcor*TTS			-0.009	-0.024
			(0.007)	(0.017)
Mean convergence rate	-0.064***	-0.170*	-0.090***	-0.247
	(0.010)	(0.089)	(0.017)	(0.163)
Linear Trends	Yes	Yes	Yes	Yes
Observations/Countries	675/20	675/20	675/20	675/20

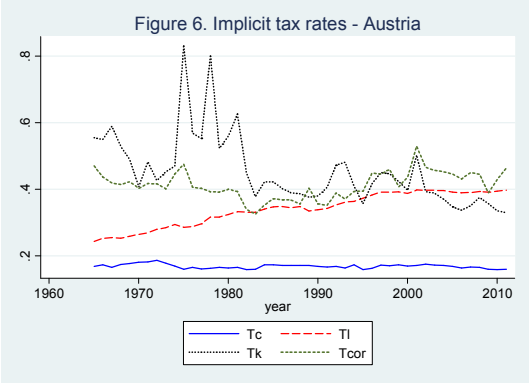
Appendix A: Implicit tax rates on consumption, labour and capital income

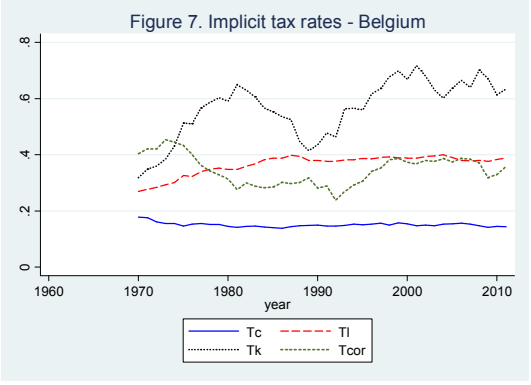












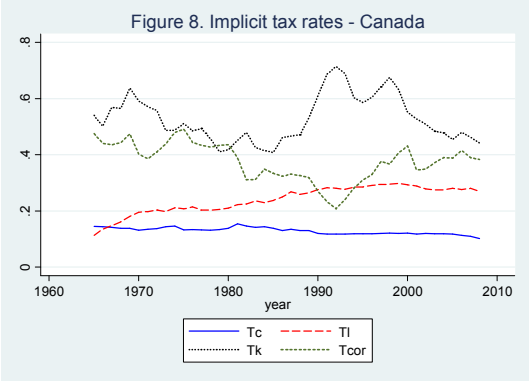


Figure 9. Implicit tax rates - Denmark

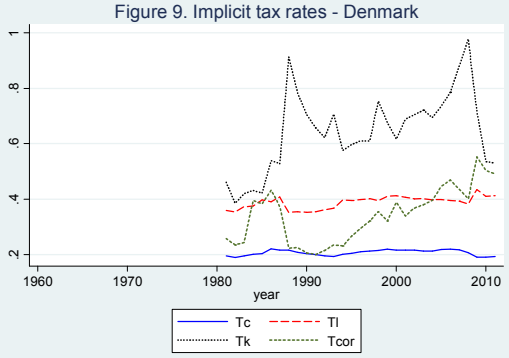


Figure 10. Implicit tax rates - Finland

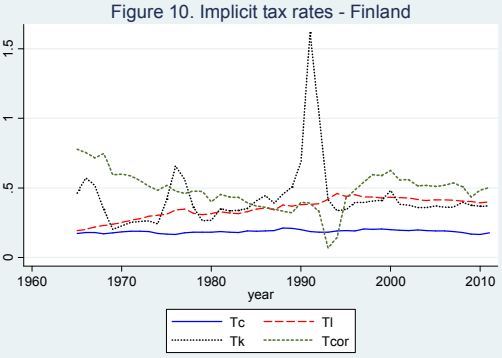


Figure 11. Implicit tax rates - France

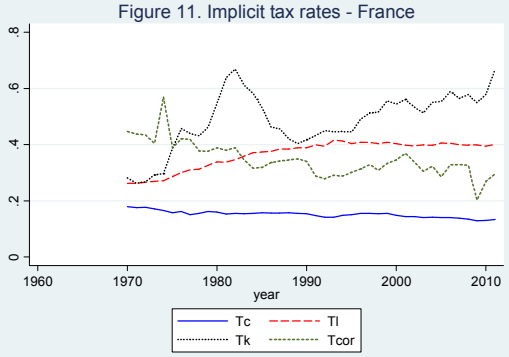


Figure 12. Implicit tax rates - Germany

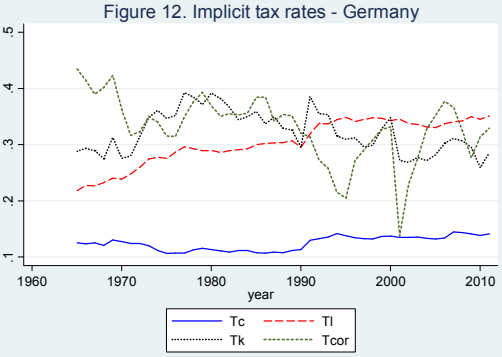


Figure 13. Implicit tax rates - Greece

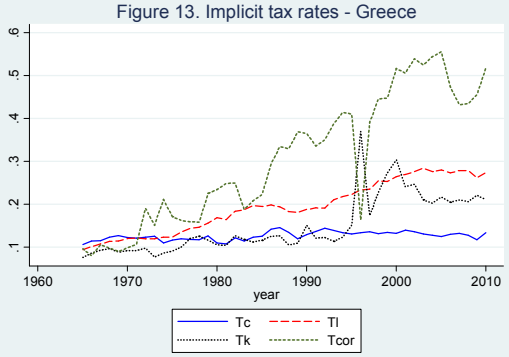


Figure 14. Implicit tax rates - Italy

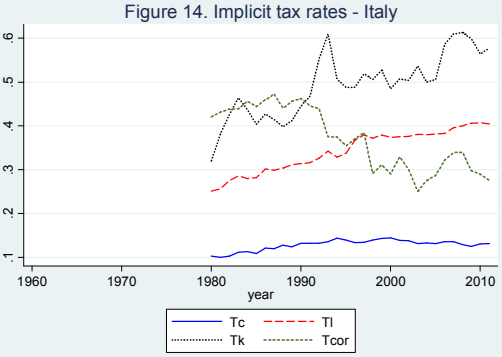


Figure 15. Implicit tax rates - Japan

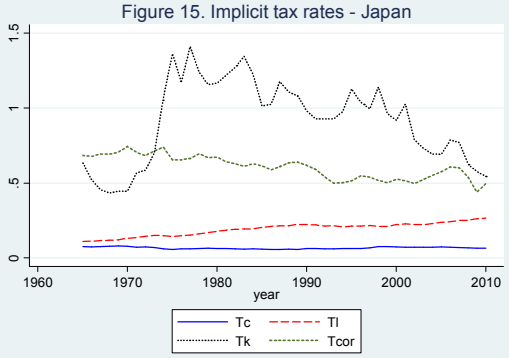


Figure 16. Implicit tax rates - Netherlands

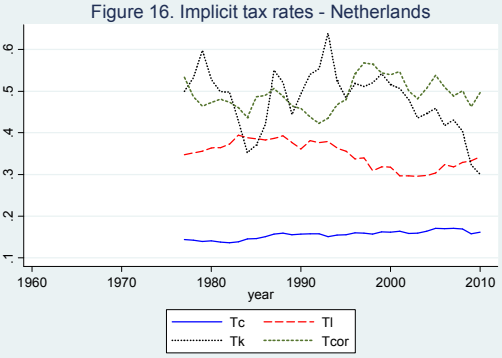


Figure 17. Implicit tax rates - New Zealand

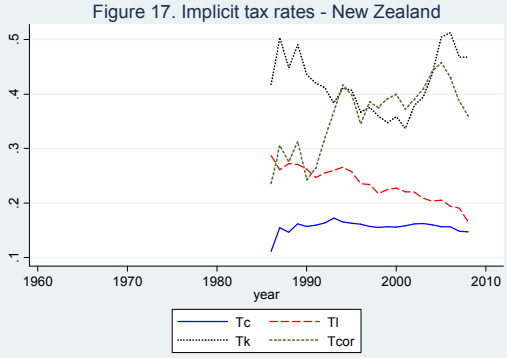


Figure 18. Implicit tax rates - Norway

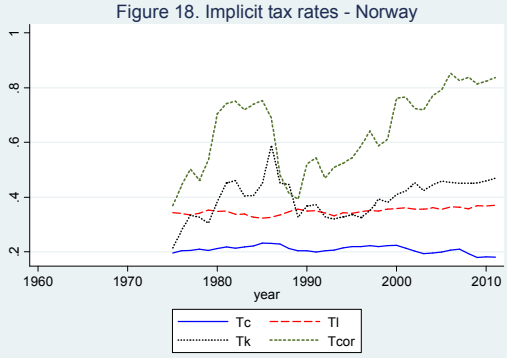


Figure 19. Implicit tax rates - Portugal

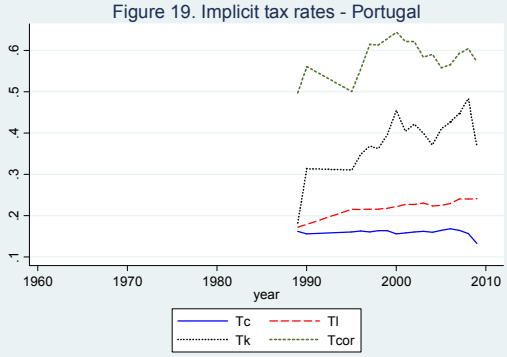


Figure 20. Implicit tax rates - Spain

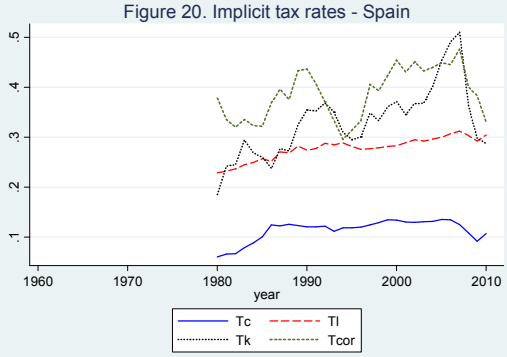


Figure 21. Implicit tax rates - Sweden

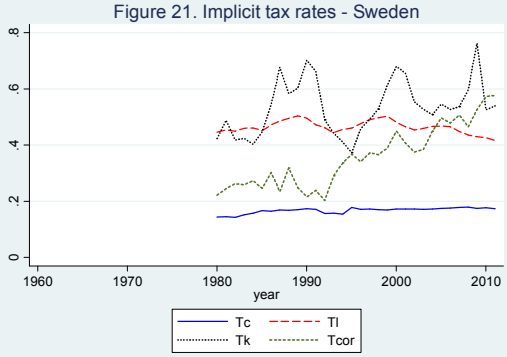


Figure 22. Implicit tax rates - Switzerland

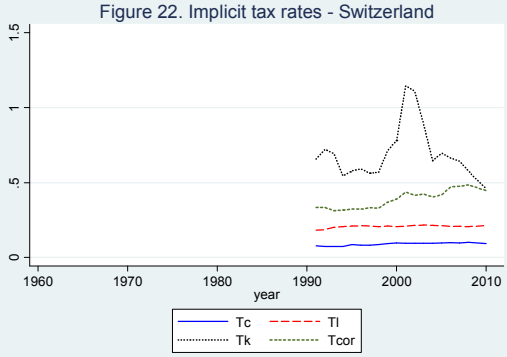


Figure 23. Implicit tax rates - United Kingdom

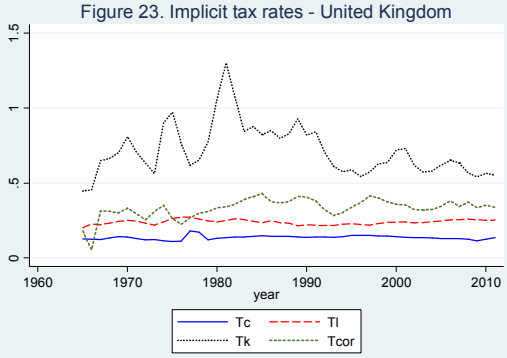
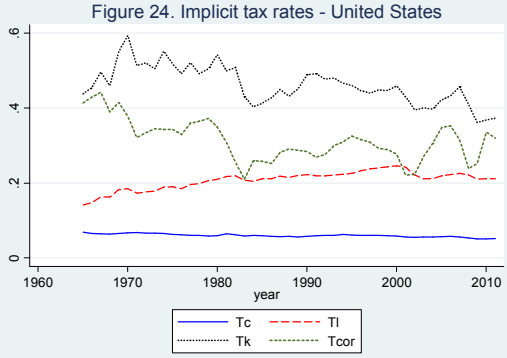


Figure 24. Implicit tax rates - United States



Appendix B: **calculation of implicit tax rates**

The following list provides the tax revenue data used in order to compute implicit tax rates; such variables are identified using the OECD codes:

- 1100 Taxes on income, profits and capital gains of individuals or households;

- 1200 Taxes on income, profits and capital gains of corporations;

- 2100 Social security contributions paid by employees;

- 2200 Social security contributions paid by employers;

- 2300 Social security contributions paid by the self-employed and persons outside of the labour force;

- 2400 Social security contributions unallocated;

- 3000 Taxes on payroll and workforce;

- 4000 Taxes on property;

- 5110 General taxes on goods and services;

- 5120 Taxes on specific goods and services;

- 5121 Excise taxes;

- 5122 Profits of fiscal monopolies;

- 5123 Customs and import duties;

- 5125 Taxes on investment goods;

- 5126 Taxes on specific services;

- 5128 Other taxes;

- 5200 Taxes on use of goods and performances;

- 5212 Taxes on motor vehicles paid by others;

- 6100 Other taxes paid solely by businesses;

- CP Private final consumption expenditure;

- EE Dependent employment;

- ES Self-employment;

- CG Government final consumption expenditure;

- OS Net operating surplus of the overall economy;

- OSPUE Unincorporated business net income (including imputed rentals on owner-occupied housing);

- PEI Interest, dividends and investment receipts;

- W Wages and salaries of dependent employment;

- WSSS Compensation of employees (including private employers' contributions to social security and to pension funds).

The implicit tax rate on consumption (τ_c) is computed as:

$$T_c = \frac{(5110 + 5121 + 5122 + 5123 + 5126 + 5128 + 5200)}{(CP + CG)}$$

In order to compute implicit tax rate on capital and on labour we first calculate the implicit tax rate on total household income (t_h), the wage-bill for the self employed (WSE), the share of labour income in household income (α) and the share of capital income in household income (β):

$$t_h = \frac{1100}{(OSPUE + PEI + W)}$$

$$WSE = \frac{ES \cdot (W - 2100)}{EE}$$

$$\alpha = \frac{W}{OSPUE + PEI + W} \qquad \beta = 1 - \alpha$$

The implicit tax rates on capital and labour are computed as:

$$T_l = \frac{(t_h \cdot (W + WSE) + 2100 + 2200 + 2300 + \alpha \cdot 2400 + 3000)}{(WSSS + WSE + 2300 + 3000)}$$

$$T_k = \frac{(t_h \cdot (OSPUE + PEI - WSE) + \beta \cdot 2400 + 1200 + 4000)}{(OS - WSE - 2300 - 3000)}$$

if social security contributions are not deductible, or they are equal to:

$$T_l = \frac{(t_h \cdot (W - 2100 + WSE - 2300 - \alpha \cdot 2400) + 2100 + 2200 + 2300 + \alpha \cdot 2400 + 3000)}{(WSSS + WSE + 2300 + 3000)}$$

$$T_k = \frac{(t_h \cdot (OSPUE + PEI - WSE - \beta \cdot 2400) + \beta \cdot 2400 + 1200 + 4000)}{(OS - WSE - 2300 - 3000)}$$

if social security contributions are deductible.