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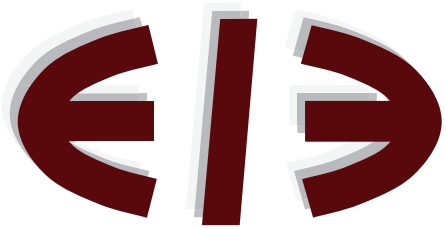

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The Impact of Taxation Structure on Growth: Empirical Evidence from EU27 Member States

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Abstract

What is the impact of taxation on growth? Is it supported by specific taxes and harmed by others? We use an error correction model to study the relationship between the tax composition and GDP growth in the EU27 Member States over the period 1995-2019. Under the constraint of revenue-neutrality, we find that, in the long-run, shifting tax away from labour (personal income tax) is growth-enhancing. In addition, growth is positively associated with a higher share of corporate income tax and consumption taxes in the total tax mix. However, evidence for property taxation is contrary to our expectation. We find a negative link between the share of property taxes and growth. Expectedly, increasing the overall tax burden has a negative impact on growth in the long-run. Results are robust to different model specifications. Supplementary evidence based on a computable general equilibrium model confirms that de-taxing wages for employees and lowering labour costs for employers would push output.

Keywords: EU27, growth, tax mix, personal income tax, corporate income tax, consumption taxes, environmental taxes, property taxes, labour tax shift, Computable General Equilibrium model.

JEL: H2, 047, C23, C68

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1. Introduction

Tax collection is a prerogative of each state, justified by different needs, such as the provision of public goods and social redistribution. Nevertheless, the tax system, especially in modern and complex economies, is never neutral. Taxes change relative prices which, in turn, change economic actors' behaviour, be it producers, investors or consumers. Taxes provide incentives or disincentives, impacting on choices of workers and firms in a more or less distortive way. Governments levy taxes, extracting resources from private entities to the state, and reallocate resources back to households through social welfare schemes or to companies via subsidies. This also implies that governments must strive to make the best use of these resources or, in other words, to collect and use tax revenues in the most efficient and effective way possible. Targeted government action via taxation must therefore be balanced with regard to the effect it has on both the economy and society as a whole. Therefore, it becomes of paramount importance to evaluate the instruments governments apply to collect resources. A given level of revenue collected by the state could have very different impacts on economic growth and income inequality depending on the structural design of the tax-benefit system. Indeed, the structure of taxation has economic and social implications that must not be neglected.

The debate on those implications has been the interest of both academic scholars and policy makers for a long time. International organisations such as the OECD and the European Commission have long argued that a tax shift from labour toward consumption and property could foster economic growth (while the design of each tax would play a role). For example, Kumhof *et al* (2021) find that a shift of taxes away from labour and capital towards land in the US would increase output and welfare. As of corporate taxes, literature seems to assume a rather positive stance of tax cuts pushing growth. However, as pointed out by Gechert and Heimberger (2022), there may be a certain "publication selectivity" towards reporting positive growth effects of lower corporate taxes. Controlling for this bias, the authors cannot rule out that corporate tax cuts be neutral to growth. This finding raises the question of corporate taxes in the context of the optimal tax mix, i.e., as potential compensation for labour tax cuts.

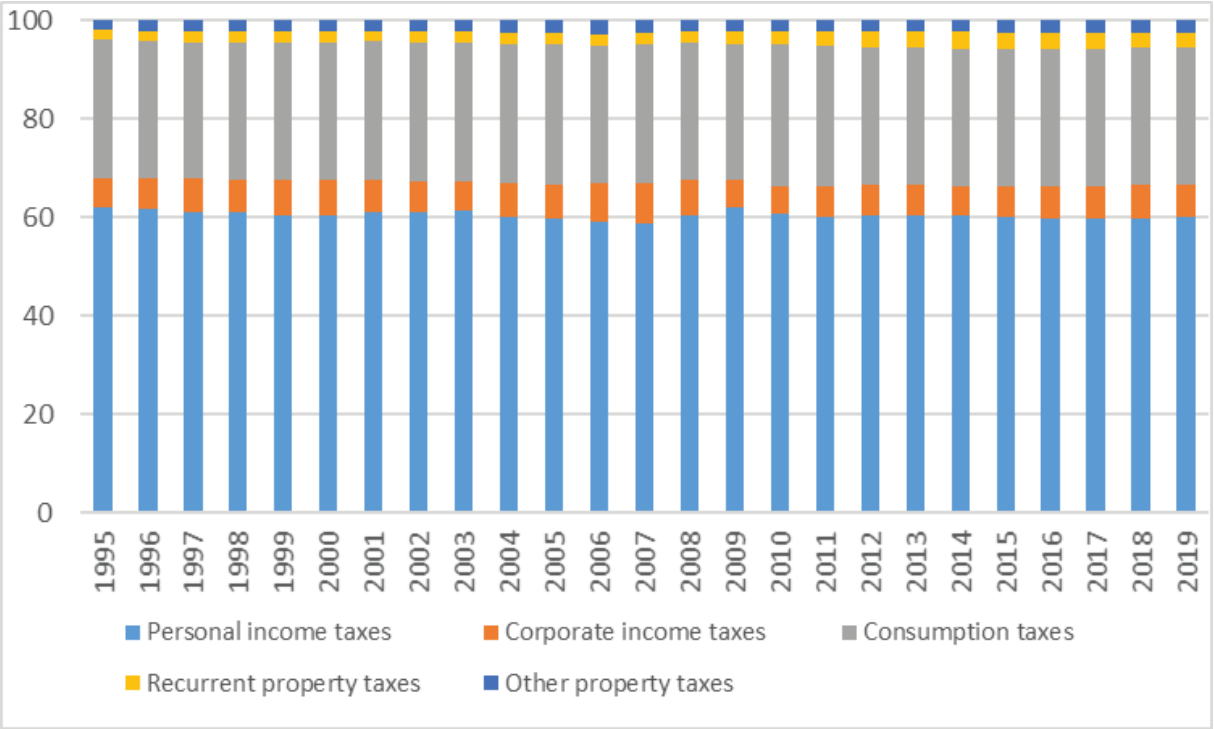
Most recently, the 2022 Annual Report on Taxation recognises: "*The literature has put forward that taxation should shift from income taxes to less (productivity/growth) distortive taxes such as various immovable property taxes (including real estate and land levies) or consumption/behavioural taxes*." (European Commission, 2022). This has been translated by the European Commission into the European Semester, where it has often been suggested that Member States' design of tax-benefit systems should be more growth–friendly, shifting the tax burden away from labour, in particular for low earners. In that context, the Commission also voiced support for environmental and property taxes[1].

During the last 35 years, while the overall tax burden increased by 1.5 percentage points of GDP (up to 39.9% of GDP), the tax mix in the EU-27 has remained practically unchanged (*Chart 1*). A

[1] A technical note prepared in 2020 by Commission Services for the Eurogroup suggested a shift of the tax burden towards other forms of taxation, especially environmental taxes. It is argued that, though potentially regressive, environmental taxes were less detrimental to the growth.

large part of the burden is borne by Personal Income Taxes (PIT), representing 62% of the total revenue, followed by consumption taxes (34%) and Corporate Income Taxes (CIT) (8%). Much smaller amounts are collected through taxes on property (less than 4% of the total).[2]

Chart 1. Taxation mix in EU27 from 1995 to 2020 – proportions of total revenue (%)

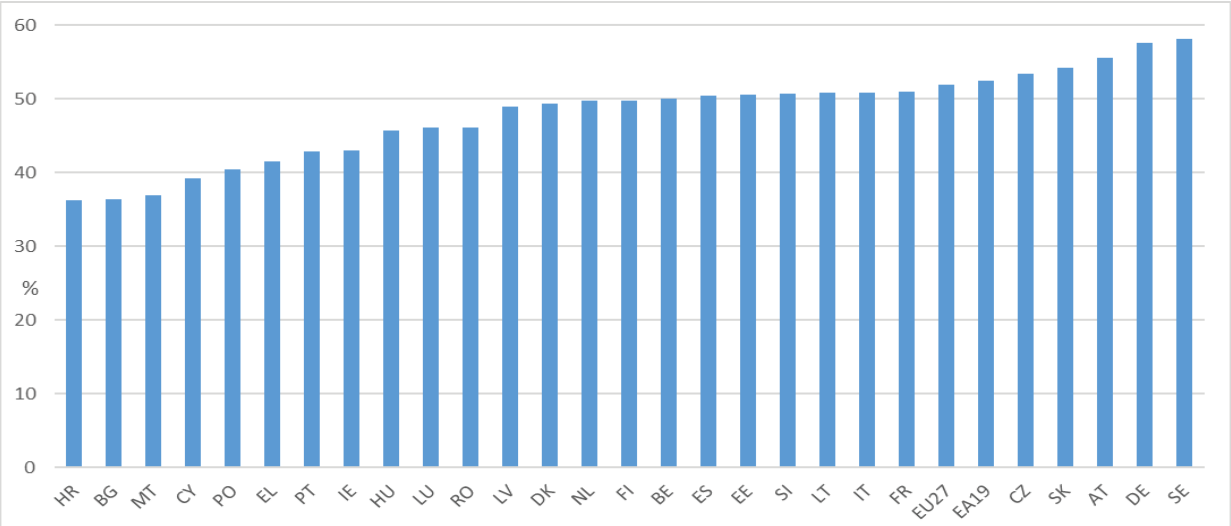


Source: TAXUD elaboration on Eurostat data

The significance of labour taxes for total revenue varies across Member States. The 2019 share of labour taxes represented 36.2% in Croatia, while it was at 58.1% in Sweden (*Chart 2*).

[2] The percentages of collected taxes refer to 2019. In relative terms from 1995, the proportion of recurrent property taxes have increases by 52%, other property taxes by 34% and corporate Income taxes by 17%, while consumption taxes dropped by almost 5%.

Chart 2. Labour taxation by Member State in 2019 as % of total revenue



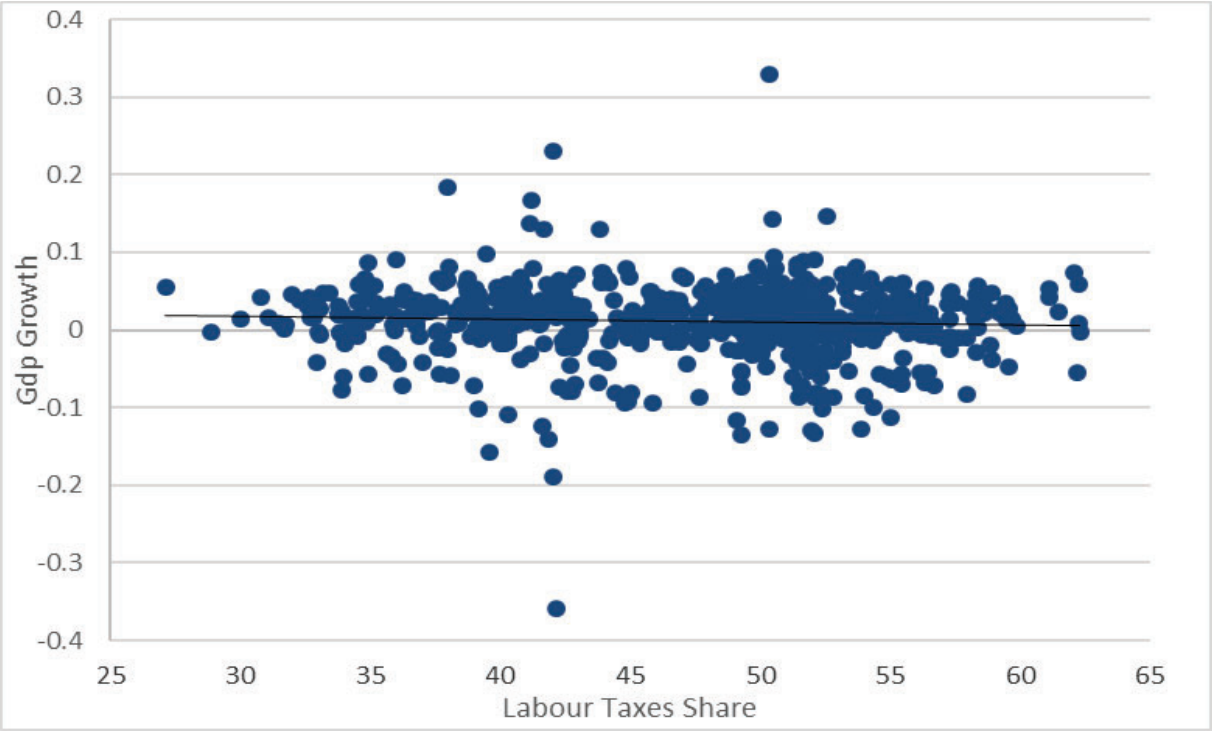
Source: Eurostat

To analyse the tax shift away from labour taxation, as advocated by the European Commission, we start by plotting the share of labour taxes in total tax revenue against economic growth. The scatter plot in *Chart 3* pools data from 1995 to 2019. It hardly shows any correlation between GDP-growth and the share of labour taxes. It is thus not evident at first glance that countries with lower proportional revenues from labour taxation have experienced higher growth.[3]

The following analysis explores the link between the tax mix and economic growth more in depth. After discussing the two existing main strands of literature, we engage in a regression analysis that distinguishes between short- and long-term growth implications of tax instruments. It also takes account of the technical links between output growth and the input of productive factors (labour, human and physical capital) which are themselves reactive to the tax mix. Finally, we use the Commission's Labour Market Model and simulate the macro-economic effects of a tax-shift away from labour: reducing wage taxes and reducing labour costs while increasing indirect taxes proxied by an increase in Value Added Tax (VAT).

[3] The distribution of labour taxes across wage groups may play a role here as it varies a lot between EU countries. Where a relatively high share of the wage tax burden lies on lower wages, this can impact the extensive margin of the labour market (i.e., the decision to work), while the intensive margin matters more for higher wage earners (i.e, how many hours to work).

Chart 3. Labour taxation and growth – EU27 countries from 1996 to 2019



Source: TAXUD elaboration on Eurostat data

In the economic literature there are two main strands of research dealing with the link between fiscal policy and economic growth. One typically looks at the marginal impact of specific tax instruments, while the other focuses on the tax composition, assessing the impact of a change under the assumption of revenue-neutrality.

1. Kalyva *et al.* (2018) look at tax systems in EU Member States. They support the view of a generally positive impact a tax shift away from labour may have on the economy while emphasising potential trade-offs this may have on equality. Durante (2021) reports recent empirical analyses and finds that tax cuts on income and consumption are growth-enhancing. Several works estimate that a decrease of income tax by one percentage-point increases GDP by between 0.78% and 6.6% (Mertens *et al.*, 2018; Zidar, 2019; Nguyen *et al.*, 2021). A meta-analysis including 49 studies on OECD countries finds that a 10% decrease in distortionary taxes or in taxes that fund unproductive investment[4] increases GDP growth by 0.2% (Alinaghi & Reed, 2021). Stoilova & Patonov (2012) show that a tax structure that relies more on direct taxes is more efficient as it is more supportive to economic growth in the EU. Stoilova (2017) sees a tax structure skewed towards consumption, personal income and property favour economic growth. These studies thus

[4] Following Kneller et al. (1999), taxes on income and profit are classified as distortionary, while social security and welfare expenditure are seen as unproductive investment.

show mix evidence. One reason is that they do not assume revenue neutrality of changes in the tax system, which largely widens heterogeneity among the results.

2. Arnold (2008) uses an Error Correction Model (ECM) and applies the revenue-neutrality assumptions in a sample of OECD countries. He finds that income taxes are associated with lower economic growth than taxes on consumption and property. This finding supports the notion of a growth-enhancing shift from direct to indirect taxation. It has been generally confirmed by other scholars (Heady *et al*., 2011; Acosta-Ormaechea & Yoo, 2019), but questioned by Baiardi *et al.* (2019), who challenge the robustness of the standard results, showing that many relationships are no longer significant if standard errors are clustered at country level.[5]

2. Econometric approach and data

Given the importance of revenue neutrality in the context of fiscal sustainability, the present analysis applies Arnold's (2008) approach to EU27 Member States. The framework is based on a Cobb-Douglas production function with constant-return-to-scale, where the output is a function of technology (*A*), physical capital (*K*), human capital (*H*) and labour (*L*):

$$Y(t) = K(t)^{\alpha} H(t)^{\beta} (A(t)L(t))^{1-\alpha-\beta} \quad (1)$$

The level of technology depends, inter alia, on the quality of institutions and public policies, which allows us to rewrite equation (1) with output being a function of tax instruments. In the intensive form, we can write the production function:

$$\Delta \log y_{i,t} = a_{0,\mathrm{i}} - \phi_i \log y_{i,t-1} + a_{1,\mathrm{i}} \log s^K_{i,t} + a_{2,\mathrm{i}} \log h_{i,t} - a_{3,\mathrm{i}}\, n_{i,t} + \sum a_{j,i}\, Tax_{i,t} + F_i(t) + b_{1,i} \Delta \log s^K_{i,t} + b_{2,i} \Delta \log h_{i,t} + b_{3,i} \Delta n_{i,t} + \sum b_{j,i}\, \Delta Tax_{i,t} + \epsilon_{i,t}\,, \quad (2)$$

where y is GDP per capita in each country i at time t. y is a function of investment rate in physical capital s, the average level of human capital h of working age population, and the growth rate of working age population n. The lagged term $y_{i,t-1}$ accounts for convergence in GDP over time. *Tax* is the vector of tax instruments. It includes the overall tax burden as a fraction of GDP[6] and the share of the different taxes in overall tax revenue. The equation also includes a set of both country

[5] However, authors appreciate that within-cluster correlation of the error terms may occur at more aggregate level. We argue that the European level is the most appropriate for our analysis of UE27 Member States, given the European institutional and economic framework.

[6] This ensures the revenue-neutrality following a change in the structure of taxes.

fixed effects $a_{o,i}$ and non-linear time trends, proxied by a sequence of dummy variables for 5-year periods (F_i)[7]. ϵ is the error term. The variables with coefficient *a* capture long-term dynamics (steady state), while those in first differences with coefficient *b* account for short-term reactions.

Members States operate in an integrated economic and technological area under the European institutional framework. This suggests that they experience similar dynamics in economic fundamentals and similar links between tax structure and output growth. Thus, it is expected that EU countries tend towards a similar steady state equilibrium. Yet they follow specific *short-term* patterns. In this context, our econometric analysis uses the Pool Mean Group (PMG) approach developed by Pesaran *et al.* (1999)[8], where the short-term parameters *b* and the convergence term ϕ vary across countries, while the long-term coefficients *a* are common. In this way, inter-country heterogeneity is taken into account in the short run while long-term slope homogeneity is imposed in the steady state. This approach increases the efficiency of the estimates with respect to mean group estimator (Pesaran and Zhao, 199), as also argued by Bassanini & Scarpetta (2001).

Equation (2) can be turned into the form of a panel error correction model (ECM):

$$\Delta \log y_{i,t} = \phi_i \left(\log y_{i,t-1} - \theta_{1,t} \log s_{i,t}^K - \theta_{2,1} \log h_{i,t} + \theta_{3,\mathrm{i}}\, n_{i,t} + \sum \theta_{j,i}\, Tax_{i,t} - a_{i,t} \right) + b_{1,i} \Delta \log s_{i,t}^K + b_{2,i} \Delta \log h_{i,t} + b_{3,i} \Delta n_{i,t} + \sum b_{j,i}\, \Delta Tax_{i,t} + \epsilon_{i,t} \qquad (3)$$

Equation (3) clarifies that the steady state coefficients and the parameters of production function (1) can be retrieved from the equation (2), once the restrictions consistent with the PMG are imposed.[9] The long-run elasticities θ are derived by dividing the estimated coefficients *a* by ϕ,[10] while the expression outside the bracket can be interpreted as the short-term deviation (the 'error') from the long-term growth path. We hypothesize that ϕ_i is negative: the system would correct for this deviation, making sure that y converges to its steady state equilibrium.

Annual data presented in *Table 1* covers EU27 Member States over a period from 1995 to 2019, where GDP per capita is expressed at constant 2010 prices in purchasing power parities (PPP). Gross fixed capital formation data[11] are used to calculate the investment rate in physical capital as ratio to GDP. Human capital of the population aged 15-64 years is proxied by the average number of schooling years in formal education.[12] The overall tax burden is expressed relative to GDP while

[7] A linear trend has been also tested for the sake of robustness.
[8] The routine *xtpmg* of the software package *Stata* implements this method for non-stationary heterogeneous panel data (see Blackburn & Frank, 2007) with a maximum likelihood estimation.
[9] Arnold et al. (2007) describe the full derivation of the equations.
[10] For example, the long-run impact of human capital on output is given by $\theta_2 = \frac{a_2}{\phi}$. The tables below report these elasticities.
[11] Gross fixed capital formation and GDP are provided by EUROSTAT ([nama_10_an6]; [nama_10_pc]).
[12] EUROSTAT provides data for three different levels of educational attainment, according to the International Standard Classification of Education (ISCED) system: i) pre-primary, primary and lower secondary (ISCED 0–2);

the taxation instruments are shares in the overall tax revenue. Tax instruments include income taxes (personal income taxes[13] and corporate income taxes), consumption taxes, property taxes (recurrent property taxes and other property taxes[14]). Eurostat's database is the main source of all data.[15]

Table 1. Descriptive statistics for EU27 Member States, 1995-2019

Variables	Obs.	Mean	S.D.	Min	Max
GDP per capita (log)	675	10.008	0.399	8.998	11.232
Physical capital	675	17.935	4.237	4.100	51.300
Human capital	675	9.805	0.932	6.061	12.238
Population growth	675	0.103	1.025	-4.498	4.351
Overall tax burden	675	35.730	5.939	20.178	48.904
Income taxes	675	62.050	6.272	43.895	72.234
Personal Income taxes	675	53.967	7.458	34.385	66.530
Corporate Income taxes	675	8.083	3.842	0.508	22.987
Consumption & Property taxes	675	37.937	6.284	27.766	56.105
Consumption taxes	675	34.122	6.615	21.245	53.849
Property taxes	675	3.816	2.131	0.299	10.420
Recurrent Property taxes	675	1.882	1.400	0.000	7.622
Other Property taxes	675	1.933	1.434	0.000	6.973

Source: TAXUD elaboration on Eurostat data

3. Empirical results

Our analysis estimates five reference models, each assessing the impact on per-capita GDP growth (in the following denoted as 'output growth') of changes in one specific tax instrument under the constraint of revenue-neutrality achieved through changes in the other tax instruments[16]. *Table 2* reports the estimated long-term parameters, while the *Table 3* presents short-term coefficients. As expected, the parameter of convergence ϕ is always negative. Deviations of output growth from its long-term path are corrected for to some extent in every given period t. This finding is consistent with each EU country's tendency towards a common steady state output growth in the long-run.

ii) upper secondary and post-secondary non-tertiary (ISCED 3–4) and iii) first and second stage of tertiary (ISCED 5–6). Following a standard approach, we calculate schooling years for each educational level [lfsa_pgaed].

[13] Social contributions are included.

[14] Recurrent taxes on property are usually paid annually and depend on the value of the property. 'Other taxes' are due, for example, when there is a change of ownership.

[15] The source of taxation data is European Commission, DG Taxation and Customs Union. It is based on Eurostat data.

[16] Revenue-neutrality is ensured by including the overall tax burden in the regressions.

Long-term impact of tax instruments

Investment in fixed capital and the level of the human capital are positively correlated with the output growth in the long-run. The coefficient of the overall tax burden is negative or not statistically different from zero, suggesting a general repressive impact on output growth. The model reported in the first column of *Table 2* shows that an increase in income taxes reduces growth, where the second column clarifies that such result is mainly driven by the negative impact of personal income taxes. The effect of corporate taxes is actually positive, although insignificant. These results are robust w.r.t. alternative model specifications. For example, the model presented in *Table A1* in the *Annex* measures real GDP without correcting for PPP. It confirms that the correlation of PIT with output growth is significantly negative, while the impact of CIT is significant and positive, both in combination with PIT and standing alone. This finding is different from Arnold (2008), but coherent with Baiardi *et al.* (2018). The non detrimental impact of an increase in CIT is not surprising, given that its rate has declined significantly over the years. On the contrary, personal income taxes are, with few exceptions, already very high in many countries. The model presented in column 3 of *Table 2* finds a positive correlation between consumption & property taxes and output growth. According to model (4), and confirmed by alternative specifications, an increase in consumption taxes has a positive impact on economic performance, contrary to taxes on property. However, when looking in more detail at property taxes Model (5) suggests a negative link between property taxes and growth.

With a focus on VAT and environmental taxes, *Tables 2* reports in columns 6 and 7 that their link to output-growth tends to be positive in the long–run, though the coefficient stays at low statistical significance. This finding is supported by Meyermans et al. (2020) who show that output increases if shifts in environmental taxes are being compensated by lowering income taxes. Yet, this last finding should be interpreted with caution, giving that environmental taxes in the EU are still relatively low. It is yet to be seen how economies will react as governments make more substantial use of environmental taxes.

Table 2: Taxation structure and growth – ECM: Long-term parameters, EU27, 1995-2019

Estimating equation (3): **Part 1: Long-term parameters**	**Dep. variable: Δlog GDP per capita**						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Convergence Parameter φ	-0.417***	-0.413***	-0.417***	-0.156**	-0.309***	-0.41***	-0.11*
	(0.0532)	(0.0628)	(0.0532)	(0.0599)	(0.069)	(0.052)	(0.051)
log Physical Capital	0.212***	0.160***	0.212***	0.173***	0.345***	0.18***	0.11
	(0.0344)	(0.0305)	(0.0345)	(0.0436)	(0.037)	(0.037)	(0.080)
log Human Capital	0.168	0.282*	0.167	5.560***	2.183***	0.34*	6.89***
	(0.1486)	(0.1351)	(0.1487)	(0.4109)	(0.223)	(0.17)	(0.69)
Population growth	-0.0247***	-0.0144*	-0.0245***	0.0157*	0.004	-0.017*	0.0096
	(0.0072)	(0.0059)	(0.0072)	(0.0068)	(0.006)	(0.0074)	(0.015)

Table 3 (continued)

Estimating equation (3): **Part 1: Long-term parameters**	**Dep. variable: Δlog GDP per capita**						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Overall Tax Burden	0.00056	-0.000764	0.000519	-0.0187***	-0.013***	0.0025	-0.016**
	(0.0024)	(0.0018)	(0.0024)	(0.004)	(0.003)	(0.0025)	(0.0057)
Income Taxes	-0.00684**						
	(0.0021)						
Personal Income Taxes		-0.00583***					
		(0.0018)					
Corporate Income Taxes		0.00215					
		(0.0025)					
Consumption Property Taxes			0.00683**				
			(0.0021)				
Consumption Taxes				0.00526*			
				(0.0026)			
Property Taxes				-0.0964***			
				(0.0123)			
Recurrenent Property Taxes					-0.181***		
					(0.024)		
Other Property Taxes					-0.118***		
					(0.016)		
Environmental Taxes						0.013*	
						(0.0054)	
VAT							0.0062
							(0.0057)
Constant	3.959***	3.815***	3.676***	-0.437**	1.478***	3.52***	-0.65*
	(0.4976)	(0.5703)	(0.4613)	(0.1658)	(0.334)	(0.43)	(0.31)
Observations	621	621	621	621	621	621	616
Country dummies	yes	yes	yes	yes	yes	yes	yes
Time dummies (5y-periods)	yes	yes	yes	yes	yes	yes	yes
Revenue–neutrality through adjusting..	Cons. & Prop. Taxes	Cons. & Prop. Taxes	Income Taxes	Income Taxes	Income & Cons. Taxes	Income & Other Cons. & Property Taxes	Income & Other Cons. & Property Taxes

Note: standard errors in parentheses. *significant at 10%; **significant at 5%; ***significant at 1%.
Dependent variable: annual change (in the logarithm) of real GDP per capita, measured as per-capita GDP at constant prices, corrected for purchasing power parities.

Short-term impact of tax instruments

Table 3 suggests that in the short run, a change in taxation has no significant impact on per-capita GDP. This finding is consistent with those presented by Baiardi *et al.* (2018). The only significant correlation is given by the negative parameter of consumption & property taxes, though this is no longer significant when disaggregating the two (models 4 and 5).

Table 3. Taxation structure and growth – ECM: Short-term parameters, EU27, 1995-2019

Estimating equation (3): Part 2: Short-term parameters	**Dep. variable: Δlog GDP per capita**						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Δ log Physical Capital	0.140***	0.115***	0.140***	0.165***	0.066*	0.15***	0.18***
	(0.0398)	(0.033)	(0.0398)	(0.0405)	(0.038)	(0.037)	(0.043)
Δ log Human Capital	0.137	0.187	0.136	-0.325	-0.398	-0.059	-0.58
	(0.8622)	(0.8291)	(0.8621)	(0.6801)	(0.452)	(0.78)	(0.54)
Δ Population growth	0.00679*	0.00809*	0.00675*	-0.004	-0.001	0.0063	-0.0028
	(0.0033)	(0.0038)	(0.0033)	(0.0042)	(0.006)	(0.0039)	(0.0037)
Δ Overall Tax Burden	-0.00115	-0.00464	-0.00115	-0.00137	-0.003	-0.0020	0.00022
	(0.0026)	(0.0031)	(0.0026)	(0.0034)	(0.004)	(0.0027)	(0.0036)
Δ Income Taxes	0.00469*						
	(0.0018)						
Δ Personal Income Taxes		0.00155					
		(0.0021)					
Δ Personal Income Taxes		0.00979**					
		(0.003)					
Δ Consumption & Property Taxes			-0.00470**				
			(0.0018)				
Δ Consumption Taxes				-0.00358			
				(0.0024)			
Δ Property Taxes				-0.0144			
				(0.0102)			
Δ Recurrent Property Taxes					-0.14***		
					(0.051)		
Δ Other Property Taxes					0.011		
					(0.015)		
Δ Environmental Taxes						-0.0068	
						(0.0040)	
Δ VAT							-0.0028
							(0.0032)

Note: standard errors in parentheses. *significant at 10%; **significant at 5%; ***significant at 1%.
Dependent variable: annual change (in the logarithm) of real GDP per capita, measured as per-capita GDP at 2010 constant prices, corrected for purchasing power parities.

4. Supplementary model-based evidence

We employ the Commission's Labour Market Model (LMM)[17], a computable general equilibrium model with particular focus on the labour market. The aim is to find additional support for our hypothesis that re-structuring the shift of taxation away from labour will support economic growth, as suggested by the above econometric analysis.

The policy-shock introduced in LMM is shift of taxation away from labour towards VAT in Germany.[18] The assumed policy volume is the equivalent of 0.5% of GDP. Two ways of reducing labour taxation are being modelled:

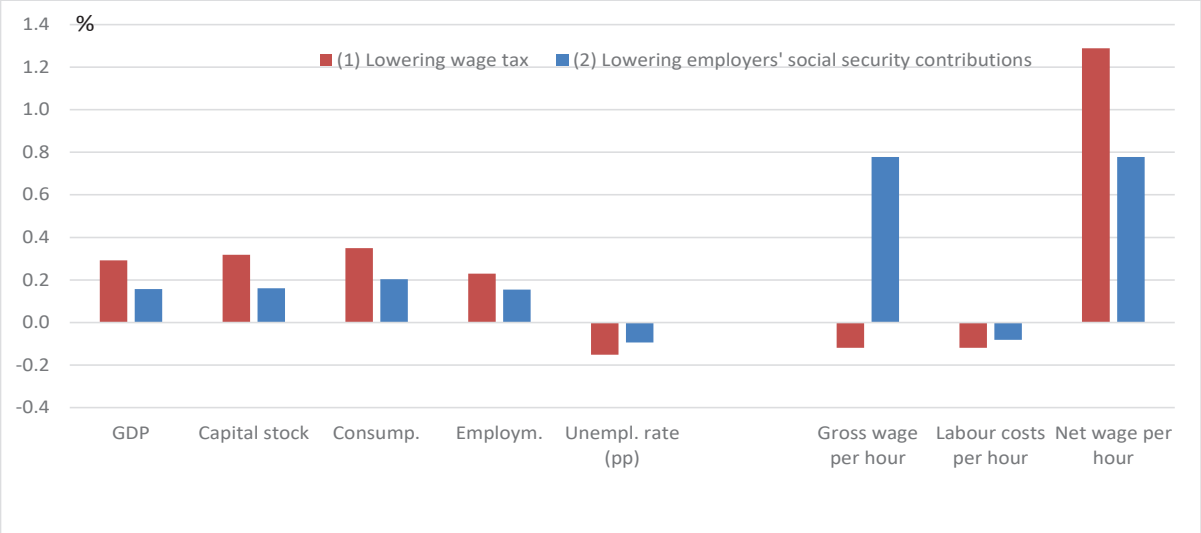
(1) Targeting labour supply: a reduction of wage taxes for employees;

[17] The model was developed for the Commission, DG Employment, Social Affairs and Inclusion. See Berger et al. (2009).
[18] Germany is taken here as an example. LMM currently supports 15 Member States.

(2) Targeting labour demand: a reduction of labour cost through lowering employers' social security contributions.

The analysis is comparative-static in the sense that the initial (pre-shock) steady state equilibrium is compared with the long-term equilibrium established after the policy measure.[19]

Chart 4. Model simulation – lowering labour taxes in Germany by 0.5% of GDP, long-term impact (% increase relative to the long-term initial steady state)



Source: Authors' analysis using the Commission's Labour Market Model

(1) The **subsidy on their wages** increases workers' take-home pay, so that their incentive to bargain hard on higher wages decreases somewhat. The (gross) wage level thus declines a bit while net wages are pushed pronouncedly due to the subsidy, incentivising workers to not stay idle but participate in the labour market. As a result, employment goes up, unemployment declines. Firms equip the new workers with capital, so that the capital stock increases due to accelerated physical investment. With employment and capital going up, so does output. GDP increases by 0.3% in the long run, relative to the initial steady state.

(2) In the case **of reduced employers' social security contributions**, firms are incentivised to hire more workers and/or to keep workers who otherwise would have been dismissed. Stronger labour demand drives (gross and net) wage levels up. However, even with the level of wages up, *total* labour cost will go down due to the subsidy on employers' social security contributions. Labour supply also increases due to higher labour participation as a result of higher net wages. Given stronger labour demand and supply, employment increases. Firms invest more in order to supply the additional workers with capital. Higher

[19] Note that this is a simulation for demonstration purpose only. We do not intend to suggest that Germany adjust their tax mix.

employment and more capital will push GDP by 0.2%, compared with the initial steady state.

Shifting taxes away from labour, be it through labour supply and demand-focussed support, results in higher employment, higher investment and higher GDP. The model simulation thus confirms the conclusions from the econometric analysis.

5. Conclusions

Under the condition of revenue neutrality, the findings of our econometric analysis, summarised in *Table 4,* provide support to the idea of shifting taxes way from labour and towards consumption through the following evidences:

- Notably, a reduction of share of personal income taxes in total tax revenue is positively associated with higher output growth in the long term. A simulation with a general-equilibrium labour market model confirms this finding: both a reduction of wage taxes (in favour of employees) and lowering of labour cost (for employers) while increasing VAT lead to higher output, more investment and more jobs;
- Contrary to that, an increase in the share of corporate taxes in the total tax mix does not appear to have a negative effect on long-term growth;
- The effect of a shift towards property taxes on growth is not meeting our theoretical expectation. An increase in property taxes impacts negatively on GDP in the long-term;
- A reduction in the overall tax burden would enhance long-term growth;
- In the short term, the tax mix has no significant impact on growth.

Table 4. Summary: Taxation shift and growth in GDP per capita: steady state relationships

Increasing Taxes on	Impact on Growth
Overall Tax Burden	-
Personal Income Taxes	-
Corporate Income Taxes	+/non significant
Consumption Taxes	+
Environment Taxes	+
Recurrent Property Taxes	-
Other Property Taxes	-

Our findings support calls for decreasing labour taxation while increasing consumption and environmental taxes. However, further research is needed. Our work applies usual macroeconomic techniques which are typical for research in the field. To better understand how firms react to changing taxation patters, it may be useful to complement the analysis by exploiting firm-level data. Finally, the relationship between the tax mix and inequality is still largely unexplored, although highly relevant.

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Annex

Table A1. Taxation shift toward Corporate Income taxes – GDP at constant prices (not corrected for purchasing power parities)

Estimating equation (3): Long-term parameters	**Dep. variable: Δlog GDP per capita**	
	(1)	(2)
Convergence Parameter φ	-0.100***	-0.131***
	(0.0202)	(0.0216)
log Physical Capital	0.211**	0.263***
	(0.0809)	(0.0692)
log Human Capital	0.104	0.635*
	(0.425)	(0.298)
Population growth	-0.0811***	-0.0719***
	(0.0169)	(0.0137)
Overall Tax Burden	-0.0340***	-0.0252***
	(0.00694)	(0.00532)
Personal Income Taxes	-0.0160**	
	(0.00593)	
Corporate Income Taxes	0.0939***	0.0786***
	(0.0101)	(0.00686)
Observations	621	621
Revenue–neutrality through adjusting..	Cons. & Prop. Taxes	Income & Cons. & Prop. Taxes
Country dummies	yes	yes
Time dummies (5y-periods)	yes	yes
Including constant	yes	yes

Note: standard errors in parentheses. *significant at 10%; **significant at 5%; ***significant at 1%.
Dependent variable: annual change (in the logarithm) of real GDP per capita, measured as per-capita GDP at 2010 constant prices.