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Convergence of Tax Mixes in 29 OECD Countries, 1980-2018

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Abstract

It has been argued in economic and political science literature that countries' divergent tax mixes will be increasingly under strain as a result of labour-capital tax arbitrage. Falling corporate rates, resulting from international competition on the taxation of above-normal returns to capital, would increase the efficiency costs of high statutory personal income tax rates, fostering the convergence of tax systems towards low-rate systems relying to an increasing extent on other revenue streams, such as social security contributions and VAT. In order to test this hypothesis, this study presents several convergence tests in a panel of 29 OECD countries between 1980 and 2018, using top statutory personal and corporate tax rates and revenue data of various tax categories as tax system indicators. Additionally, the relation between statutory corporate and personal income tax rates is estimated in a linear model controlling for several domestic institutional factors. The analyses are repeated in sub-sets of the panel reflecting groups of homogeneous tax systems, which are determined using statistical cluster analysis. The results are mixed. A declining corporate income tax rate appears to be related to some decline in the personal income tax rate, but the effect diminishes in systems where the personal income tax is a relatively important component of the tax mix. Revenues of general consumption taxes and social security contributions converge upwards, although most of this convergence has taken place during the global tax reform wave between 1980 and 1995. The panel-wide revenue average of personal income taxes declines until 2010, but slightly rises since then. The observed effects in the various tax regime clusters differ significantly.

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Keywords: convergence, tax mix, tax competition

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1. Introduction

A large literature has studied international convergence of social policy in developed countries by looking at many different welfare state indicators. Contrary to theoretical predictions of a 'social race to the bottom' resulting from worldwide or EU economic integration (e.g. Sinn, 2003), many studies find a constant or slightly rising trend in social expenditures with a catch-up of previously tight welfare states, and overall convergence in several indicators (e.g. Caminada et al., 2010; Starke et al., 2008). With public social expenditures being financed primarily by tax revenues (topped with debt financing), is it not surprising that tax-to-GDP ratios in OECD countries have followed a similar trend in the recent decades (see: OECD, 2019). However, national tax systems differ in many aspects, such as the composition of the tax mix and the height of statutory rates. The convergence of these tax system indicators has received considerably less attention in the literature.

This is remarkable, given the lively debate that is present since the onset of economic globalization in the 1980s about the extent to which governments are forced to compete for mobile tax bases. Although an extensive literature addresses the effects of international economic integration on tax systems, the research scope of most existing papers is limited: some scholars investigate tax rate convergence or a 'race to the bottom' in one specific tax at the time (e.g. Franzese & Hays, 2007; Plümper et al., 2009; Regis et al., 2015), while others focus solely on the broad categories of capital or labour tax burdens (e.g. Bretschger & Hettich, 2002; Schwarz, 2007). A recent contribution by Delgado & Presno (2017) does analyse convergence in multiple tax categories, using a "convergence club" approach identifying convergence into several sub-groups or clubs of countries.

The approach of the present study is threefold. Firstly, this study presents σ- and β-convergence tests of tax systems in a panel of 29 OECD countries between 1980 and 2018; σ-convergence tests measure the change in cross-sectional dispersion and β-convergence tests determine the presence of a catch-up effect. The tests are based on revenue data of categories of taxes (including social security contributions) as a percentage of GDP and as a share of the tax mix, and on statutory rates.

Secondly, this study provides an identification of distinct types of tax regimes using cluster analysis in base years 1995 through 1999. While not aimed at constructing a detailed typology of systems, this cluster analysis is used to control for existing differences between countries when performing the convergence tests. Contrary to the approach of Delgado & Presno (2017), performing cluster analysis *ex ante* makes it possible to determine whether

certain tax regimes converge quicker than others and whether they converge towards each other, thus showing whether distinct regime types persist. Δ-convergence tests are conducted to measure any change in the distance between the defined clusters (cf. Heichel et al., 2005).

Thirdly, building on the work of Ganghof (2006; 2008) and Ganghof & Genschel (2008), this study analyses one possible driving factor behind tax system convergence, namely international capital tax competition undermining the so-called backstop function of the corporate income tax. As corporate taxation prevents companies to be used as tax shelters for personal income (Gordon & Slemrod, 2000; Gordon & MacKie-Mason, 1995; Slemrod, 2004), Ganghof and Genschel hypothesise that falling corporate tax rates as a result of international competition make it more attractive to engage in tax arbitrage between labour income and capital income. This would increase the efficiency costs of high personal income tax rates, forcing governments to adjust those downwards. The process would lead to pressure on nations levying high marginal personal income tax rates to reduce the tax rate gap with corporate income taxes, which may force these countries to shift their tax mix from personal income taxation towards other revenue streams. Ganghof (2008) finds preliminary evidence for a spill-over effect from corporate to personal income tax rates, using a one-year cross-sectional regression analysis. The present study aims to improve the analysis using panel data for 29 OECD countries since 1995 in a fixed-effects regression, estimating a model controlling for additional variables that capture political and economic differences between countries.

The outline of this paper is as follows. Section 2 reviews the existing economic and political science literature on how international tax competition and domestic institutions influence national tax mixes. From this literature follow three testable hypotheses about the extent to which tax competition causes tax mixes to converge. The section also presents some tax mix data for OECD countries, visualising trends in the recent decades. Cluster analyses and tests of σ-, β- and δ-convergence of tax mixes will be conducted in section 3. Section 4 contains the regression analysis of the spill-over hypothesis. Some concluding remarks will be made in section 5, together with suggestions for further research.

2. Theory

2.1 Globalisation-induced convergence

When tax systems evolve under economic closure, divergence is expected to occur insofar domestic policy preferences regarding taxation differ internationally. This economic closure existed in the post-war era up until the early 1980s, when trade barriers and capital controls

limited international transactions and tax-base mobility (Genschel, 2002; cf. Bretschger & Hettich, 2002). Not only were there many differences between tax systems on the micro level with every country having a unique total of exemptions, deductions, investment credits and tax holidays that were specifically tailored to the national economy, countries' tax mixes on the macro level also showed a diverging trend. These differences could partially be attributed to the rise of different 'worlds of welfare capitalism' (cf. Esping-Andersen, 1990): in many social-democratic countries, for instance, the personal income tax developed into a major revenue source, while in conservative/corporatist countries the income tax merely served as a progressivity adjustment to a welfare system that was mostly built on regressive social security contributions (Esping-Andersen, 2006; Ganghof, 2006; 2008).

The well-known baseline model of tax competition, on the other hand, predicts that economic openness triggers countries to enact policies attracting mobile tax bases (cf. Zodrow & Mieszkowski, 1986). Positively depending on the openness of their economies, countries would reduce their taxes on mobile capital (especially corporate income), which would hurt total tax revenues and/or lead to a raise in tax burdens on immobile factors (mostly labour). Given that countries engage in the same downward trend in capital taxes and that tax policy setting is no longer solely a matter of domestic policy preferences, one would expect a convergence – or at least a diminution of divergence – of tax systems.

The academic debate on this model of tax competition has arisen in the 1980s and early 1990s, when the basis had been created for increasing globalisation: the removal of trade barriers and the emergence of information technology fostered the international mobility of labour, capital, goods and services (Genschel & Schwartz, 2011).

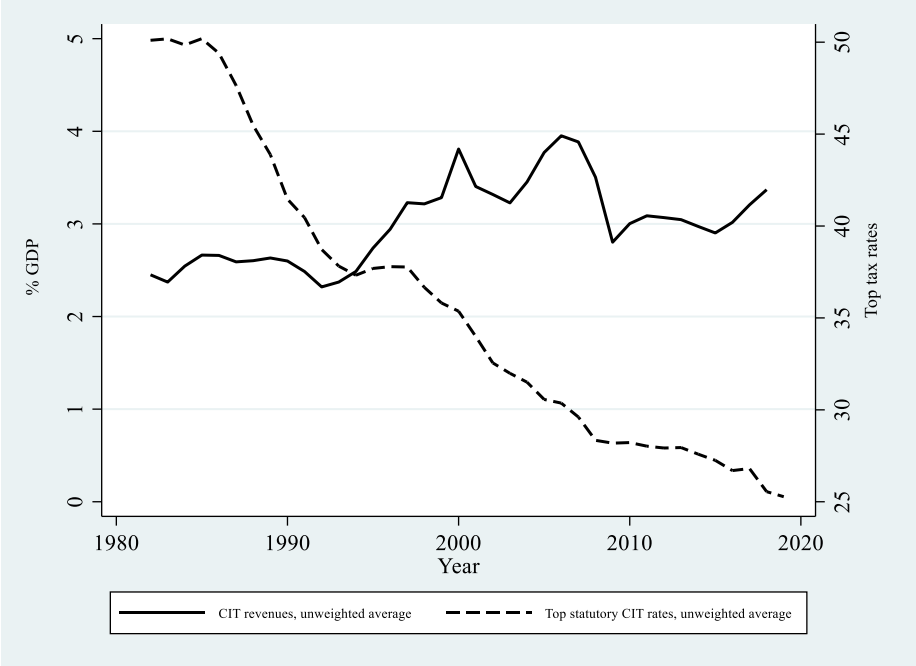
In these decades, a global wave of tax reforms occurred in which countries lowered their statutory tax rates on both labour and capital (especially corporate) income, reduced the number of tax brackets, and curtailed tax instrumentalism by scaling back micro-manipulations of the economy in the form of tax credits, allowances and exemptions (Swank, 2016). The result of this reform wave was certainly not a full convergence of tax systems (Ganghof, 2006). International differences in the size of the tax/welfare states persisted, and different reform models developed. New Zealand, for instance, broadened its tax bases and strove for neutrality in taxation of different types of income by setting both the personal and corporate income tax rate at 33% (see: White, 2009). Ireland kept its bases narrow while lowering rates, and expanded tax incentives aimed at specific economic activities (see: Christensen, 2013). The Nordic countries implemented versions of the dual income tax model, according to which capital income is taxed at a uniform low and proportional rate while labour income is subjected to a

higher and progressive rate schedule (see: Sørensen, 1994). Nevertheless, virtually all reforms yielded significant cuts in tax rates (e.g. Swank, 2008).

As illustrated in figure 2.1 from the year 1981 onwards, the trend towards lower corporate income tax rates has continued ever since. The fall in tax rates has been conditional to country size since the 1990s, with smaller countries having enacted deeper cuts (Ganghof, 2008: 84). This suggests that tax policy is shaped by globalisation-induced competition, because especially small countries have an incentive to lower tax rates: the revenue losses from their domestic tax bases are relatively small in comparison to the revenue gains from the inflow of foreign tax bases (cf. Bucovetsky, 1991; Kanbur & Keen, 1993; Wilson, 1991). Many empirical studies have indeed provided evidence linking the downward trend in tax rates with measures of economic openness (e.g. Devereux et al., 2008; Slemrod, 2004; Winner, 2005). Some scholars additionally stress the importance of strategic interaction with competitor nations (e.g. Basinger & Hallerberg, 2004; Devereux et al., 2008), or argue that nations respond to moves of the U.S. as a tax reform leader (Altshuler & Goodspeed, 2015; Swank, 2006; 2016).

On the other hand, corporate income tax revenues expressed as a percentage of GDP have remained relatively stable both during and ever since the tax reforms, and there has been no deterioration of total tax revenues (cf. OECD, 2019) – figures 2.1 and 2.2 illustrate these statements. Moreover, the evidence on the supposed increase of the labour-capital tax ratio as a result of globalisation is inconclusive (Genschel & Schwarz, 2011). This calls into question whether tax systems will actually converge as a result of international tax competition.

Figure 2.1. Averages of corporate income tax rates and revenues in a panel of 22 OECD countries, excluding Central and Eastern European (CEE) countries



Source: OECD (2019). Note: for reasons of data availability, seven OECD countries are not included, namely Chile, Israel, South Korea, Lithuania, Mexico, Switzerland and Turkey. CEE countries, for which data are available only from the mid-1990s onwards, are excluded from this graph for the sake of comparability through time; these include the Czech Republic, Estonia, Hungary, Latvia, Poland, Slovenia and the Slovak Republic.

Figure 2.2. Averages of total tax revenues in a panel of 22 OECD countries, excluding CEE countries

Tax revenues retrieved from OECD (2019); GDP data retrieved from the World Bank Data Catalogue. Note: for reasons of data availability, seven OECD countries are not included, namely Chile, Israel, South Korea, Lithuania, Mexico, Switzerland and Turkey. CEE countries (countries in Central and Eastern Europe), for which data are available only from the mid-1990s onwards, are excluded from this graph for the sake of comparability through time; these include the Czech Republic, Estonia, Hungary, Latvia, Poland, Slovenia and the Slovak Republic.

2.2 Mediating effect of institutions

Studies in the political science literature, however, have contributed to the baseline models of tax competition by showing that domestic political and economic institutions may significantly affect tax policy outcomes and alter countries' tax policy reactions under competitive pressure. According to this literature, tax competition may affect national systems, but dissimilarities in national institutions may still lead to divergence or mediate any convergence process.

One important factor that is acknowledged by most authors is domestic politics, with partisan politics and government ideology as its most visual components. Monitoring countries' policy reactions to the U.S. tax reform in 1986, Swank (2006) for instance finds that where right-wing parties have held a large share of cabinet portfolios, tax rates declined significantly steeper. Osterloh & Debus (2012) show that left-wing governments set higher corporate tax rates than right-wing governments, even under competitive pressure, although this effect declines in the course of the studied time period.

Relatedly, Basinger & Hallerberg (2004) find that "domestic politics mitigates the pressures for tax rates to convergence downward" because national governments face domestic costs to tax reform. These costs can arise as a result of veto players in the legislative process (such as opposition parties vis-à-vis a minority government or a powerful upper house) or as a result of electoral resistance. Electoral resistance to tax reforms is related to societal norms on fairness and redistribution; Plümper et al. (2009) show that these norms mitigate the reduction of the capital tax burden. Limberg (2019; 2020) suggests that fairness norms in society have been a contributing factor to the rise of top marginal income tax rates in some countries after the Great Recession. Driven by the electorate's wish for redistribution, states may expand their welfare system in order to protect their citizens from the risks associated with the openness of the economy (the 'compensation hypothesis'; see: Rodrik, 1998; Walter, 2010), thus increasing the need for tax revenues and making it harder to reduce taxes on capital or corporate income.

Besides these ideological factors that deliver input to the policy making process, a relevant factor is the design of the process itself. Hays (2003), for instance, finds that the labour-capital tax ratio is somewhat higher in consensus democracies than in majoritarian systems. He argues that the proportional-representation electoral institutions in consensus democracies lead to broad coalitions including right-wing parties, keeping capital taxes relatively low. In majoritarian systems, instead, the median voter (being a worker with more labour income than capital income) is more influential for government composition and may therefore push taxes on capital to their revenue-maximising level. Illustrative is the development of the dual income tax model, taxing most returns to capital at much lower rates than labour, in social democratic

countries being consensus democracies. Conversely, the countries that strove for more equal taxation of labour and capital in their tax reforms in the 1980s were market-liberal countries with majoritarian electoral systems (see Ganghof, 2006, for an elaborate overview of these reforms; cf. Esping-Andersen, 1990).

According to Swank (2002; 2006; 2008), these systems of electoral-party interest representation may also affect the extent to which countries react to globalisation by retrenching the tax/welfare state. Swank (2002) argues that proportional-representation systems, as well as social-corporatist interest representation, centralised political authority and universal welfare systems, contribute to the representation of pro-welfare and higher-taxation interests in policy making. This would lead to divergence in the size of welfare/tax-states, with retrenchment as a result of globalisation mainly occurring in previously tight welfare states with decentralised decision making and majoritarian electoral systems.

This theory is congruent with the literature describing varieties of democratic capitalism, which on the one hand defines a more coordinated type of market economy with a large government, a generous welfare state and coordinated bargaining, and a liberal type of market economy having a tighter welfare state and competitive market arrangements on the other (see: Hall & Soskice, 2001). Using a resembling dichotomy, Garrett (1998) argues that coordinated economies with social democratic governments and a large tax/welfare state can be as efficient as liberal market economies. Boix (1998: 52) argues that high-tax nations may retain or attract capital through supply-side economic strategies, including direct investment in fixed capital, human capital formation through education, provision of production inputs through public firms, or stimulation of private capital accumulation.

Swank (2016) theorises that such coordinated market economies may face higher costs and lower benefits than liberal market economies when they enact "neo-liberal" reform packages – defined by him as lowering tax rates, reducing the number of brackets, shifting the emphasis from equity towards efficiency by curtailing the use of tax policy to accomplish collective goals, and scaling back economic micro-manipulations in the form of tax credits, allowances and exemptions. Coordinated market economies, according to Swank, may face economic costs of reform, for instance because their ability to implement capital-increasing supply-side strategies diminishes when tax revenues decrease. They may also face political costs, as both labour and capital have an interest in retaining the abovementioned benefits of the high-tax system. Therefore, Swank argues and finds that neo-liberal tax reforms should be more likely to occur in liberal market economies, although all nations have moved somewhat closer to the neoliberal model.

2.3 Interpretations of the tax reform wave in the 1980s

Describing many possible reasons why tax systems may diverge even under competitive pressure, these institutionalist theories do not explain why virtually all developed countries, including social democratic nations (cf. Esping-Andersen, 1990) – or put more broadly: coordinated market economies (cf. Hall & Soskice, 2001) – lowered marginal rates and broadened tax bases so radically and in such a short period of time since the late 1980s (cf. Tanzi, 1995). Understanding the driving forces behind these reforms is important when making predictions about whether tax systems should continue to develop in a 'neo-liberal' direction. Were the reforms the result of a one-off shift in political views, or was tax competition the main contributing factor – a factor that is still present today? An interesting debate about the answer to this question occurred in the 2000s between Steinmo (2003) and Ganghof (2006; 2008).

Steinmo argues that the base-broadening and rate-cutting reforms were the result of policy learning: they were a common reaction by governments to their negative experiences with the inefficient existing tax policies in the 1970s through 1990s. At the time, top marginal tax rates were high and tax legislation included numerous complicated tax expenditures and other incentive mechanisms in order to affect investment in certain sectors, regions and companies, as well as to achieve socio-economic goals like income equality. The multitude of provisions caused widespread tax arbitrage and a high degree of economic inefficiency (Ganghof, 2006; cf. Gordon & Slemrod, 1988).

According to Steinmo, policymakers on both sides of the ideological spectrum contributed to implementing these provisions, and both eventually were disillusioned with the results of state intervention (see: Williams, 1991: 24, and Sandford, 1993: 20, as cited in Steinmo, 2003). Thus, Steinmo argues, the tax reforms were not part of an ideological shift to the right, but the result of a growing consensus that labour and capital should be taxed at more market-conforming rates and that there was less room for the state to interfere in the economy using base-narrowing tax expenditures. Analysing the arguments of policy making elites, Steinmo also argues that globalisation has played at most a limited role: it was a "bogey-man (…) provid[ing] a powerful justification for tax policies which tax economists and tax policy advisers had long wanted to make" instead of the main cause of the reforms (Steinmo, 2003: 230).

Ganghof (2006; 2008) also builds upon the concept of policy learning, acknowledging the dissatisfaction of policy makers with the many system inefficiencies. However, he disagrees about the supposed shift from equity towards efficiency or market-conformity. Instead,

Ganghof interprets the reform wave in the 1980s as a quest for a more efficient hybrid between two 'ideal-types' of taxation, namely comprehensive income taxation and expenditure taxation, and argues that tax competition played a crucial role in the eventual outcome of the reforms.

Expenditure taxation uses consumption as a measure of someone's ability to pay (see: Fisher, 1937; Kaldor, 1955). Its tax base includes all labour income, as well as above-normal returns to capital (i.e. the risk-free return plus a premium that for instance rewards risk-taking, innovation, or a monopoly position). Normal returns to capital are exempted: those are the risk-free returns to deferring consumption which compensate for inflation and hence do not increase someone's ability to consume. Comprehensive income taxation, on the other hand, is based on the Schanz-Haig-Simons income definition (Schanz, 1896; Haig, 1921; Simons, 1938), which includes all inflows of resources, whether they originate from labour income or from past savings, and whether they are spent or saved. Its tax base thus includes labour income and all returns to capital, including the risk-free return, and taxes them at the same rate.

All tax systems, before as well as after the tax reform wave in the 1980s, have contained elements of both expenditure taxation and comprehensive income taxation. Some countries may for instance levy taxes on financial capital, or wealth in general, regardless of the returns to this capital; consequently, low normal returns are taxed more severely than high above-normal returns, contravening the ideal-type of expenditure taxation. The same country might exempt the rents from owner-occupied dwellings or allow for generous tax deductions of interest payments; this would exempt most of the returns to real estate, conflicting with both the Schanz-Haig-Simons and Fisher-Kaldor definitions of ability-to-pay. Besides taxing sources of capital income dissimilarly, many countries apply higher and progressive rates for labour income. This again violates the principle of comprehensive income taxation.

It is not surprising that countries do not make a clear-cut choice between the two ideal types. Firstly, as Ganghof argues, taxing some specific forms of capital income is politically sensitive; examples could include inheritances or the returns to owner-occupied housing.[1] Secondly, optimal taxation theory and empirics are inconclusive about which ideal-type is the most efficient one. Policymakers striving for economically neutral, non-distorting taxation may, on the one hand, choose an expenditure tax for the reason that taxing normal returns distorts saving and investment decisions while taxing above-normal returns does not. On the other hand, exempting normal returns will necessitate higher rates on above-normal returns and/or wages given a certain revenue requirement, which reduce entrepreneurial risk-taking and labour

[1] See for instance Hammar et al, 2008, for a public opinion analysis in Sweden

supply. Thirdly, economic theory suggests that it is efficient to differentiate the tax treatment of various forms of capital income, in order to correct inefficient behaviour (such as people saving save too little for their pensions – see Bernheim & Scholz, 1993), make use of positive externalities (for instance by incentivising investments in research and development – see Becker, 2015; Djankov et al., 2010), or account for elasticities of tax bases (cf. Ramsey, 1927).

Ganghof therefore argues that the micro-management of the economy through tax systems until the 1980s was not only the result of governments' equity considerations and willingness to influence taxpayer behaviour, but also a reaction to economic and political constraints. He calls into question the statement that the base-broadening and rate-cutting tax reforms were part of a shift towards efficient taxation, as differentiation of tax burdens may in fact be necessary to increase efficiency. Moreover, the question of tax rate setting is independent from the question of tax differentiation: when reforming the tax system to make it more efficient, a low tax rate is a political choice instead of a necessary condition. Ganghof illustrates his point mentioning the dual income tax that existed in Italy between 1999 and 2004, which taxed all normal returns to capital at a low but non-zero rate, and above-normal profits and labour at a high rate; the system was a hybrid between expenditure taxation and comprehensive income taxation which minimised distortions while maintaining high marginal rates (cf. Bordignon et al., 2001).

Thus, Ganghof concludes that the actual cause of the deep cuts in tax rates in the 1980s and 1990s was international competitive pressure on the taxation of capital. Specifically, he points towards the taxation of above-normal profits. These play an important role in tax competition, because foreign direct investments are usually made in the prospect of high profitability. This view finds support in the literature. A majority of studies find that foreign direct investment is negatively affected by taxation (Genschel & Schwarz, 2011). As argued by Bond (2000: 172–173), the European Commission (2001: 8) and Ganghof (2006; 2008), cutting statutory corporate tax rates while broadening the tax base is a logical strategy for countries competing on the taxation of above-normal profits. This is because the effective tax rate on investments depends to an increasing extent on the top rate and to a decreasing extent on the tax base as profits rise. Additionally, tax rates may serve as a signal of an investment-friendly business climate. Once profitable investments have been made, low-tax and broad-base regimes also provide some protection against outward profit-shifting as they limit the tax-rate differential with tax havens, whereas in high-tax and narrow-base regimes, companies have the incentive to shift any taxable profit outwards (Genschel & Schwarz, 2011). Many studies confirm that statutory corporate tax rate setting is an important instrument in international

competition for investment (e.g. Devereux et al., 2008; Rincke & Overesch, 2011) and that companies' location decisions are sensitive to it (e.g. Büttner & Ruf, 2007).

2.4 Summary and effects on the tax mix

In sum, there seems to be a broad agreement in the literature that international tax competition should continue to cause a downward trend in statutory corporate tax rates, although the extent to which this trend is converging may depend on countries' domestic institutions. There is no conclusive evidence about any effect of tax competition on corporate tax revenues. Judging from the large institutionalist literature, total tax revenues are also not likely to converge, as political institutions and the structure of the market economy seem to be more determinant for the size of the tax/welfare state than downward pressure on statutory corporate rates.

From the arguments of Ganghof (2006; 2008) and Ganghof & Genschel (2008), however, follows that tax mixes are likely to converge. This is because the corporate income tax has an important backstop function: it helps to prevent corporate entities from being used as a tax shelter for personal income (e.g. De Mooij & Nicodème, 2008; Slemrod, 2004). As Ganghof and Genschel argue, a downward trend in corporate tax rates undermines this backstop function, because a growing gap between the corporate and personal rates makes it more attractive to engage in tax arbitrage by reclassifying labour income as capital income. An obvious example of such arbitrage is the incorporation of sole proprietorships (cf. Pirttilä & Selin, 2011), but anecdotal evidence from Norway telling that corporations were used by celebrities to acquire most of their labour income from show business as capital income (Christiansen, 2004) makes clear that the phenomenon ranges wider than small businesses. It has indeed been shown empirically that capital-labour tax arbitrage is existent and significant (De Mooij & Nicodème, 2008). Christiansen & Tuomala (2008) show that as a result, the efficiency costs of high marginal personal income tax rates increase.

Contrary to the corporate tax rate being an important instrument in tax competition, the personal income tax rate is still presumed by many scholars to be a matter of national policy preferences. Recent evidence for instance suggests that fairness norms in society have been a contributing factor to the rise of top marginal income tax rates after the Great Recession (Limberg, 2019; 2020). The question remains therefore to what extent any downward pressure on rate schedules will actually result in lower rates and revenues of the personal income tax.

This does not only depend on the width of the tax rate gap, but also on the existing tax mix. Ganghof (2006) notes that in some continental European countries, the income tax is a relatively small revenue source alongside high social security contributions, so that the top

marginal rate can be reduced without large budgetary consequences. In countries, however, where a large part of the taxation of labour is achieved through progressive personal income taxes of which the top rates set in at relatively low levels in the income distribution (for instance the Nordic countries, especially Denmark), a rate reduction would be much harder to achieve without seriously hurting total revenues. Insofar the latter group of countries wishes to maintain a large tax/welfare state, one would expect them to react to the raised efficiency costs of their tax systems by increasing taxes on labour that are less sensible to tax arbitrage, namely social security contributions and consumption taxes. Swank (2002: 257, footnote 14) similarly predicts that "a cumulative process of tax reform may produce less egalitarian tax structures in a large majority of developed nations in the not-so-distant future", related to a shift towards (relatively regressive) social security contributions. He links this process to a shift towards market-conforming (i.e. low-rate and broad-base; see p. 245) tax policy regimes.

Based on this literature, the following hypotheses are formulated:

Hypothesis 1. Countries experience a downward converging trend in personal income taxes and an upward converging trend in social security contributions and consumption taxes.

Hypothesis 2. There is a positive relation between top statutory personal income tax rates and corporate tax rates, so that a decline in the latter is associated with a decline in the former.

Hypothesis 3. Any positive relation between statutory personal and corporate tax rates is strengthened by a country's existing reliance on other revenue streams, such as social security contributions and consumption taxes.

3. Convergence tests

3.1 Research design

In order to test hypothesis 1, this section will present statistical tests of the convergence of countries' tax systems. Tests for β-, σ- and δ-convergence will be performed on a selection of taxation variables for a panel of 29 OECD countries between 1980 and 2018, as well as for several sub-groups and clusters of those countries.[2]

[2] The total panel of countries consists of: Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Germany, Spain, Estonia, France, Finland, Greece, Iceland, Ireland, Italy, Hungary, Japan, Latvia, Luxembourg, Netherlands, New Zealand, Norway, Poland, Portugal, Slovenia, the Slovak Republic, Sweden, the United

The selection of variables, intended to provide an adequate summary of tax systems within the limits of data availability and robustness, will be explained in paragraph 3.2. Paragraph 3.3 will justify the choice of several sub-groups and clusters in the analysis. The concepts of β-, σ- and δ-convergence will be explained in detail in paragraph 3.4. Paragraph 3.5 will present the results of the convergence tests.

3.2 Tax system indicator variables

The convergence analyses will be based on top statutory rates and tax revenues. Top rates are included in most empirical analyses of tax systems, and they are relevant in the present study for several reasons. As theorised in the literature, top rates are important instruments in tax competition by attracting or repelling highly profitable foreign direct investments and by incentivising profit shifting from one jurisdiction to another. They are also the main cause of tax arbitrage between labour income and capital income, which hypothetically leads to a decline in personal income taxation. Top rate data are retrieved from multiple sources, including the OECD Tax Database (OECD, 2019) and a dataset compiled by Piketty et al. (2014). The data reflect the combined rate of the central and sub-central government(s), taking into account any deductibility of sub-central taxes. Any surcharges and premiums that are integrated in the levy of personal income taxes are included insofar they are uncapped and thus affect the top marginal rate. Data availability varies per country; personal income tax rates for the entire panel are available from 1981 onwards, except for the Central and Eastern European (CEE) countries and Iceland; corporate tax rates are available from 1982, with the CEE countries, Iceland and Luxembourg missing until the 1990s. A detailed description and a complete list of data sources are provided in the data annex.

An obvious limitation of top rates as tax system indicators is that they are uninformative about the many provisions that constitute the tax base, and ignore the existence of multiple-rate systems. The literature has come up with several methodologies to design a variable that partly controls for these aspects. Scholars have for instance analysed measures of average effective taxation on certain types of income (e.g. Mendoza et al., 1994). These concepts, however, are still unable to capture all features of the tax base, as they disregard heterogeneity between taxpayers leading to differences in tax liability. This severely limits the international comparability of the concepts. Furthermore, the measures are not available for a wide range of

Kingdom, and the United States. For reasons of data availability, six OECD countries could not be included, namely Chile, Israel, South Korea, Lithuania, Mexico, Switzerland and Turkey.

countries and years. Indicators summarising the tax base are therefore not included in the present analysis.

Tax revenues, however, provide some indirect information about the tax bases, as revenues are the product of a tax rate and the base to which it is applied. Moreover, revenue data are the most reliable and internationally comparable measure of the tax burden (when expressed as a percentage of a country's GDP) and of the tax mix (when expressed as a percentage of total revenues). This is because revenue data on a certain category of taxation only need a simple definition indicating which tax objects fall into that category, unlike variables summarising the tax base which are based on arbitrary assumptions about heterogeneous tax subjects. The present analysis uses both revenue data expressed as a percentage of total revenues (thus describing the share of certain taxes in the tax mix) and revenue data expressed as a percentage of GDP (in order to control for the level of taxation). Data are retrieved from the OECD Revenue Statistics (OECD, 2019), which provide internationally comparable data in a common format for the years 1965 through 2018. The types of taxes included here are personal income taxes, corporate income taxes, social security contributions, payroll taxes, property taxes, specific consumption taxes, and general consumption taxes. Additionally, total tax revenues are included. The OECD revenue category numbers are provided in the data annex.

3.3 Sub-groups and clustering

The convergence tests are carried out on the entire data panel, as well as on sub-groups of this panel, which are intended to reflect groups of countries with similar characteristics. The first and largest sub-group consists of member states of the European Union (EU). The EU influences national tax policy in several ways: it for instance exerts significant power over countries' indirect taxes, and involves an internal market which may foster tax competition due to the mobility of production factors (e.g. Genschel et al., 2011; Sinn, 1990; 2003). This makes it useful to analyse the convergence between EU member states separately from non-EU OECD countries.[3]

[3] The EU sub-group consists of the abovementioned countries in the data panel, excluding Australia, Canada, Iceland, Japan, New Zealand, Norway, and the United States. European countries that have joined the EU (or the European Economic Community, its predecessor) after 1980 are regarded as a member state for the entire time period in the analysis.

In two other sub-groups, Western EU member states and (post-communist) CEE member states are analysed separately.[4] Not having a free market economy before the 1990s, the CEE countries were not subject to globalisation-induced tax competition for a significant part of the studied time period. Even in their post-communist years, there are caveats concerning their comparability with Western Europe given their lower level of development. One could for instance argue that the current trend towards low and flat-rate personal and corporate income taxation in some CEE countries should be interpreted as a signal of a business-friendly investment climate, which results from a need of capital (cf. Appel & Orenstein, 2013; Evans & Aligica, 2008; Ganghof, 2008; Sinn, 2003). This trend may cause a bias in the results of EU-wide convergence tests, which is removed by excluding the CEE countries.

Four other sub-groups are determined using statistical cluster analysis using a selection of tax system indicator variables averaged over the years 1995 through 1999. Cluster analysis is the use of an algorithm to group a series of cases in such a way that the similarity of cases within each group is maximised, as well as the distance between each group. The method is often used in social science to detect 'families of nations' or 'families of welfare states' showing strong internal homogeneity (e.g. Kangas, 1994; Obinger & Wagschal, 1998; Castles & Obinger, 2008). Similarly, the technique can be used in the study of tax systems to detect distinct families of tax systems (see Kellerman & Kammer, 2009; Peters, 1991). Peters, for example, studies tax system indicators in the year 1965 and finds, inter alia, a Southern-European cluster of countries relying strongly on social security contributions and a Scandinavian cluster with high personal income taxes and consumption taxes.

The aim of the present cluster analysis, however, is not to present a detailed taxonomy of tax systems congruent with the welfare state typologies of Esping-Andersen (1990) and others. Instead, the analysis is used to control for differences in national tax systems that arose in the major reforms of the 1980s and 1990s, with some countries equalling personal and corporate tax rates, for instance, and others implementing a dual income tax model – likely as a result of divergent national preferences and institutions. Cluster analysis captures these more or less homogeneous groups of tax systems, so that their development since the 1990s can be followed through time. It can for instance be shown whether countries that still levied high personal income taxes in the 1990s have since then experienced a relatively strong decline in

[4] The CEE countries in the data panel are: the Czech Republic, Estonia, Hungary, Latvia, Poland, Slovenia and the Slovak Republic. Lithuania, as an OECD member, was not included in the panel in the first place, for reasons of data availability. Other CEE countries are not member states of the OECD.

top rates and a convergence towards other clusters that rely to a larger extent on social security contributions.

The present analysis therefore differs from the "convergence club" approach used by Delgado & Presno (2017), which measures whether countries converge into separate clusters at the end of the studied time period, thus not controlling for system differences *ex ante*. Another difference from the approach of Delgado and Presno is that the algorithm in the present analysis is run using a broad selection of indicators summarising relevant aspects of the tax system, instead of identifying a new cluster division for every indicator separately.

The indicators used here include statutory top rates of personal and corporate income taxation, and revenues of personal income taxation, social security contributions, payroll taxation, property taxation and consumption taxation as a percentage of GDP and as a percentage of the tax mix. Additionally, the summed revenues of direct taxes on labour as a percentage of GDP, as well as total taxation as a percentage of GDP are included. A caveat of this selection is that it assigns relatively much weight to the categories of personal income taxation, social security contributions and payroll taxation, as those are taken into account both separately and in the sum of labour tax revenues. However, it is necessary to include all of these indicators in order to measure both the burden of labour taxation and the categories of taxes through which it is levied. Average values for the indicators over the years 1995 through 1999 are used in order to correct for outliers in specific years.

The analysis is performed using Ward's method. This clustering algorithm merges the two clusters whose merger causes the minimal change in within-cluster variance. The process starts with the individual observations and is continually repeated until there is one big cluster. The order of merging is visualised in a dendrogram: a family tree-like chart showing the hierarchical clustering order. The lower the point in the chart at which countries are linked, the earlier they have been merged as the more similar they are. Figure 3.1 shows the outcome of the algorithm, producing roughly three large clusters, respectively consisting of the English-speaking countries plus Denmark and Iceland, a large group of continental Western European countries plus Japan, and the CEE countries plus Portugal and Greece.

Cluster analysis is an explanatory method, so theoretical considerations should play an important role when deciding upon the resulting cluster division. This especially applies to the case of Denmark, which is an outlier in the data: it is unique for having almost the highest tax burden in the world, relying strongly on personal income taxation and having almost zero revenues from social security contributions. Bottom-up hierarchical clustering algorithms are sensitive for such outliers: they continually merge clusters with close-by observations, not

considering the position of observations that are further away, while those may optimally belong to one of the clusters. Therefore, outliers are sometimes classified as a separate cluster or assigned to the wrong cluster.

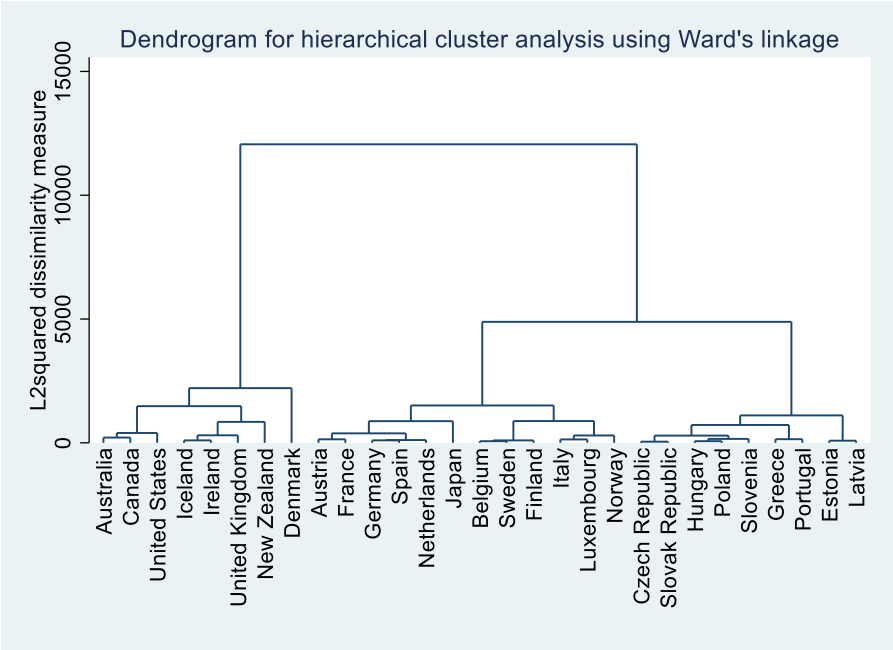
This appears to be the case with Denmark: its dual income tax system with high top rates supplemented by high VAT revenues has few similarities with the lower-tax systems in the English speaking countries and many similarities with the systems in Nordic countries. For the upcoming analysis, Denmark is therefore clustered with the Western European countries (cf. Kellerman & Kammer, 2009).

Within this Western European group, the algorithms show two or more sub-clusters. There are large differences between the tax and welfare systems of these countries: some have relatively generous welfare states with high personal income taxes, and others rely more on employee and employer contributions financing social insurance programmes (e.g. Bonoli, 1997; Esping-Andersen, 1990; 2006). This distinction is relevant, because as formulated in hypothesis 3, changes in tax systems caused by downward pressure on top corporate and personal income tax rates might be mediated by existing revenue streams of social security contributions. For this reason, and given the fact that Denmark has been added, the cluster analysis is repeated for the Western European group. The results, presented in figure 3.2, suggest that there is a separate cluster consisting of Austria, France, Germany, Japan, the Netherlands and Spain. Another cluster consists of Belgium, Finland, Italy, Luxembourg, Norway and Sweden. Denmark, which appears as a total outlier, is added to the latter group in the final division, given its resemblance to the other Nordic countries and Italy in terms of a dual income tax system blueprint and low reliance on social security contributions (cf. Kellerman & Kammer, 2009).[5] Table 3.3 shows the final cluster division.[6]

[5] Italy implemented a dual income tax in 1998, thus within the time range of this cluster analysis.

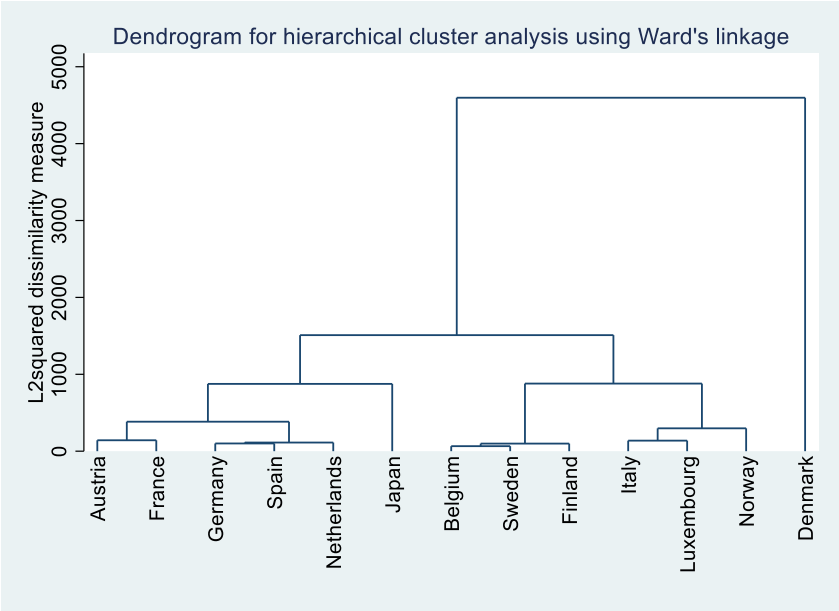
[6] Although the cluster analysis is not intended to present a detailed taxonomy of tax systems congruent with the many existing welfare state typologies, it is notable that the resulting division shows many similarities to the outcomes of these studies. In many welfare state typologies, the English-speaking countries are often clustered together in a 'liberal' or 'Anglo-Saxon' group; the welfare systems of the Nordic countries often form a group that sometimes includes Belgium; Southern-European countries are often classified separately from other continental European nations. These patterns are partly present in the cluster outcome. A likely explanation is that similar domestic factors, such as redistribution preferences, affect both welfare and tax systems. Moreover, some indicators of welfare and tax systems are correlated: total welfare spending and the tax-to-GDP ratio are likely to have a strong association, and the extent to which welfare benefits are linked to the place of employment influences the share of social security contributions in the tax mix.

Figure 3.1. Results of hierarchical cluster analysis using Ward's linkage



Data source: OECD (2019).

Figure 3.2. Results of hierarchical cluster analysis of the Western European countries and associates

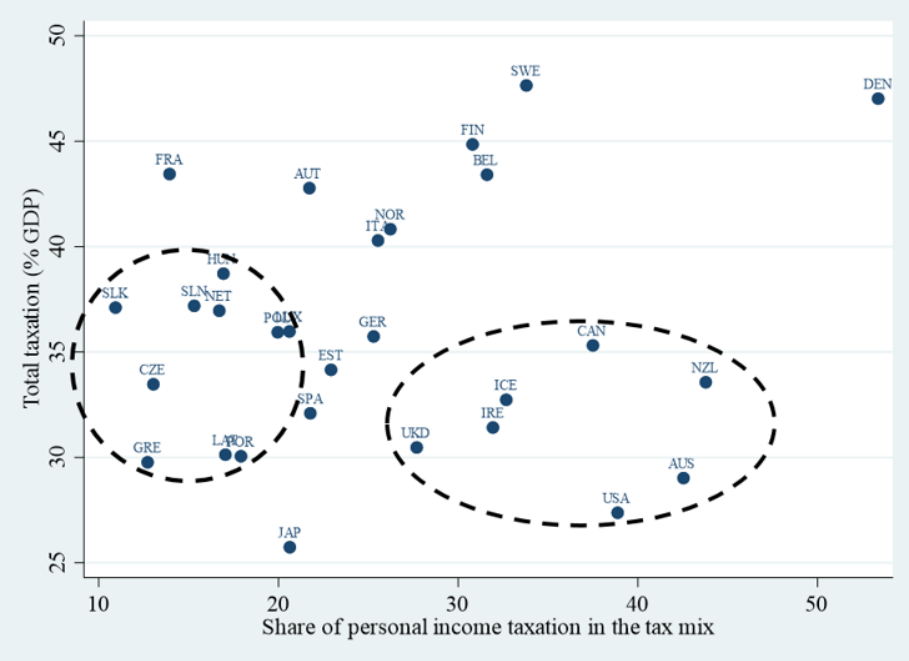


Data source: OECD (2019).

Table 3.3. Final cluster division

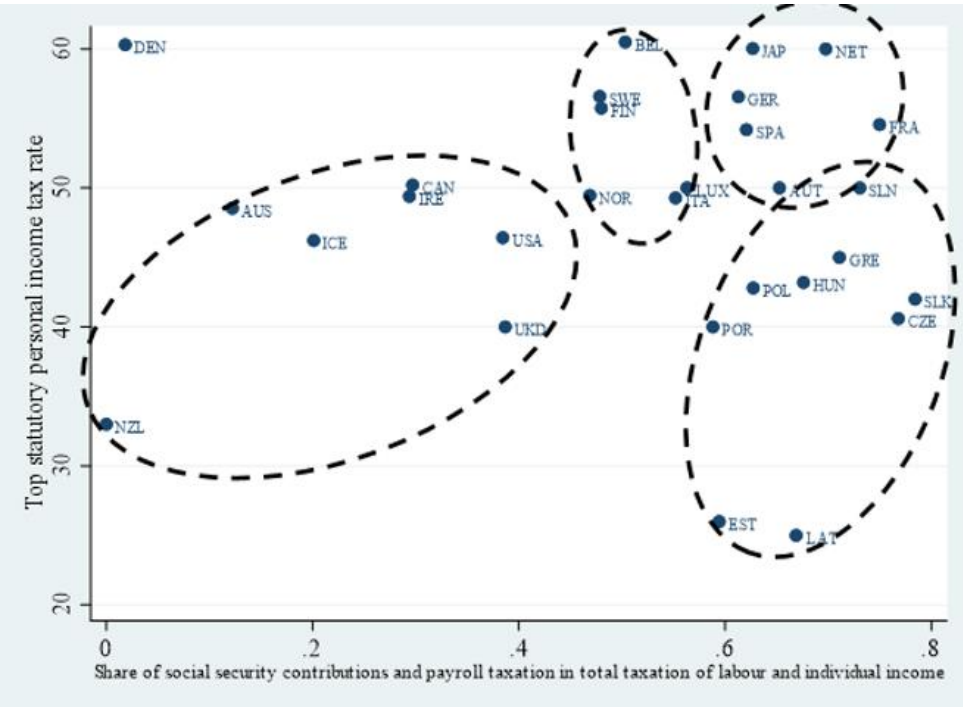
Cluster	Countries
1	Australia; Canada; Iceland; Ireland; New Zealand; United Kingdom; United States
2	Czech Republic; Estonia; Greece; Hungary; Latvia; Poland; Portugal; Slovak Republic; Slovenia
3	Austria; France; Germany; Netherlands; Japan; Spain
4	Belgium; Denmark; Finland; Italy; Luxembourg; Norway; Sweden

Figure 3.4. Scatter plot of total taxation (% GDP) against the share of personal income taxation in the tax mix



Data source: OECD (2019).

Figure 3.5. Scatter plot of the top statutory personal income tax rate against the share of social security contributions and payroll taxation in total taxation of labour and individual income



Data source: OECD (2019).

The clusters seem to hold rather well when plotting the observations of several variables. Figure 3.4 shows a scatter plot of observations for total taxation as a percentage of GDP and the share of personal income taxation in the tax mix. Clusters 1 and 2 are clearly distinguishable as lox-tax systems; they differ in the sense that cluster 2 has a remarkably lower reliance on personal income taxation. Comparing clusters 3 and 4, the latter seem to have both higher

overall taxation and higher reliance on personal income taxes on average, although the distinction is not clear-cut. The distinction is clearer when plotting the top statutory personal income tax rate against the share of social security contributions in individual income taxation (figure 3.5). Clusters 2 and 3 are clearly visible as the ones with the highest reliance on social security contributions. They are also internally distinguishable, with cluster 2 having considerably lower top rates on personal income. This figure also shows Denmark as a clear outlier, lying closest to either cluster 1 or 4.

3.4 σ-, β- and δ-convergence

A widely applied method of measuring convergence is comparing cross-sectional dispersion at multiple points in time. So-called σ-convergence is present when this dispersion, measured by (e.g.) the standard deviation or the coefficient of variation, declines (see Barro & Sala-i-Martin, 1992). A drawback of using the standard deviation is that its value is affected by the mean value of the data, so that outcomes can be spurious when a certain variable experiences an upward or downward time trend. Following Caminada et al. (2010), the σ-convergence tests performed here are therefore based on the coefficient of variation (CV), which is calculated by dividing the standard deviation by the observations' mean value.

Additionally, a series of β-convergence tests is conducted by performing an OLS cross-sectional regression of the annual growth rate of the tax system indicator variables on their initial level at the beginning of the studied time period. A negative and statistically significant β-coefficient estimate provides evidence of β-convergence, in which case a catch-up effect is present, with countries in the tail of the distribution experiencing a stronger convergence towards the mean than 'average' countries (see: Sala-i-Martin, 1996a; 1996b). Such a sub-set of countries may experience this catch-up without σ-convergence being present in the entire panel, for instance when other countries diverge away from the mean. It is therefore useful to use both concepts in a convergence analysis.

In order to test the hypothesis that tax systems have moved in the direction of a model with low statutory top rates, low reliance on personal income taxes and high reliance on social security contributions and consumption taxes, the concept of δ-convergence is used on cluster level. This type of convergence occurs when observations for certain variables move closer to those of an exemplary model (see: Heichel et al., 2005). It is necessary to examine δ-convergence in addition to σ-convergence, as clusters may approach a model by parallel moves of different variables, so that they do not immediately become similar and will hence show no sign of panel-wide σ-convergence.

In the present research, it is not possible to construct an exemplary model, for there are no given definitions of 'low' statutory rates or 'high' reliance on social security contributions. An alternative approach is to take one series of observations as a reference point, following for instance Starke et al. (2008) who test the 'Americanisation' of social policy by looking at countries' δ-convergence towards indicator values that are found in the United States. In this case, cluster 2 serves as the reference point, having the lowest statutory top rates, lowest personal income tax revenues, second highest revenues of social security contributions and payroll taxes, and highest revenues of general and specific consumption taxation.

3.5 Results

Table 3.6 indicates a strong σ-convergence of slightly rising total tax revenues in the OECD-29 and all sub-groups except cluster 1. Panel-wide and EU-wide convergence seems to have taken place mainly between 1980 and 1995, during the tax reform wave. The slight convergence of the EU-15 between 1995 and 2018 is probably driven mainly by Spain, Greece and Portugal catching up. This is confirmed by the finding of significant β-convergence, reported in table A3.9 in the appendix; the effect is present in all sub-groups except for the CEE countries and cluster 1. Given that a strong correlation between the tax-to-GDP ratio and total welfare spending can be expected, it is not surprising that these results are in line with the convergence of welfare spending found in the social policy literature (e.g. Caminada et al., 2010).

During the tax reform wave, σ-convergence also occurred within clusters 3 and 4, but this may be driven by the fact that the clustering algorithms were run using the data years 1995 through 1999, so that within-cluster variation is expected to be especially small in 1995. This caveat equally applies to all other convergence tests in this study. Interesting, however, is that clusters 2, 3 and 4 also show convergence between 1995 and 2018, thus increasing their internal homogeneity that already existed during the cluster analysis years. Given that little panel-wide convergence was present at the same time, existing differences between groups of tax systems apparently remained.

It should be noted that cluster 2 between 1980 and 1995 only consists of Greece and Portugal, as the rest of the cluster comprises CEE countries for which no data are available before their transition to capitalism. The observations for cluster 2 in that time period therefore give spurious results, and hence are not reported. The absence of the CEE countries in the data also slightly affects the pre-1995 results of the OECD-29 and EU-22 groups. Judging from the coefficients of variation of the EU groups that respectively include and exclude the CEE

countries, the effect seems to be small: the difference between these groups ranges from 0.001 in 2010 to 0.019 in 1995.

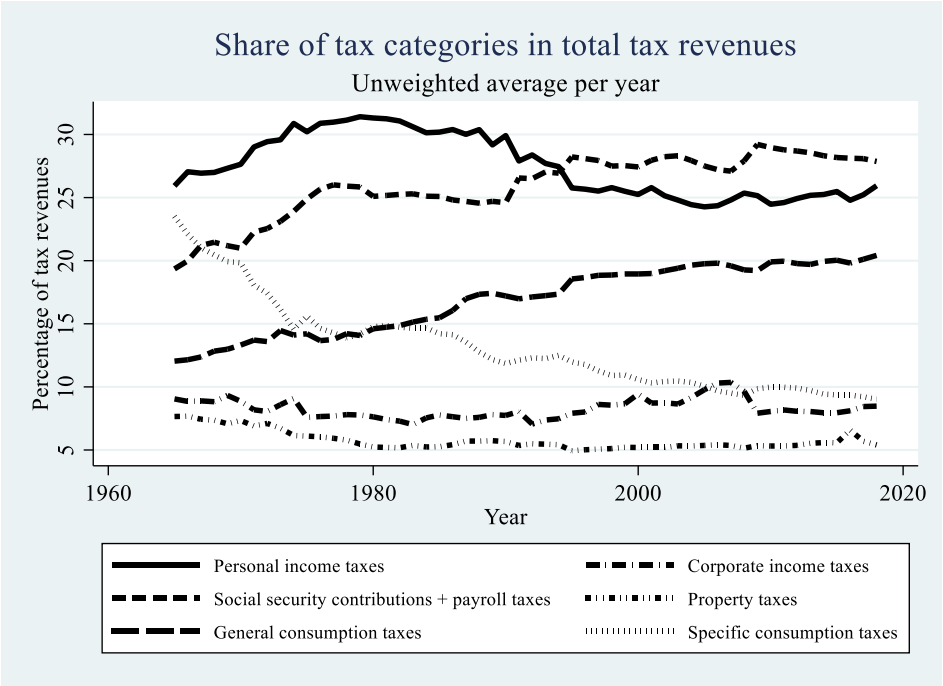
Convergence tests are also performed on the various categories of taxes, expressed both as a percentage of GDP and as a share of the tax mix, and on top statutory rates. Stylised trends are presented in figure 3.7, showing aggregate tax mix shares, and table 3.8, showing top statutory rates. Figure 3.7 reveals that from the 1980s onwards, there has been an equally large increase in social security contributions and decline in personal income taxes. Moreover, the share of specific consumption taxes has partially been replaced by general consumption taxes. The share of the tax mix comprising corporate income taxes is small and relatively stable over time, and the same applies to property taxes. Compared to their level in the 1980s, top rates of both personal and corporate income taxes have fallen considerably, as indicated in table 3.8. In some nations, however, personal income tax rates have stabilised or slightly risen since 1995.

Table 3.6. Individual country values, mean and σ-convergence tests of total taxation, 1980-2018

	1980	1985	1990	1995	2000	2005	2010	2015	2018	Change 1980-1995	Change 1995-2018	Change 1980-2018
Australia	26.21	27.76	28.11	28.29	30.46	29.98	25.27	27.87	28.53	2.08	0.24	2.32
Austria	38.57	40.44	39.29	41.27	42.29	41.01	40.96	43.04	42.18	2.70	0.91	3.61
Belgium	40.51	43.48	41.17	42.61	43.54	43.15	42.62	44.73	44.85	2.10	2.24	4.34
Canada	30.32	31.61	35.07	34.63	34.67	32.66	31.01	32.82	32.99	4.31	-1.64	2.67
Czech Republic				34.71	32.43	34.45	32.48	33.35	35.28		0.57	35.28
Denmark	41.16	43.59	44.40	46.50	46.88	48.01	44.76	46.06	44.86	5.34	-1.64	3.70
Estonia				36.03	31.09	29.97	33.25	33.24	33.24		-2.79	33.24
Finland	35.32	39.14	42.91	44.50	45.82	42.11	40.79	43.86	42.67	9.18	-1.83	7.35
France	39.53	42.04	41.17	42.33	43.43	42.90	42.15	45.28	46.10	2.80	3.77	6.57
Germany	36.45	36.10	34.80	36.23	36.24	33.87	35.01	36.98	38.19	-0.22	1.96	1.74
Greece	20.75	24.56	25.19	28.30	33.42	31.87	32.04	36.64	38.74	7.55	10.44	17.99
Hungary				40.78	38.51	36.54	37.27	38.66	36.55		-4.23	36.55
Iceland	29.12	27.71	30.44	30.68	35.96	39.41	32.30	35.40	36.69	1.56	6.01	7.57
Ireland	30.08	33.58	32.35	31.73	30.77	29.40	27.01	23.08	22.32	1.65	-9.41	-7.76
Italy	28.72	32.52	36.39	38.58	40.60	39.15	41.88	42.90	42.05	9.86	3.47	13.33
Japan	24.47	26.39	28.20	25.85	25.78	26.24	26.53	30.68	31.37	1.38	5.52	6.90
Latvia				29.72	29.13	27.94	28.78	30.16	30.74		1.02	30.74
Luxembourg	34.16	37.79	33.49	34.85	36.92	37.79	37.40	37.36	40.05	0.69	5.20	5.89
Netherlands	39.75	39.28	39.70	37.25	36.91	35.01	35.66	37.01	38.75	-2.50	1.50	-1.00
New Zealand	31.66	31.21	36.18	35.57	32.54	36.06	30.27	31.69	32.69	3.91	-2.88	1.03
Norway	41.94	41.87	40.25	40.04	41.89	42.60	41.90	38.43	39.03	-1.90	-1.01	-2.91
Poland				36.62	32.94	32.96	31.42	32.35	35.03		-1.59	35.03
Portugal	21.88	24.12	26.48	29.28	31.05	30.81	30.41	34.45	35.39	7.40	6.11	13.51
Slovak Republic				39.56	33.63	31.26	28.08	32.08	33.05		-6.51	33.05
Slovenia				38.36	36.63	37.95	36.90	36.33	36.38		-1.98	36.38
Spain	22.00	26.84	31.62	31.28	33.23	35.14	31.21	33.63	34.40	9.28	3.12	12.40
Sweden	43.70	44.73	49.42	45.57	48.92	46.56	43.17	43.06	43.93	1.87	-1.64	0.23
United Kingdom	33.38	35.07	32.87	29.49	32.92	32.68	32.39	32.16	33.54	-3.89	4.05	0.16
United States	25.57	24.66	26.03	26.55	28.29	26.10	23.46	26.15	24.33	0.98	-2.22	-1.24
Mean OECD-29	32.51	34.29	35.25	35.76	36.10	35.64	34.36	35.84	36.34	3.25	0.76	4.01
CV	0.220	0.203	0.185	0.164	0.164	0.165	0.175	0.165	0.161	-0.056	-0.003	-0.059
Mean EU-22	33.44	35.73	36.59	37.12	37.29	36.69	35.70	37.26	37.79	3.68	0.67	4.35
CV	0.227	0.200	0.186	0.147	0.154	0.153	0.152	0.155	0.146	-0.081	0.000	-0.081
Mean EU-15	33.44	35.73	36.59	37.40	39.06	38.41	37.16	38.90	39.41	3.95	2.01	5.97
CV	0.227	0.200	0.186	0.166	0.150	0.147	0.151	0.158	0.151	-0.061	-0.015	-0.077
Mean CEE-7				36.54	33.48	33.01	32.59	33.74	34.32		-2.22	
CV				0.100	0.095	0.108	0.110	0.085	0.061		-0.039	
Mean cluster 1	29.48	30.23	31.58	30.99	32.23	32.33	28.82	29.88	30.16	1.51	-0.83	0.68
CV	0.095	0.122	0.115	0.106	0.081	0.137	0.124	0.144	0.175	0.010	0.069	0.080
Mean cluster 2				34.82	33.20	32.64	32.29	34.14	34.93		0.12	
CV				0.134	0.087	0.098	0.099	0.078	0.067		-0.067	
Mean cluster 3 [a]	33.46	35.18	35.80	35.70	36.31	35.70	35.25	37.77	38.50	2.24	4.22	6.46
CV	0.240	0.197	0.144	0.175	0.177	0.165	0.167	0.146	0.137	-0.065	-0.038	-0.103
Mean cluster 4	37.93	40.44	41.15	41.81	43.51	42.77	41.79	42.34	42.49	3.88	0.69	4.56
CV	0.141	0.106	0.127	0.101	0.094	0.086	0.055	0.076	0.054	-0.041	-0.047	-0.088

Source: OECD Revenue Statistics (OECD, 2019), and own calculations
Note: for Japan, 2017 data are used in the 2018 column

Figure 3.7. Trends in taxes' shares in tax mixes, OECD-29, 1965-2018



Source: OECD (2019).

Table 3.8. Top statutory personal and corporate income taxes, 1981/2-2018

	Personal income taxes					Corporate income taxes				
	1981	1995	2018	Change 1981-1995	Change 1995-2018	1982	1995	2018	Change 1982-1995	Change 1995-2018
Australia	60.00	48.50	47.00	-11.50	-1.50	50.00	36.00	30.00	-14.00	-6.00
Austria	62.00	50.00	55.00	-12.00	5.00	61.30	34.00	25.00	-27.30	-9.00
Belgium	74.50	60.50	52.93	-14.00	-7.57	48.00	40.17	29.58	-7.83	-10.59
Canada	62.78	52.32	53.53	-10.46	1.21	49.50	42.90	26.80	-7.60	-16.10
Czech Republic		43.00	15.00		-28.00		41.00	19.00		-22.00
Denmark	70.86	63.50	52.02	-7.36	-11.48	40.00	34.00	22.00	-6.00	-12.00
Estonia		26.00	20.00		-6.00		26.00	20.00		-6.00
Finland	66.85	56.14	51.11	-10.71	-5.03	60.20	25.00	20.00	-35.20	-5.00
France	60.00	56.80	49.00	-3.20	-7.80	50.00	36.70	34.43	-13.30	-2.27
Germany	56.00	56.98	47.48	0.98	-9.50	62.38	56.55	29.89	-6.38	-26.66
Greece	60.00	45.00	55.00	-15.00	10.00	43.40	40.00	29.00	-3.40	-11.00
Hungary		44.00	15.00		-29.00		33.30	9.00		-24.30
Iceland		46.93	46.24		-0.69		33.00	20.00		-13.00
Ireland	62.00	50.25	48.00	-11.75	-2.25	50.00	38.50	12.50	-13.50	-26.00
Italy	72.00	51.00	43.00	-21.00	-8.00	38.80	52.20	27.81	15.90	-24.39
Japan	89.65	62.90	56.35	-26.75	-6.55	54.70	50.00	29.74	-4.70	-20.26
Latvia		25.00	31.40		6.40		25.00	20.00		-5.00
Luxembourg	57.00	50.00	45.78	-7.00	-4.22		39.34	26.01		-13.33
Netherlands	72.00	60.00	51.95	-12.00	-8.05	48.00	35.00	25.00	-13.00	-10.00
New Zealand	60.00	33.00	33.00	-27.00	0.00	45.00	33.00	28.00	-12.00	-5.00
Norway	70.70	49.50	46.60	-21.20	-2.90	50.80	28.00	23.00	-22.80	-5.00
Poland		45.00	32.00		-13.00		40.00	19.00		-21.00
Portugal	84.40	40.00	53.00	-44.40	13.00	55.06	39.60	31.50	-15.46	-8.10
Slovak Republic		42.00	25.00		-17.00		40.00	21.00		-19.00
Slovenia		50.00	50.00		0.00		25.00	19.00		-6.00
Spain	65.09	56.00	45.00	-9.09	-11.00	33.00	35.00	25.00	2.00	-10.00
Sweden	85.00	56.50	57.12	-28.50	0.62	60.40	28.00	22.00	-32.40	-6.00
United Kingdom	60.00	40.00	45.00	-20.00	5.00	52.00	33.00	19.00	-19.00	-14.00
United States	73.73	46.72	43.65	-27.01	-3.07	49.57	39.29	25.84	-10.28	-13.45

Source: OECD (2019).

The convergence test results of tax revenues specified by category and top statutory rates are reported in the appendix (tables A3.1 through A3.8 show σ-convergence, tables A3.9 through A3.23 show β-convergence and tables A3.24 through A3.38 show δ-convergence).

Table A3.1 shows evidence of some panel-wide convergence in the revenues of personal income taxes. Interestingly, most convergence has taken place after the tax reform wave, with the coefficient of variation declining by roughly one-tenth in the OECD-29 and one-fifth in the EU-15. This may be caused by the fact that countries reformed their taxes in different ways in the 1980s (recall the difference between flat-rate systems and the dual income tax), leading to divergence between 1980 and 1995, while since the late 1990s, systems might have equally started to feel the rising efficiency costs of personal income taxation when corporate tax rates had significantly declined. Interesting to see is that most clusters continue to show a decline in internal variation after the years for which the clustering algorithms were run.

Regarding the level of personal income tax revenues, relevant in the light of hypothesis 1, table A3.1 reports evidence of a small panel-wide decline during the tax reform wave. Revenues kept on falling until 2010, in line with hypothesis 1, but seem to slightly rise since then. This is congruent with the slightly rising trend (albeit diverging) in personal income tax rates since 2010, observed in table A3.7. A possible explanation for this trend could be an increasing demand for tax progressivity through the personal income tax, caused by changed societal fairness norms since the Great Recession, as observed by Limberg (2019; 2020). Although revenues and rates increase in all sub-groups since 2010, revenues in the clusters with the highest reliance on personal income taxation (clusters 1 and 4) are still below their 1995 levels. This may indicate that these clusters are feeling the raised economic costs of their large personal income taxes, making it difficult for them to increase revenues further.

In corporate income taxes, there has been even more convergence (see table A3.2).[7] Interestingly, corporate tax revenues have slightly risen, while statutory rates experienced a strong decline (see also figure 2.1). Despite their strong downward trend, the rates rarely show σ-convergence (table A3.8). The upward converging trend in revenues and the downward diverging trend in statutory rates (with some downward catch-up effect, given the significant β-convergence reported in table A3.23) are an indication of substantial base-broadening.

Revenues of social security contributions and payroll taxation have increased and converged considerably (tables A3.3, A3.14 and A3.15), but this has occurred mainly between 1980 and 1995. The largest increase took place in cluster 3 (mostly continental European

[7] Results before 1990 are spurious to a small extent, as data for Luxembourg and Iceland are missing.

counties with a long history of high social security contributions) and cluster 4 (mostly high-tax countries for which social security contributions are an alternative revenue stream to their sizable personal income taxes). Although these observations are line with hypothesis 1, it must be noted that upward convergence is remarkably weak after 1995. This may be related to the equally weak decline (and rise after 2010) in personal income taxes, causing a low need to search for alternative revenue streams – see hypothesis 3.

Little convergence is found in property taxation (tables A3.4, A3.16 and A3.17), while general and specific consumption taxes show both strong σ- and β-convergence in an upward and downward trend, respectively (tables A3.5, A3.6 and A3.18 through A3.21). The changes in revenues of cluster 4 between 1995 and 2018 are above-average in all of these categories.

Tables A3.24 through A3.38 report the δ-convergence tests. Those show the mean values of cluster 2 as the reference group, and the absolute distance of the other respective clusters to these values. Δ-convergence is present when this distance declines. The tables also report a coefficient obtained by dividing the distance by the mean value in the respective year. Analogous to the coefficient of variation used in the σ-convergence tests, this coefficient thus controls for the size of the variable. Because of the fact that the reference cluster includes the CEE countries, the tables only report convergence from 1995 onwards. The results suggest that little δ-convergence is present, although there is some evidence of cluster 4 moving towards cluster 2 in the categories of personal income taxation and social security contributions. This is in line with the results of σ- and β-convergence in some categories (total taxation, personal income taxation and to some extent corporate income taxation and corporate tax rates), showing strong within-cluster convergence while panel-wide convergence is weaker or absent. Existing differences between groups of tax systems apparently persist.

In sum, there is tentative evidence of tax mix convergence in the hypothesised directions: countries seem to experience downward personal income tax convergence and upward convergence in revenues of social security contributions and general consumption taxes. Most of the expected changes in revenue levels appear to have taken place during the tax reform wave. Trends have been more stable since 1995, and personal income tax revenues and top rates have even moved in the opposite (i.e. upward) direction since 2010. It is notable that cluster 4 still shows an above-average change in the hypothesised directions after 1995 for all indicator variables except corporate tax rates. This is in line with hypothesis 1, as this cluster comprises high-tax countries with relatively large personal income taxes and high top rates (and includes all nations with dual-income tax systems in this panel), thus being the most likely to feel the increased efficiency costs of the personal income tax. However, despite the presence of

some δ-convergence of personal income tax revenues of cluster 4 towards cluster 2, it appears that the high-tax systems have not moved in the direction of low-tax systems funded mainly by social security contributions and consumption taxes.

4. Spill-over hypothesis

4.1 Model and data

This section analyses one possible contributing factor to the converging trends, namely the spill-over effect of corporate to personal income tax rates, as theorised by Ganghof (2006; 2008) and Ganghof & Genschel (2008) and formulated in hypothesis 2. To this end, the relation between top marginal corporate and personal income tax rates is estimated in a linear model using fixed-effects regressions. The estimations are conducted for the same panel of 29 OECD countries as used in section 3, using yearly data between 1995 and 2015. The regressions are also repeated for the same sub-groups (EU-22, EU-15 and CEE-7) and the same clusters. This paragraph explains the methodological choices regarding the estimations. Data sources and summary statistics are provided in the data annex.

The dependent variable in this model is the top statutory personal income tax rate for the combined central and sub-central governments. The main independent variable is the combined central and sub-central top statutory rate of the corporate income tax.[8] A second independent variable is added to control for the mediating effect of other revenue streams, thus testing hypothesis 3. The variable denotes the ratio of personal income tax revenues to the sum of social security contributions and general consumption tax revenues; it is added both separately and in an interaction term with the corporate tax rate. The variable provides information about the relative importance of the personal income tax in the tax mix: a high (low) ratio should make it relatively harder (easier) for a country to lower personal income taxes because the government can rely to a relatively small (large) extent on other taxes or premiums. The choice for the categories of social security contributions and general consumption taxes in the denominator is motivated by the assumption that these are often large existing revenue streams which can be raised relatively easily by changing their rates, unlike specific consumption taxes that are often small and highly dependent on external factors (e.g. alcohol taxes, customs duties and taxes on imports). According to hypothesis 3, the coefficient for the

[8] Both the dependent and independent variable take into account any deductibility of sub-central taxes.

interaction term should be negative, indicating that a high existing reliance on personal income taxation makes any positive effect of corporate tax rates on personal income tax rates smaller.

In order to isolate the effect of corporate tax rates and existing tax mix composition from other time-variant factors influencing the top marginal rate on personal income, several control variables are added. Following Ganghof´s (2008) one-year cross-sectional regression, one of those is the total tax revenue as a percentage of GDP, capturing differences between high-tax and low-tax nations. As argued by Ganghof, high total taxation often leads to high marginal rates on personal income, either because a country taxes labour extensively or because a small but high-rate personal income tax serves as a progressivity adjustment to (more regressive) social security contributions and consumption taxes.

A second important control variable is government ideology. Top personal income tax rates are often the subject of political debate and may serve as an important signal to the electorate of a government's tax and redistribution policy. Although higher top marginal income tax rates need not necessarily be related to more progressivity (cf. Caminada, 1996), there are many pieces of anecdotic evidence showing that top personal rates are in fact used for redistribution purposes – or at least as a signal of such purposes – as a part of a left-wing political agenda. Examples include the 75% tax bracket introduced by French president François Hollande in 2013 and the introduction of the 50% top rate in the United Kingdom under Gordon Brown's ministry. The existence of divergent tax and redistribution policies as a result of government ideology has been confirmed empirically (e.g. Potrafke, 2009; Osterloh & Debus, 2012). Including a control variable showing the ideology of a country's government in a particular year is therefore appropriate.

The ideology index used here is constructed using data from the quantitative analysis of party manifestos. Budge et al. (2001) compile a dataset by coding the wording of election manifestos according to the frequency of sentences and phrases in 142 categories, such as 'Environment' or 'Welfare state expansion'. With this wide variety of categories, an ideology index can be constructed showing any programmatic dimension by adding up the share of phrases that are generally associated with one side of the political spectrum and subtracting those that are typically ascribed to the other side. Seki & Williams (2014) use an updated version of this data set (see: Volkens et al., 2016) and combine it with updated data on government composition (originally by Woldendorp et al., 2000) to calculate ideology index values on government level instead of party level.

For the present analysis, a left-right dimension of governments is constructed using the Seki & Williams governments dataset with a selection of variables denoting economic policy

preferences. This dimension excludes categories that probably have little influence on tax rate setting, such as the upholding of traditional social values or parties' positions with respect to the military. A higher value in the present index means a higher degree of left-wing economic policy preferences. A more detailed description of its construction, including data sources, is provided in the data annex. The ideology variable is lagged one year, as changes in tax policy will most likely be implemented in the year after they have been passed by parliament. Additionally, an interaction term of the variables denoting ideology and total tax revenue is added, for it can be expected that the political preference to increase tax rates diminishes once a country is already heavily taxed. The interaction term is also lagged one year.

Three other control variables summarise various differences between governments' economic situations. Firstly, a one-year lag of the central government's budget surplus (or deficit) is included, as countries with a large budget deficit could be inclined to raise personal income taxes in the next year for revenue purposes. Secondly, the natural logarithm of GDP per capita in constant prices is used to control for poorer countries adjusting their rate schedules in order to attract investment. Finally, the sum of exports and imports as a percentage of GDP is included, serving as a proxy for the trade openness or closeness of an economy, a factor which may indicate the extent to which tax rate cuts are a domestic policy choice or a response to international competitive pressure.

Robust standard errors are used. The regressions are carried out with dummy variables for countries and years, thus providing fixed-effects estimations that take into account the variables' deviations from country-specific and year-specific averages. This is useful in the present model, where it is necessary to isolate unmeasured country-specific factors that affect personal income taxation (such as egalitarian cultures preferring a high level of redistribution) from the pull-down effect exercised by corporate tax rates. Such factors are likely to be correlated with some of the independent variables; in case of redistribution preferences, for instance, one would expect a correlation with political ideology and total taxation. Pooled OLS estimations will therefore be biased, making the use of fixed-effects regressions more appropriate.

The model is thus specified as follows: $PIT\ rate_{i,t} = \beta_1 + \beta_2 CIT\ rate_{i,t} + \beta_3 PIT\ ratio_{i,t} + \beta_4 CIT\ rate * PIT\ ratio_{i,t} + \beta_5 Ideology_{i,t-1} + \beta_6 Ideology_{i,t-1} * Total\ taxation_{i,t-1} + \beta_7 Budget\ surplus_{i,t-1} + \beta_8 ln(GDP\ per\ capita)_{i,t} + \beta_9 Trade_{i,t} + \beta_{10} Year_t + \alpha_t + \eta_i + \varepsilon_{i,t}$

4.2 Results and robustness

Table 4.1 shows the model estimates for the entire panel and for all previously defined sub-groups. Significant results appear mainly in the OECD-29, EU-23, CEE-7, cluster 2 and cluster 4 estimates.

Table 4.1. Estimation results

VARIABLES	(1) OECD-30	(2) EU-23	(3) EU-16	(4) CEE-7	(5) Cluster 1	(6) Cluster 2	(7) Cluster 3	(8) Cluster 4
CIT rate	0.345***	0.291***	0.035	1.389***	-0.169	1.412***	0.235	0.256**
	(0.067)	(0.074)	(0.068)	(0.259)	(0.133)	(0.193)	(0.570)	(0.099)
PIT ratio	10.918***	16.148**	0.282	166.419***	-6.335	168.856***	19.414	-4.698
	(3.430)	(6.316)	(4.480)	(28.300)	(4.998)	(20.409)	(49.445)	(4.200)
PIT ratio * CIT rate	-0.262***	-0.173*	0.147	-4.954***	0.162	-4.619***	-0.181	0.180**
	(0.082)	(0.104)	(0.090)	(0.854)	(0.121)	(0.601)	(1.195)	(0.076)
Total taxation (% GDP)	0.534***	0.269	-0.259*	0.462	0.210	0.548*	0.369	-0.524**
	(0.130)	(0.166)	(0.138)	(0.362)	(0.219)	(0.282)	(0.365)	(0.232)
Ideology $_{t-1}$	0.021	-0.129	-0.506**	0.345	-0.204	0.558	-0.259*	-0.680**
	(0.090)	(0.174)	(0.204)	(0.468)	(0.249)	(0.388)	(0.132)	(0.331)
Ideology $_{t-1}$ * total taxation	-0.001	0.002	0.010**	-0.010	0.009	-0.018	0.010**	0.013*
	(0.003)	(0.004)	(0.005)	(0.014)	(0.008)	(0.012)	(0.004)	(0.007)
Budget surplus $_{t-1}$	-0.456***	-0.538***	-0.201***	-0.647***	0.000	-0.534***	0.011	0.130
	(0.080)	(0.107)	(0.063)	(0.140)	(0.084)	(0.127)	(0.241)	(0.122)
Ln GDP per capita	-4.497*	-4.942**	-5.834	-5.429	-23.841***	-10.527***	-13.693	-19.010**
	(2.302)	(2.381)	(3.659)	(7.982)	(9.020)	(3.506)	(12.858)	(7.320)
Trade	-0.070***	-0.069***	-0.012	-0.117***	0.042	-0.151***	0.138*	0.010
	(0.016)	(0.017)	(0.011)	(0.040)	(0.026)	(0.027)	(0.077)	(0.012)
Constant	46.320**	59.587**	121.647***	17.876	299.778***	89.751**	183.364	271.643***
	(22.541)	(23.461)	(44.522)	(71.864)	(101.720)	(39.053)	(140.766)	(84.323)
Observations	583	439	302	137	145	177	121	140
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.882	0.896	0.801	0.917	0.804	0.916	0.746	0.909

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

The positive coefficient of the corporate tax rate and the negative coefficient of its interaction term tentatively point in the direction of hypotheses 2 and 3: the effect of the corporate tax rate on the personal tax rate becomes smaller when a country is relatively dependent on personal income tax revenues. Given the size of the coefficients in cluster 2 and the CEE-7 sub-group, the relation is probably driven by the CEE countries that opted for low-rate flat taxes. They were able to do so by relying strongly on social security contributions and value added taxes. Surprisingly, the interaction term has a positive coefficient in cluster 4, but

this is probably caused by the observations for Denmark, where the ratio of personal income taxes is very high and both personal and corporate tax rates declined.

A possible explanation for the lack of significance in cluster 1 is that some of its countries had already adopted low and relatively flat tax rate schedules during the tax reform wave, thus before the studied time period in this regression analysis. For instance, New Zealand set both the personal and corporate tax rate at 33% in the 1980s, and the Thatcher government in the UK brought down top personal income tax rates from 83% to 40%. These cuts were sometimes followed by an increase during the studied time period (cf. Limberg, 2019; 2020). The UK, for instance, increased the personal income tax rate to 50% in 2010. On average, the personal rate in cluster 1 has been relatively constant since 1995 (see table A3.7). Another reason for the insignificance could be this cluster's vast reliance on the personal income tax in the tax mix, which makes it difficult to lower top rates even further given certain revenue requirements. In that case, however, it is surprising that the estimated effects of the personal income tax ratio and the interaction term are also insignificant.

The lack of significance in cluster 3 is more surprising, although it is in line with the lack of δ-convergence towards lower-tax systems (cluster 2) in terms of personal and corporate tax rates and revenues, determined in section 3. It cannot be ruled out that the insignificance here is caused by the fixed-effects estimator, which has the drawback of discarding the information that is provided by persistent differences between countries in tax rates and other variables. For instance, it does not account for the situation in which the corporate tax is low in the first place. Pooled OLS estimates do pick up these relative levels of taxation, but they do not provide a satisfactory solution as they are very likely to be biased, as explained in paragraph 4.1. Instead, there is an opportunity for further research to re-estimate the model using data covering a longer time period.

Touching quickly upon the control variables, the significant positive coefficient of total taxation in the OECD-29 and negative coefficient of budget surplus in most sub-groups are in line with theoretical predictions. One of the results that does strike the eye is the sign and significance of the estimated ideology coefficient. In some regressions, the coefficient is negative and significant, indicating that left-wing ideology is associated with tax rate cuts (notwithstanding the effect of the interaction term). Although this is contrary to the expectations, these cuts may have been complemented with increases in social security contributions or other taxes, which are not taken up by the present ideology variable. It might also be the case that the ideology variable is biased here, picking up the effects of institutional factors such as veto-players that can influence tax policy. Unfortunately, it is difficult to account

for such institutional factors in quantitative analyses; future research could therefore complement the empirical model with a qualitative study.

Considering the robustness of the results, a final issue that must be addressed is reverse causation: it remains a question whether lower (higher) corporate tax rates cause personal income tax rates to decline (rise), or vice versa. There is no satisfactory method to answer this question decisively, other than relying on theoretical considerations. Theory however suggests that it is highly unlikely that declines in personal income taxes are the driving factor behind falling corporate tax rates. There is an extensive literature, addressed in section 2, that finds evidence for the contribution of economic globalisation and resulting tax competition to the 'race to the bottom' of corporate tax rates, while no such relation has been found for personal income tax rates. Instead, personal income taxation has been described by many scholars as a domestic policy that is constrained by revenue requirements.

5. Conclusion

Although globalisation-induced capital tax competition is expected to affect tax systems by creating downward pressure on corporate tax rates, a large body of political science literature has stressed the importance of domestic institutions in mediating this process, stating that tax revenues will not necessarily decline or converge. Some scholars have argued, however, that falling corporate tax rates increase the efficiency costs of personal income tax rates as a result of labour-capital tax arbitrate, leading to downward pressure on rate schedules and revenues of the personal income tax. This could result in convergence towards tax mixes based on other revenue streams, such as social security contributions and consumption taxes.

In order to test this hypothesis, this study has presented several convergence tests using top statutory rates and revenues of various tax categories as tax system indicators. The relation between statutory corporate and personal income tax rates, which is the hypothetical driving force behind such convergence, has been tested in a linear model controlling for several domestic factors including government ideology.

The results indicate that top statutory corporate and personal income tax rates are indeed positively related, although the coefficient declines with the relative importance of personal income tax revenues in the tax mix. The latter observation reflects that it is harder for a country to lower personal income taxes when those generate a relatively important revenue stream. The results regarding tax mix convergence are mixed. In line with the hypotheses, revenues of general consumption taxes and the sum of social security contributions and payroll taxes

converge upwards, although most of this convergence has taken place during the global tax reform wave between 1980 and 1995. The panel-wide revenue average of personal income taxes appears to have declined until 2010, but slightly rises since then, contrary to theoretical expectations.

In general, there is little reason to conclude that capital tax competition and labour-capital tax arbitrage are substantially deteriorating the possibility to collect personal income taxes. However, the observed effects differ significantly between the distinct groups of homogeneous tax systems that were determined using statistical clusters analysis. For instance, the share of personal income taxes in the tax mix declined relatively steeply in a group of high-tax nations with high top rates, confirming the expectation that especially those regimes would face the increased efficiency costs of personal income taxes.

Although the use of cluster analysis controls for some persisting institutional differences between countries, there is an opportunity for future research to conduct an even more in-depth investigation of institutional factors. A remaining question is how institutions mediate the change of tax mixes under competitive pressure, especially the shift towards social security contributions and consumption taxes. Qualitative research could for instance shed light on how electoral systems, parliamentary majorities or redistribution preferences contribute to countries' convergence towards a certain taxation blueprint. Future analyses could also include a more elaborate testing of this study's model concerning the spill-over hypothesis using panel data covering a longer time period, as the available data for the current panel run from 1995 to 2015, and hence do not comprise all major tax reforms.

Appendix

Table A3.1. Mean and σ-convergence tests of personal income taxation (% GDP and share of tax mix), 1980-2018

	1980	1985	1990	1995	2000	2005	2010	2015	2018	Change 1980-1995	Change 1995-2018	Change 1980-2018
% GDP:												
Mean OECD-29	10.50	10.56	10.72	9.28	9.24	8.81	8.46	9.16	9.19	-1.22	-0.09	-1.31
CV	0.459	0.461	0.459	0.499	0.499	0.506	0.473	0.472	0.450	0.040	-0.049	-0.009
Mean EU-22	10.09	10.34	10.28	8.83	8.76	8.38	8.22	8.82	8.91	-1.26	0.08	-1.18
CV	0.519	0.523	0.544	0.562	0.573	0.572	0.540	0.544	0.516	0.043	-0.046	-0.003
Mean EU-15	10.09	10.34	10.28	10.16	10.39	10.00	9.80	10.71	10.73	0.07	0.57	0.64
CV	0.519	0.523	0.544	0.534	0.509	0.500	0.460	0.439	0.419	0.015	-0.115	-0.100
Mean CEE-7				5.97	5.26	4.91	4.84	4.77	5.01		-0.96	
CV				0.313	0.267	0.238	0.301	0.223	0.160		-0.153	
Mean cluster 1	11.07	10.99	11.73	11.19	11.73	11.30	9.91	10.74	10.87	0.12	-0.32	-0.20
CV	0.361	0.376	0.270	0.231	0.136	0.212	0.152	0.186	0.224	-0.130	-0.007	-0.137
Mean cluster 2				5.61	5.18	4.87	4.80	5.16	5.32		-0.29	
CV				0.331	0.243	0.211	0.272	0.245	0.176		-0.155	
Mean cluster 3	7.53	7.30	7.79	7.27	7.27	6.98	7.38	8.20	8.47	-0.26	1.20	0.94
CV	0.383	0.302	0.256	0.255	0.240	0.211	0.199	0.207	0.187	-0.128	-0.068	-0.196
Mean cluster 4	13.51	13.94	14.18	13.79	13.66	12.96	12.62	13.53	13.11	0.28	-0.68	-0.40
CV	0.375	0.361	0.400	0.420	0.424	0.422	0.391	0.396	0.392	0.045	-0.028	0.017
Share of tax mix:												
Mean OECD-29	31.31	30.19	29.91	25.76	25.25	24.27	24.47	25.48	25.35	-5.55	-0.41	-5.96
CV	0.379	0.405	0.360	0.417	0.419	0.408	0.399	0.408	0.403	0.038	-0.014	0.024
Mean EU-22	28.32	27.28	27.01	23.21	22.65	21.97	22.39	23.12	23.16	-5.11	-0.05	-5.16
CV	0.377	0.398	0.398	0.443	0.438	0.423	0.428	0.434	0.427	0.066	-0.016	0.050
Mean EU-15	28.32	27.28	27.01	26.37	25.85	25.24	25.94	27.28	27.12	-1.95	0.75	-1.20
CV	0.377	0.398	0.398	0.404	0.397	0.371	0.362	0.343	0.351	0.027	-0.053	-0.026
Mean CEE-7				16.43	15.77	14.96	14.79	14.21	14.67		-1.76	
CV				0.311	0.265	0.246	0.283	0.244	0.188		-0.123	
Mean cluster 1	37.60	36.52	36.98	35.92	36.51	34.85	34.46	35.96	36.06	-1.68	0.14	-1.54
CV	0.333	0.367	0.205	0.159	0.140	0.135	0.110	0.134	0.140	-0.174	-0.019	-0.193
Mean cluster 2				16.11	15.65	14.99	14.85	15.15	15.26		-0.85	
CV				0.298	0.243	0.217	0.259	0.251	0.180		-0.118	
Mean cluster 3	22.56	21.10	22.24	20.78	20.10	19.51	20.95	21.67	21.91	-1.78	1.13	-0.65
CV	0.275	0.278	0.285	0.260	0.176	0.119	0.126	0.140	0.131	-0.015	-0.129	-0.144
Mean cluster 4	34.85	33.97	33.69	32.28	30.75	29.69	29.87	31.55	30.56	-2.57	-1.72	-4.29
CV	0.284	0.293	0.308	0.333	0.356	0.338	0.340	0.331	0.350	0.049	0.017	0.066

Source: OECD Revenue Statistics (OECD, 2019), and own calculations
Note: for Greece, 2017 data are used in the 2018 column

Table A3.2. Mean and σ-convergence tests of corporate income taxation (% GDP and share of tax mix), 1980-2018

	1980	1985	1990	1995	2000	2005	2010	2015	2018	Change 1980-1995	Change 1995-2018	Change 1980-2018
% GDP:												
Mean OECD-29	2.42	2.66	2.60	2.74	3.37	3.45	2.73	2.75	3.02	0.32	0.28	0.60
CV	0.619	0.683	0.516	0.489	0.515	0.566	0.629	0.334	0.442	-0.130	-0.047	-0.177
Mean EU-22	1.81	2.08	2.22	2.53	2.97	2.86	2.27	2.50	2.71	0.72	0.18	0.90
CV	0.670	0.715	0.511	0.560	0.473	0.347	0.444	0.305	0.396	-0.110	-0.164	-0.274
Mean EU-15	1.81	2.08	2.22	2.43	3.42	3.06	2.46	2.60	2.97	0.62	0.54	1.16
CV	0.670	0.715	0.511	0.519	0.408	0.329	0.431	0.261	0.355	-0.151	-0.164	-0.315
Mean CEE-7				2.75	1.99	2.43	1.86	2.29	2.13		-0.62	
CV				0.654	0.419	0.362	0.426	0.412	0.433		-0.221	
Mean cluster 1	2.40	2.29	2.35	2.81	3.56	3.81	2.77	3.08	3.39	0.41	0.58	0.99
CV	0.417	0.519	0.442	0.405	0.442	0.401	0.441	0.311	0.435	-0.012	0.030	0.018
Mean cluster 2				2.64	2.40	2.54	2.03	2.36	2.25		-0.39	
CV				0.597	0.455	0.318	0.378	0.366	0.402		-0.195	
Mean cluster 3	2.41	2.52	2.90	2.22	2.88	2.93	2.17	2.48	2.84	-0.19	0.62	0.43
CV	0.636	0.621	0.616	0.518	0.307	0.334	0.251	0.287	0.284	-0.118	-0.234	-0.352
Mean cluster 4	2.70	3.44	2.84	3.26	4.85	4.70	4.06	3.17	3.80	0.56	0.54	1.10
CV	0.742	0.714	0.506	0.444	0.466	0.682	0.700	0.314	0.434	-0.298	-0.010	-0.308
Share of tax mix:												
Mean OECD-29	7.63	7.77	7.74	7.91	9.44	9.78	8.05	7.95	8.47	0.28	0.56	0.84
CV	0.664	0.676	0.608	0.522	0.500	0.515	0.574	0.399	0.480	-0.142	-0.042	-0.184
Mean EU-22	5.31	5.64	6.25	6.92	7.99	7.87	6.42	6.88	7.29	1.61	0.37	1.98
CV	0.654	0.691	0.555	0.569	0.465	0.348	0.439	0.358	0.423	-0.085	-0.146	-0.231
Mean EU-15	5.31	5.64	6.25	6.64	8.93	8.12	6.71	6.89	7.80	1.33	1.16	2.49
CV	0.654	0.691	0.555	0.559	0.433	0.361	0.437	0.333	0.412	-0.095	-0.147	-0.242
Mean CEE-7				7.52	5.96	7.34	5.79	6.87	6.21		-1.31	
CV				0.617	0.424	0.327	0.460	0.437	0.432		-0.185	
Mean cluster 1	8.25	7.49	7.55	9.07	11.18	11.96	9.80	10.44	11.35	0.82	2.28	3.10
CV	0.443	0.450	0.484	0.401	0.459	0.394	0.472	0.318	0.448	-0.042	0.047	0.005
Mean cluster 2				7.58	7.28	7.78	6.38	7.00	6.45		-1.13	
CV				0.531	0.469	0.295	0.408	0.391	0.407		-0.124	
Mean cluster 3	7.93	7.86	8.75	6.78	8.35	8.68	6.43	6.84	7.43	-1.15	0.65	-0.50
CV	0.866	0.835	0.794	0.717	0.431	0.483	0.417	0.427	0.353	-0.149	-0.364	-0.513
Mean cluster 4	7.31	8.70	7.36	8.15	11.40	11.11	9.85	7.65	9.09	0.84	0.94	1.78
CV	0.746	0.722	0.637	0.575	0.519	0.695	0.712	0.391	0.482	-0.171	-0.093	-0.264

Source: OECD Revenue Statistics (OECD, 2019), and own calculations
Note: for Greece, 2017 data are used in the 2018 column

Table A3.3. Mean and σ-convergence tests of social security contributions and payroll taxation (% GDP and share of tax mix), 1980-2018

	1980	1985	1990	1995	2000	2005	2010	2015	2018	Change 1980-1995	Change 1995-2018	Change 1980-2018
% GDP:												
Mean OECD-29	8.15	8.71	8.79	10.22	9.90	9.74	10.02	10.24	10.41	2.07	0.19	2.26
CV	0.619	0.607	0.596	0.506	0.492	0.487	0.470	0.481	0.477	-0.113	-0.029	-0.142
Mean EU-22	9.74	10.46	10.42	11.76	11.38	11.13	11.44	11.60	11.82	2.02	0.06	2.08
CV	0.512	0.497	0.498	0.399	0.380	0.382	0.355	0.374	0.366	-0.113	-0.033	-0.146
Mean EU-15	9.74	10.46	10.42	10.92	10.67	10.61	11.03	11.17	11.23	1.18	0.31	1.49
CV	0.512	0.497	0.498	0.491	0.466	0.454	0.428	0.453	0.444	-0.021	-0.047	-0.068
Mean CEE-7				13.55	12.89	12.26	12.31	12.53	13.08		-0.47	
CV				0.153	0.154	0.214	0.172	0.173	0.170		0.017	
Mean cluster 1	3.31	3.64	3.72	3.81	3.64	3.78	4.00	3.84	3.87	0.50	0.06	0.56
CV	0.754	0.717	0.660	0.627	0.665	0.645	0.607	0.617	0.627	-0.127	0.000	-0.127
Mean cluster 2				12.39	12.03	11.63	11.74	11.92	12.52		0.13	
CV				0.237	0.206	0.229	0.190	0.190	0.182		-0.055	
Mean cluster 3	12.98	13.96	13.46	14.25	13.78	13.41	13.93	14.49	14.58	1.27	0.33	1.60
CV	0.288	0.295	0.290	0.272	0.219	0.213	0.193	0.194	0.169	-0.016	-0.103	-0.119
Mean cluster 4	9.13	9.50	10.22	10.37	10.11	10.14	10.49	10.82	10.67	1.24	0.30	1.54
CV	0.476	0.448	0.465	0.469	0.456	0.467	0.455	0.449	0.452	-0.007	-0.017	-0.024
Share of tax mix:												
Mean OECD-29	25.10	25.09	24.60	28.22	27.43	27.50	28.96	28.18	28.28	3.12	0.06	3.18
CV	0.561	0.541	0.520	0.446	0.465	0.451	0.429	0.434	0.435	-0.115	-0.011	-0.126
Mean EU-22	29.57	29.31	28.36	31.61	30.85	30.73	32.24	31.19	31.31	2.04	-0.30	1.74
CV	0.457	0.440	0.433	0.353	0.364	0.352	0.320	0.334	0.335	-0.104	-0.018	-0.122
Mean EU-15	29.57	29.31	28.36	29.05	27.30	27.87	29.65	28.44	28.19	-0.52	-0.86	-1.38
CV	0.457	0.440	0.433	0.431	0.430	0.419	0.377	0.391	0.389	-0.026	-0.042	-0.068
Mean CEE-7				37.09	38.47	36.85	37.78	37.09	37.99		0.90	
CV				0.113	0.119	0.138	0.143	0.152	0.141		0.028	
Mean cluster 1	11.26	12.05	12.17	12.69	11.45	12.27	14.12	13.18	13.37	1.43	0.68	2.11
CV	0.736	0.733	0.699	0.655	0.700	0.698	0.637	0.633	0.657	-0.081	0.002	-0.079
Mean cluster 2				35.29	36.12	35.35	36.32	34.97	35.87		0.58	
CV				0.149	0.173	0.159	0.157	0.186	0.176		0.027	
Mean cluster 3	38.85	39.12	36.94	39.32	37.70	37.40	39.44	38.20	37.80	0.47	-1.52	-1.05
CV	0.181	0.143	0.170	0.107	0.058	0.078	0.055	0.068	0.070	-0.074	-0.037	-0.111
Mean cluster 4	24.77	23.93	25.19	25.16	23.42	24.17	25.38	25.84	25.27	0.39	0.11	0.50
CV	0.490	0.455	0.446	0.449	0.434	0.457	0.449	0.435	0.440	-0.041	-0.009	-0.050

Source: OECD Revenue Statistics (OECD, 2019), and own calculations
Note: for Japan and Greece, 2017 data are used in the 2018 column

Table A3.4. Mean and σ-convergence tests of property taxation (% GDP and share of tax mix), 1980-2018

	1980	1985	1990	1995	2000	2005	2010	2015	2018	Change 1980-1995	Change 1995-2018	Change 1980-2018
% GDP:												
Mean OECD-29	1.63	1.72	1.91	1.65	1.81	1.85	1.75	1.95	1.95	0.02	0.30	0.32
CV	0.551	0.528	0.423	0.572	0.570	0.575	0.602	0.601	0.620	0.021	0.048	0.069
Mean EU-22	1.27	1.34	1.59	1.35	1.56	1.60	1.44	1.68	1.67	0.08	0.32	0.40
CV	0.465	0.422	0.409	0.561	0.606	0.612	0.618	0.656	0.689	0.096	0.128	0.224
Mean EU-15	1.27	1.34	1.59	1.66	1.94	2.01	1.77	2.10	2.12	0.39	0.46	0.85
CV	0.465	0.422	0.409	0.417	0.463	0.446	0.491	0.510	0.525	-0.048	0.108	0.060
Mean CEE-7				0.67	0.75	0.72	0.73	0.78	0.71		0.04	
CV				0.490	0.491	0.574	0.530	0.559	0.547		0.057	
Mean cluster 1	2.50	2.52	2.62	2.61	2.71	2.81	2.71	2.75	2.74	0.11	0.13	0.24
CV	0.324	0.355	0.236	0.288	0.279	0.264	0.347	0.365	0.379	-0.036	0.091	0.055
Mean cluster 2				0.82	1.00	0.90	0.87	1.09	1.05		0.23	
CV				0.544	0.683	0.601	0.527	0.777	0.821		0.277	
Mean cluster 3	1.44	1.67	1.78	1.84	1.88	2.04	1.83	2.04	2.05	0.40	0.21	0.61
CV	0.293	0.403	0.390	0.557	0.537	0.570	0.638	0.643	0.624	0.264	0.067	0.331
Mean cluster 4	1.21	1.28	1.58	1.61	1.88	1.95	1.85	2.16	2.22	0.40	0.61	1.01
CV	0.605	0.403	0.422	0.344	0.524	0.440	0.432	0.480	0.518	-0.261	0.174	-0.087
Share of tax mix:												
Mean OECD-29	5.24	5.26	5.67	4.94	5.20	5.36	5.32	5.57	5.50	-0.30	0.56	0.26
CV	0.577	0.591	0.505	0.670	0.620	0.622	0.663	0.624	0.642	0.093	-0.028	0.065
Mean EU-22	3.86	3.79	4.45	3.73	4.21	4.32	3.99	4.45	4.33	-0.13	0.60	0.47
CV	0.425	0.432	0.443	0.595	0.605	0.585	0.561	0.600	0.622	0.170	0.027	0.197
Mean EU-15	3.86	3.79	4.45	4.59	5.11	5.30	4.81	5.45	5.40	0.73	0.81	1.54
CV	0.425	0.432	0.443	0.460	0.495	0.446	0.451	0.473	0.475	0.035	0.015	0.050
Mean CEE-7				1.90	2.29	2.22	2.25	2.31	2.05		0.15	
CV				0.553	0.534	0.600	0.528	0.559	0.546		-0.007	
Mean cluster 1	8.44	8.36	8.40	8.53	8.42	8.90	9.44	9.21	9.14	0.09	0.61	0.70
CV	0.281	0.311	0.270	0.307	0.273	0.312	0.341	0.333	0.351	0.026	0.044	0.070
Mean cluster 2				2.49	3.05	2.81	2.72	3.14	2.93		0.44	
CV				0.660	0.686	0.620	0.531	0.732	0.754		0.094	
Mean cluster 3	4.55	5.06	5.16	5.54	5.49	5.90	5.40	5.49	5.41	0.99	-0.13	0.86
CV	0.424	0.533	0.481	0.684	0.611	0.578	0.638	0.595	0.582	0.260	-0.102	0.158
Mean cluster 4	3.27	3.17	3.95	3.99	4.50	4.65	4.46	5.15	5.24	0.72	1.25	1.97
CV	0.595	0.409	0.531	0.446	0.641	0.495	0.454	0.502	0.529	-0.149	0.083	-0.066

Source: OECD Revenue Statistics (OECD, 2019), and own calculations
Note: for Greece, 2017 data are used in the 2018 column

Table A3.5. Mean and σ-convergence tests of general consumption taxation (% GDP and share of tax mix), 1980-2018

	1980	1985	1990	1995	2000	2005	2010	2015	2018	Change 1980-1995	Change 1995-2018	Change 1980-2018
% GDP:												
Mean OECD-29	4.95	5.44	6.11	6.69	6.85	7.05	6.87	7.18	7.35	1.74	0.66	2.40
CV	0.512	0.452	0.371	0.344	0.284	0.279	0.290	0.282	0.284	-0.168	-0.060	-0.228
Mean EU-22	5.76	6.34	6.85	7.31	7.42	7.67	7.44	7.68	7.88	1.55	0.57	2.12
CV	0.375	0.304	0.238	0.237	0.181	0.173	0.176	0.197	0.190	-0.138	-0.047	-0.185
Mean EU-15	5.76	6.34	6.85	6.90	7.29	7.51	7.22	7.33	7.52	1.14	0.62	1.76
CV	0.375	0.304	0.238	0.222	0.183	0.188	0.158	0.177	0.190	-0.153	-0.032	-0.185
Mean CEE-7				8.20	7.69	8.00	7.91	8.45	8.67		0.47	
CV				0.234	0.184	0.142	0.203	0.209	0.165		-0.069	
Mean cluster 1	3.95	4.74	5.63	5.66	6.01	6.22	5.49	5.61	5.69	1.71	0.03	1.74
CV	0.594	0.557	0.507	0.494	0.456	0.469	0.447	0.468	0.491	-0.100	-0.003	-0.103
Mean cluster 2				7.80	7.55	7.90	7.80	8.35	8.64		0.84	
CV				0.236	0.170	0.134	0.181	0.188	0.144		-0.092	
Mean cluster 3	5.12	5.48	5.75	5.63	6.09	6.10	6.04	6.47	6.56	0.51	0.93	1.44
CV	0.644	0.581	0.434	0.407	0.325	0.306	0.312	0.185	0.192	-0.237	-0.215	-0.452
Mean cluster 4	6.32	6.64	6.96	7.18	7.44	7.60	7.75	7.86	8.02	0.86	0.84	1.70
CV	0.291	0.232	0.257	0.257	0.196	0.188	0.173	0.171	0.185	-0.034	-0.072	-0.106
Share of tax mix:												
Mean OECD-29	14.61	15.48	17.21	18.55	18.95	19.76	19.91	20.04	20.19	3.94	1.64	5.58
CV	0.422	0.408	0.353	0.325	0.265	0.259	0.258	0.262	0.267	-0.097	-0.058	-0.155
Mean EU-22	16.96	17.80	19.05	19.95	20.18	21.22	21.07	20.89	21.13	2.99	1.18	4.17
CV	0.279	0.286	0.264	0.257	0.200	0.195	0.172	0.203	0.208	-0.022	-0.049	-0.071
Mean EU-15	16.96	17.80	19.05	18.72	18.90	19.77	19.63	19.00	19.19	1.76	0.47	2.23
CV	0.279	0.286	0.264	0.247	0.202	0.192	0.148	0.149	0.157	-0.032	-0.090	-0.122
Mean CEE-7				22.58	22.92	24.35	24.18	24.95	25.29		2.71	
CV				0.244	0.139	0.127	0.128	0.160	0.162		-0.082	
Mean cluster 1	13.20	15.55	17.46	17.91	18.30	18.63	18.63	18.39	18.33	4.71	0.42	5.13
CV	0.590	0.576	0.491	0.468	0.411	0.376	0.395	0.400	0.397	-0.122	-0.071	-0.193
Mean cluster 2				22.52	22.71	24.30	24.08	24.42	24.81		2.29	
CV				0.213	0.134	0.121	0.113	0.155	0.153		-0.060	
Mean cluster 3	13.98	14.61	15.51	15.17	16.36	16.72	16.78	17.09	16.97	1.19	1.80	2.99
CV	0.563	0.518	0.369	0.321	0.222	0.215	0.223	0.120	0.132	-0.242	-0.189	-0.431
Mean cluster 4	16.53	16.32	16.74	16.99	16.98	17.66	18.49	18.58	18.88	0.46	1.89	2.35
CV	0.216	0.175	0.187	0.192	0.134	0.119	0.142	0.159	0.175	-0.024	-0.017	-0.041

Source: OECD Revenue Statistics (OECD, 2019), and own calculations
Note: for Greece, 2017 data are used in the 2018 column

Table A3.6. Mean and σ-convergence tests of specific consumption taxation (% GDP and share of tax mix), 1980-2018

	1980	1985	1990	1995	2000	2005	2010	2015	2018	Change 1980-1995	Change 1995-2018	Change 1980-2018
% GDP:												
Mean OECD-29	4.55	4.68	4.08	4.25	3.78	3.54	3.39	3.34	3.26	-0.30	-0.99	-1.29
CV	0.408	0.353	0.308	0.331	0.235	0.231	0.247	0.277	0.278	-0.077	-0.053	-0.130
Mean EU-22	4.67	4.78	4.28	4.46	4.00	3.79	3.66	3.62	3.55	-0.21	-0.91	-1.12
CV	0.432	0.339	0.268	0.305	0.183	0.178	0.189	0.226	0.224	-0.127	-0.081	-0.208
Mean EU-15	4.67	4.78	4.28	4.33	3.90	3.73	3.43	3.40	3.38	-0.34	-0.95	-1.29
CV	0.432	0.339	0.268	0.207	0.192	0.212	0.167	0.223	0.247	-0.225	0.040	-0.185
Mean CEE-7				4.73	4.22	3.91	4.15	4.09	3.91		-0.82	
CV				0.447	0.166	0.085	0.168	0.192	0.155		-0.292	
Mean cluster 1	5.30	5.02	4.11	3.80	3.38	3.06	2.73	2.52	2.40	-1.50	-1.40	-2.90
CV	0.473	0.390	0.352	0.291	0.291	0.272	0.253	0.231	0.254	-0.182	-0.037	-0.219
Mean cluster 2				4.85	4.21	3.93	4.13	4.15	4.04		-0.81	
CV				0.384	0.152	0.144	0.149	0.168	0.145		-0.239	
Mean cluster 3	3.21	3.39	3.09	3.27	3.09	3.02	2.77	2.89	2.84	0.06	-0.43	-0.37
CV	0.167	0.125	0.172	0.180	0.171	0.174	0.174	0.215	0.263	0.013	0.083	0.096
Mean cluster 4	4.61	5.03	4.59	4.76	4.22	3.97	3.62	3.50	3.48	0.15	-1.28	-1.13
CV	0.341	0.317	0.224	0.212	0.210	0.222	0.154	0.236	0.212	-0.129	0.000	-0.129
Share of tax mix:												
Mean OECD-29	14.76	14.21	11.85	11.98	10.59	10.05	9.98	9.37	9.03	-2.78	-2.95	-5.73
CV	0.497	0.437	0.366	0.317	0.235	0.238	0.245	0.256	0.242	-0.180	-0.075	-0.255
Mean EU-22	15.08	14.33	12.24	12.21	10.93	10.53	10.45	9.87	9.48	-2.87	-2.73	-5.60
CV	0.563	0.495	0.390	0.323	0.215	0.221	0.230	0.238	0.231	-0.240	-0.092	-0.332
Mean EU-15	15.08	14.33	12.24	11.96	10.18	9.88	9.39	8.83	8.59	-3.12	-3.37	-6.49
CV	0.563	0.495	0.390	0.302	0.232	0.242	0.213	0.204	0.216	-0.261	-0.086	-0.347
Mean CEE-7				12.73	12.56	11.94	12.72	12.09	11.38		-1.35	
CV				0.382	0.106	0.126	0.115	0.149	0.141		-0.241	
Mean cluster 1	18.05	16.58	13.02	12.33	10.49	9.46	9.46	8.48	7.98	-5.72	-4.35	-10.07
CV	0.482	0.394	0.352	0.296	0.291	0.241	0.224	0.209	0.184	-0.186	-0.112	-0.298
Mean cluster 2				13.97	12.66	12.13	12.79	12.12	11.55		-2.42	
CV				0.352	0.116	0.176	0.108	0.129	0.125		-0.227	
Mean cluster 3	9.95	9.92	8.62	9.15	8.53	8.47	7.87	7.60	7.49	-0.80	-1.66	-2.46
CV	0.236	0.218	0.106	0.073	0.071	0.116	0.079	0.140	0.120	-0.163	0.047	-0.116
Mean cluster 4	12.11	12.37	11.20	11.48	9.78	9.33	8.69	8.22	8.18	-0.63	-3.30	-3.93
CV	0.303	0.283	0.210	0.225	0.226	0.230	0.163	0.198	0.203	-0.078	-0.022	-0.100

Source: OECD Revenue Statistics (OECD, 2019), and own calculations
Note: for Greece, 2017 data are used in the 2018 column

Table A3.7. Mean and σ-convergence tests of top statutory personal income tax rates, 1981-2018

	1981	1985	1990	1995	2000	2005	2010	2015	2018	Change 1981-1995	Change 1995-2018	Change 1981-2018
Mean OECD-29	67.84	66.04	52.35	48.54	46.43	43.14	41.98	43.19	43.66	-19.30	-4.88	-24.18
CV	0.142	0.128	0.182	0.200	0.194	0.218	0.255	0.285	0.279	0.058	0.079	0.137
Mean EU-22	67.69	67.09	55.14	48.85	46.41	42.50	40.84	42.10	42.77	-18.85	-6.07	-24.92
CV	0.137	0.107	0.127	0.204	0.214	0.246	0.289	0.321	0.312	0.067	0.108	0.175
Mean EU-15	67.69	67.09	55.51	53.31	51.06	47.14	47.51	49.68	50.18	-14.39	-3.13	-17.52
CV	0.137	0.107	0.128	0.120	0.123	0.137	0.103	0.086	0.083	-0.017	-0.037	-0.053
Mean CEE-7				39.29	36.43	32.57	26.57	25.86	26.91		-12.37	
CV				0.248	0.251	0.332	0.340	0.468	0.459		0.210	
Mean cluster 1	63.09	59.41	42.74	45.39	44.74	42.79	45.15	45.29	45.20	-17.70	-0.18	-17.88
CV	0.085	0.084	0.205	0.147	0.084	0.085	0.111	0.125	0.138	0.062	-0.009	0.053
Mean cluster 2				40.00	37.78	34.22	30.76	31.94	32.93		-7.07	
CV				0.217	0.223	0.290	0.371	0.503	0.487		0.270	
Mean cluster 3	67.46	67.65	56.45	57.11	52.39	48.06	47.35	49.99	50.80	-10.34	-6.32	-16.66
CV	0.180	0.147	0.082	0.076	0.086	0.061	0.094	0.079	0.087	-0.104	0.011	-0.093
Mean cluster 4	70.99	69.27	59.52	55.31	54.15	50.75	48.63	49.73	49.79	-15.68	-5.51	-21.19
CV	0.118	0.107	0.103	0.098	0.102	0.138	0.125	0.106	0.098	-0.020	0.000	-0.020

Source: OECD Revenue Statistics (OECD, 2019), and own calculations

Table A3.8. Mean and σ-convergence tests of top statutory corporate income tax rates, 1982-2018

	1982	1985	1990	1995	2000	2005	2010	2015	2018	Change 1982-1995	Change 1995-2018	Change 1982-2018
Mean OECD-29	50.11	50.19	41.34	36.54	33.18	28.15	25.96	25.19	23.76	-13.57	-12.78	-26.35
CV	0.154	0.147	0.137	0.212	0.210	0.264	0.256	0.261	0.240	0.058	0.028	0.086
Mean EU-22	50.04	51.00	41.50	36.24	32.47	26.47	24.03	23.99	23.03	-13.80	-13.21	-27.01
CV	0.190	0.166	0.126	0.222	0.226	0.282	0.248	0.269	0.263	0.032	0.041	0.073
Mean EU-15	50.04	51.00	41.70	37.80	35.36	29.23	26.45	26.45	25.31	-12.24	-12.49	-24.73
CV	0.190	0.166	0.133	0.213	0.188	0.240	0.214	0.239	0.217	0.023	0.004	0.027
Mean CEE-7				32.90	26.29	20.57	18.86	18.71	18.14		-14.76	
CV				0.228	0.167	0.215	0.099	0.118	0.226		-0.002	
Mean cluster 1	49.34	47.33	39.12	36.53	33.25	28.14	26.73	25.17	23.16	-12.81	-13.37	-26.18
CV	0.047	0.086	0.114	0.106	0.186	0.337	0.329	0.340	0.268	0.059	0.162	0.221
Mean cluster 2				34.43	28.80	22.61	20.28	21.06	20.83		-13.60	
CV				0.209	0.222	0.252	0.163	0.239	0.309		0.100	
Mean cluster 3	51.56	51.34	42.30	41.21	39.04	34.06	30.66	29.65	28.18	-10.35	-13.03	-23.38
CV	0.209	0.211	0.222	0.233	0.170	0.155	0.181	0.166	0.137	0.024	-0.096	-0.072
Mean cluster 4	49.70	52.13	43.56	35.24	33.70	30.23	28.47	26.71	24.34	-14.46	-10.90	-25.36
CV	0.189	0.128	0.093	0.269	0.173	0.132	0.113	0.192	0.144	0.080	-0.125	-0.045

Source: OECD Revenue Statistics (OECD, 2019), and own calculations. Note: data for Luxembourg and Iceland are missing before 1990.

Table A3.9. β-convergence of total taxation (% GDP), 1980-2018

	OECD-30	EU-23	EU-16	CEE-7 (1995-2018)	Cluster 1	Cluster 2 (1995-2018)	Cluster 3	Cluster 4
β	-0.051***	-0.065***	-0.065***	-0.077	-0.001	-0.142***	-0.052**	-0.085***
	(0.017)	(0.021)	(0.021)	(0.061)	(0.112)	(0.043)	(0.021)	(0.031)
Intercept	2.128***	2.775***	2.775***	2.550	0.263	5.036***	2.239***	3.628***
	(0.571)	(0.721)	(0.721)	(2.254)	(3.307)	(1.506)	(0.717)	(1.204)
Observations	857	584	584	164	272	212	234	273
R-squared	0.010	0.016	0.016	0.010	0.000	0.050	0.026	0.026

Note: growth rates are multiplied by 100. Standard errors in parentheses. *** p<0.01; ** p<0.05; * p<0.1.

Table A3.10. β-convergence of personal income taxation (% GDP), 1980-2018

	OECD-30	EU-23	EU-16	CEE-7 (1995-2018)	Cluster 1	Cluster 2 (1995-2018)	Cluster 3	Cluster 4
β	-0.163***	-0.169***	-0.169***	-0.472*	-0.188**	-0.724**	-0.327**	-0.086
	(0.044)	(0.053)	(0.053)	(0.285)	(0.090)	(0.289)	(0.165)	(0.057)
Intercept	2.183***	2.432***	2.432***	2.474	2.365**	4.345**	3.237**	1.256
	(0.509)	(0.602)	(0.602)	(1.771)	(1.052)	(1.700)	(1.319)	(0.814)
Observations	818	545	545	164	272	212	234	273
R-squared	0.016	0.018	0.018	0.017	0.016	0.029	0.017	0.008

Note: growth rates are multiplied by 100. Standard errors in parentheses. *** p<0.01; ** p<0.05; * p<0.1.

Table A3.11. β-convergence of personal income taxation (% total revenues), 1980-2018

	OECD-30	EU-23	EU-16	CEE-7 (1995-2018)	Cluster 1	Cluster 2 (1995-2018)	Cluster 3	Cluster 4
β	-0.040**	-0.051**	-0.051**	-0.169*	-0.056**	-0.193*	-0.124*	-0.006
	(0.016)	(0.024)	(0.024)	(0.098)	(0.026)	(0.099)	(0.069)	(0.024)
Intercept	1.315**	1.673**	1.673**	2.703	2.220**	3.292**	3.057*	-0.111
	(0.535)	(0.720)	(0.720)	(1.672)	(1.043)	(1.662)	(1.600)	(0.875)
Observations	818	545	545	164	272	212	234	273
R-squared	0.008	0.008	0.008	0.018	0.016	0.018	0.014	0.000

Note: growth rates are multiplied by 100. Standard errors in parentheses. *** p<0.01; ** p<0.05; * p<0.1.

Table A3.12. β-convergence of corporate income taxation (% GDP), 1980-2018

VARIABLES	OECD-30	EU-23	EU-16	CEE-7 (1995-2018)	Cluster 1	Cluster 2 (1995-2018)	Cluster 3	Cluster 4
β	-0.698	-1.235	-1.235	-1.358	-1.880*	-1.416*	-0.670	-0.465
	(0.501)	(0.832)	(0.832)	(0.840)	(1.126)	(0.837)	(0.695)	(0.905)
Intercept	4.554***	5.659***	5.659***	4.773*	6.773**	5.240**	3.610*	5.180*
	(1.420)	(1.790)	(1.790)	(2.701)	(2.903)	(2.529)	(1.935)	(2.962)
Observations	818	545	545	164	272	212	234	273
R-squared	0.002	0.004	0.004	0.016	0.010	0.013	0.004	0.001

Note: growth rates are multiplied by 100. Standard errors in parentheses. *** p<0.01; ** p<0.05; * p<0.1.

Table A3.13. β-convergence of corporate income taxation (% total revenues), 1980-2018

VARIABLES	OECD-30	EU-23	EU-16	CEE-7 (1995-2018)	Cluster 1	Cluster 2 (1995-2018)	Cluster 3	Cluster 4
β	-0.264*	-0.439	-0.439	-0.525*	-0.532*	-0.522*	-0.171	-0.250
	(0.144)	(0.284)	(0.284)	(0.313)	(0.291)	(0.313)	(0.147)	(0.328)
Intercept	4.343***	5.183***	5.183***	5.135*	6.365**	5.277**	2.718*	5.223*
	(1.307)	(1.786)	(1.786)	(2.712)	(2.594)	(2.652)	(1.487)	(2.915)
Observations	818	545	545	164	272	212	234	273
R-squared	0.004	0.004	0.004	0.017	0.012	0.013	0.006	0.002

Note: growth rates are multiplied by 100. Standard errors in parentheses. *** p<0.01; ** p<0.05; * p<0.1.

Table A3.14. β-convergence of social security contributions and payroll taxation (% GDP), 1980-2018

VARIABLES	OECD-30	EU-23	EU-16	CEE-7 (1995-2018)	Cluster 1	Cluster 2 (1995-2018)	Cluster 3	Cluster 4
β	-0.280***	-0.414***	-0.414***	-0.082	-0.252	-0.186**	-0.123**	-0.983***
	(0.078)	(0.103)	(0.103)	(0.163)	(0.186)	(0.094)	(0.056)	(0.250)
Intercept	3.654***	5.540***	5.540***	0.944	1.762**	2.437**	2.057***	11.312***
	(0.759)	(1.123)	(1.123)	(2.234)	(0.811)	(1.188)	(0.752)	(2.496)
Observations	818	584	584	164	233	212	234	273
R-squared	0.016	0.027	0.027	0.002	0.008	0.018	0.020	0.054

Note: growth rates are multiplied by 100. Standard errors in parentheses. *** p<0.01; ** p<0.05; * p<0.1.

Table A3.15. β-convergence of social security contributions and payroll taxation (% total revenues), 1980-2018

VARIABLES	OECD-30	EU-23	EU-16	CEE-7 (1995-2018)	Cluster 1	Cluster 2 (1995-2018)	Cluster 3	Cluster 4
β	-0.121***	-0.178***	-0.178***	-0.057	-0.054	-0.023	-0.085***	-0.351***
	(0.028)	(0.038)	(0.038)	(0.072)	(0.062)	(0.048)	(0.030)	(0.088)
Intercept	4.000***	6.235***	6.235***	2.241	1.387	0.882	3.291***	10.620***
	(0.822)	(1.217)	(1.217)	(2.696)	(0.911)	(1.691)	(1.198)	(2.392)
Observations	818	584	584	164	233	212	234	273
R-squared	0.022	0.037	0.037	0.004	0.003	0.001	0.032	0.055

Note: growth rates are multiplied by 100. Standard errors in parentheses. *** p<0.01; ** p<0.05; * p<0.1.

Table A3.16. β-convergence of property taxation (% GDP), 1980-2018

VARIABLES	OECD-30	EU-23	EU-16	CEE-7 (1995-2018)	Cluster 1	Cluster 2 (1995-2018)	Cluster 3	Cluster 4
β	-0.854	0.047	0.047	0.036	-3.051	3.619**	0.903	-1.601
	(1.171)	(2.624)	(2.624)	(2.319)	(4.074)	(1.805)	(1.212)	(1.224)
Intercept	3.738*	3.053	3.053	0.469	10.742	-1.445	-0.600	4.301**
	(2.168)	(3.654)	(3.654)	(1.722)	(10.626)	(1.662)	(1.806)	(1.698)
Observations	857	584	584	164	272	212	234	273
R-squared	0.001	0.000	0.000	0.000	0.002	0.019	0.002	0.006

Note: growth rates are multiplied by 100. Standard errors in parentheses. *** p<0.01; ** p<0.05; * p<0.1.

Table A3.17. β-convergence of property taxation (% total revenues), 1980-2018

VARIABLES	OECD-30	EU-23	EU-16	CEE-7 (1995-2018)	Cluster 1	Cluster 2 (1995-2018)	Cluster 3	Cluster 4
β	-0.158	0.249	0.249	-0.269	-0.693	0.607	0.179	-0.544
	(0.246)	(0.665)	(0.665)	(0.749)	(0.934)	(0.469)	(0.252)	(0.433)
Intercept	2.379	1.090	1.090	1.318	7.823	-0.074	-0.597	3.688**
	(1.481)	(2.770)	(2.770)	(1.599)	(8.155)	(1.384)	(1.229)	(1.616)
Observations	857	584	584	164	272	212	234	273
R-squared	0.000	0.000	0.000	0.001	0.002	0.008	0.002	0.006

Note: growth rates are multiplied by 100. Standard errors in parentheses. *** p<0.01; ** p<0.05; * p<0.1.

Table A3.18. β-convergence of general consumption taxation (% GDP), 1980-2018

VARIABLES	OECD-30	EU-23	EU-16	CEE-7 (1995-2018)	Cluster 1	Cluster 2 (1995-2018)	Cluster 3	Cluster 4
β	-0.460***	-0.480***	-0.480***	-0.429*	-0.255	-0.443**	-0.663***	-0.321**
	(0.099)	(0.134)	(0.134)	(0.240)	(0.207)	(0.212)	(0.155)	(0.157)
Intercept	3.664***	3.826***	3.826***	3.897*	2.375**	4.049**	4.836***	2.857***
	(0.553)	(0.819)	(0.819)	(2.002)	(0.928)	(1.692)	(0.941)	(1.024)
Observations	847	584	584	164	272	212	224	273
R-squared	0.025	0.022	0.022	0.019	0.006	0.020	0.076	0.015

Note: growth rates are multiplied by 100. Standard errors in parentheses. *** p<0.01; ** p<0.05; * p<0.1.

Table A3.19. β-convergence of general consumption taxation (% total revenues), 1980-2018

VARIABLES	OECD-30	EU-23	EU-16	CEE-7 (1995-2018)	Cluster 1	Cluster 2 (1995-2018)	Cluster 3	Cluster 4
β	-0.164***	-0.114**	-0.114**	-0.144*	-0.092	-0.138*	-0.271***	-0.121
	(0.039)	(0.057)	(0.057)	(0.077)	(0.060)	(0.074)	(0.061)	(0.079)
Intercept	3.351***	2.444**	2.444**	3.912**	2.433***	3.631**	4.817***	2.450*
	(0.615)	(1.005)	(1.005)	(1.767)	(0.903)	(1.704)	(0.983)	(1.340)
Observations	847	584	584	164	272	212	224	273
R-squared	0.021	0.007	0.007	0.021	0.008	0.016	0.081	0.009

Note: growth rates are multiplied by 100. Standard errors in parentheses. *** p<0.01; ** p<0.05; * p<0.1.

Table A3.20. β-convergence of specific consumption taxation (% GDP), 1980-2018

VARIABLES	OECD-30	EU-23	EU-16	CEE-7 (1995-2018)	Cluster 1	Cluster 2 (1995-2018)	Cluster 3	Cluster 4
β	-0.005***	-0.006***	-0.006***	-0.009*	-0.004**	-0.009**	-0.019**	-0.006**
	(0.001)	(0.001)	(0.001)	(0.005)	(0.002)	(0.004)	(0.008)	(0.002)
Intercept	0.015**	0.022***	0.022***	0.044*	0.004	0.045*	0.059**	0.023*
	(0.006)	(0.007)	(0.007)	(0.026)	(0.010)	(0.023)	(0.026)	(0.012)
Observations	857	584	584	164	272	212	234	273
R-squared	0.018	0.028	0.028	0.019	0.019	0.020	0.023	0.021

Note: growth rates are multiplied by 100. Standard errors in parentheses. *** p<0.01; ** p<0.05; * p<0.1.

Table A3.21. β-convergence of specific consumption taxation (% total revenues), 1980-2018

VARIABLES	OECD-30	EU-23	EU-16	CEE-7 (1995-2018)	Cluster 1	Cluster 2 (1995-2018)	Cluster 3	Cluster 4
β	-0.110***	-0.112***	-0.112***	-0.381*	-0.107**	-0.382**	-0.278	-0.163
	(0.029)	(0.031)	(0.031)	(0.210)	(0.049)	(0.164)	(0.173)	(0.100)
Intercept	0.528	0.748	0.748	5.282*	0.226	5.274**	2.275	1.181
	(0.478)	(0.539)	(0.539)	(2.856)	(0.969)	(2.432)	(1.763)	(1.264)
Observations	857	584	584	164	272	212	234	273
R-squared	0.016	0.021	0.021	0.020	0.017	0.025	0.011	0.010

Note: growth rates are multiplied by 100. Standard errors in parentheses. *** p<0.01; ** p<0.05; * p<0.1.

Table A3.22. β-convergence of top statutory personal income tax rates, 1981-2018

VARIABLES	OECD-30	EU-23	EU-16	CEE-7 (1995-2018)	Cluster 1	Cluster 2 (1995-2018)	Cluster 3	Cluster 4
β	-0.020	-0.023	-0.023	-0.070	-0.022	-0.049	-0.022	-0.016
	(0.018)	(0.021)	(0.021)	(0.072)	(0.076)	(0.065)	(0.025)	(0.028)
Intercept	0.642	0.918	0.918	1.501	0.691	1.225	0.855	0.250
	(1.229)	(1.437)	(1.437)	(2.906)	(4.823)	(2.640)	(1.702)	(1.964)
Observations	810	538	538	174	233	224	231	269
R-squared	0.002	0.002	0.002	0.005	0.000	0.003	0.003	0.001

Note: growth rates are multiplied by 100. Standard errors in parentheses. *** p<0.01; ** p<0.05; * p<0.1.

Table A3.23. β-convergence of top statutory corporate income tax rates, 1982-2018

	OECD-30	EU-23	EU-16	CEE-7 (1995-2018)	Cluster 1	Cluster 2 (1995-2018)	Cluster 3	Cluster 4
β	-0.057**	-0.054*	-0.054*	-0.120	-0.237	-0.069	-0.040	-0.077
	(0.029)	(0.030)	(0.030)	(0.086)	(0.177)	(0.076)	(0.037)	(0.050)
Intercept	1.264	1.143	1.143	1.891	9.927	0.582	0.646	2.169
	(1.449)	(1.540)	(1.540)	(2.907)	(8.749)	(2.686)	(1.956)	(2.535)
Observations	756	491	491	174	228	224	227	226
R-squared	0.005	0.006	0.006	0.011	0.008	0.004	0.005	0.010

Note: growth rates are multiplied by 100. Standard errors in parentheses. *** p<0.01; ** p<0.05; * p<0.1.

Table A3.24. Distance of clusters 2, 3 and 4 to cluster 1 in terms of total taxation (% GDP), 1995-2018

	1995	2000	2005	2010	2015	2018	Change 1995-2018
Mean:							
Cluster 1	30.99	32.23	32.33	28.82	29.88	30.16	
Cluster 2	34.82	33.20	32.64	32.29	34.14	34.93	
Cluster 3	35.70	36.31	35.70	35.25	37.77	38.50	
Cluster 4	41.81	43.51	42.77	41.79	42.34	42.49	
Distance to cluster 2:							
Cluster 1	3.83	0.97	0.31	3.47	4.26	4.78	0.95
Cluster 3	0.88	3.11	3.06	2.96	3.63	3.56	2.68
Cluster 4	6.99	10.31	10.13	9.50	8.20	7.56	0.57
Distance to cluster 2 as a fraction of the mean:							
Cluster 1	0.107	0.027	0.009	0.101	0.119	0.131	0.024
Cluster 3	0.025	0.086	0.086	0.086	0.101	0.098	0.073
Cluster 4	0.195	0.286	0.284	0.276	0.229	0.208	0.013

Table A3.25. Distance of clusters 2, 3 and 4 to cluster 1 in terms of personal income taxation (% GDP), 1995-2018

	1995	2000	2005	2010	2015	2018	Change 1995-2018
Mean:							
Cluster 1	11.19	11.73	11.30	9.91	10.74	10.87	
Cluster 2	5.61	5.18	4.87	4.80	5.16	5.32	
Cluster 3	7.27	7.27	6.98	7.38	8.20	8.47	
Cluster 4	13.79	13.66	12.96	12.62	13.53	13.11	
Distance to cluster 2:							
Cluster 1	5.58	6.55	6.43	5.10	5.58	5.55	-0.03
Cluster 3	1.66	2.10	2.11	2.58	3.04	3.14	1.48
Cluster 4	8.19	8.48	8.09	7.82	8.37	7.78	-0.40
Distance to cluster 2 as a fraction of the mean:							
Cluster 1	0.602	0.709	0.730	0.604	0.609	0.604	0.002
Cluster 3	0.179	0.227	0.240	0.305	0.332	0.342	0.163
Cluster 4	0.883	0.918	0.918	0.925	0.914	0.847	-0.036

Table A3.26. Distance of clusters 2, 3 and 4 to cluster 1 in terms of personal income taxation (% of total revenues), 1995-2018

	1995	2000	2005	2010	2015	2018	Change 1995-2018
Mean:							
Cluster 1	35.92	36.51	34.85	34.46	35.96	36.06	
Cluster 2	16.11	15.65	14.99	14.85	15.15	15.26	
Cluster 3	20.78	20.10	19.51	20.95	21.67	21.91	
Cluster 4	32.28	30.75	29.69	29.87	31.55	30.56	
Distance to cluster 2:							
Cluster 1	19.80	20.86	19.86	19.62	20.82	20.80	1.00
Cluster 3	4.67	4.45	4.52	6.10	6.53	6.65	1.98
Cluster 4	16.17	15.10	14.70	15.02	16.40	15.30	-0.86
Distance to cluster 2 as a fraction of the mean:							
Cluster 1	0.769	0.826	0.819	0.802	0.817	0.821	0.052
Cluster 3	0.181	0.176	0.186	0.249	0.256	0.262	0.081
Cluster 4	0.628	0.598	0.606	0.614	0.644	0.604	-0.024

Table A3.27. Distance of clusters 2, 3 and 4 to cluster 1 in terms of corporate income taxation (% GDP), 1995-2018

	1995	2000	2005	2010	2015	2018	Change 1995-2018
Mean:							
Cluster 1	2.81	3.56	3.81	2.77	3.08	3.39	
Cluster 2	2.64	2.40	2.54	2.03	2.36	2.25	
Cluster 3	2.22	2.88	2.93	2.17	2.48	2.84	
Cluster 4	3.26	4.85	4.70	4.06	3.17	3.80	
Distance to cluster 2:							
Cluster 1	0.17	1.16	1.26	0.74	0.71	1.14	0.97
Cluster 3	0.42	0.48	0.38	0.14	0.11	0.59	0.17
Cluster 4	0.62	2.45	2.15	2.03	0.80	1.55	0.94
Distance to cluster 2 as a fraction of the mean:							
Cluster 1	0.061	0.345	0.366	0.273	0.259	0.377	0.316
Cluster 3	0.152	0.143	0.111	0.050	0.040	0.195	0.043
Cluster 4	0.225	0.726	0.625	0.745	0.292	0.514	0.289

Table A3.28. Distance of clusters 2, 3 and 4 to cluster 1 in terms of corporate income taxation (% of total revenues), 1995-2018

	1995	2000	2005	2010	2015	2018	Change 1995-2018
Mean:							
Cluster 1	9.07	11.18	11.96	9.80	10.44	11.35	
Cluster 2	7.58	7.28	7.78	6.38	7.00	6.45	
Cluster 3	6.78	8.35	8.68	6.43	6.84	7.43	
Cluster 4	8.15	11.40	11.11	9.85	7.65	9.09	
Distance to cluster 2:							
Cluster 1	1.49	3.91	4.18	3.43	3.44	4.90	3.41
Cluster 3	0.81	1.07	0.90	0.05	0.16	0.99	0.18
Cluster 4	0.57	4.12	3.33	3.47	0.66	2.64	2.07
Distance to cluster 2 as a fraction of the mean:							
Cluster 1	0.188	0.414	0.427	0.426	0.433	0.579	0.390
Cluster 3	0.102	0.113	0.092	0.006	0.020	0.117	0.015
Cluster 4	0.072	0.437	0.341	0.431	0.082	0.312	0.240

Table A3.29. Distance of clusters 2, 3 and 4 to cluster 1 in terms of social security contributions and payroll taxation (% GDP), 1995-2018

	1995	2000	2005	2010	2015	2018	Change 1995-2018
Mean:							
Cluster 1	3.81	3.64	3.78	4.00	3.84	3.87	
Cluster 2	12.39	12.03	11.63	11.74	11.92	12.52	
Cluster 3	14.25	13.78	13.41	13.93	14.49	14.58	
Cluster 4	10.37	10.11	10.14	10.49	10.82	10.67	
Distance to cluster 2:							
Cluster 1	8.59	8.39	7.86	7.74	8.08	8.66	0.07
Cluster 3	1.86	1.75	1.78	2.18	2.57	2.06	0.20
Cluster 4	2.03	1.92	1.49	1.25	1.11	1.85	-0.18
Distance to cluster 2 as a fraction of the mean:							
Cluster 1	0.841	0.848	0.806	0.772	0.789	0.831	-0.009
Cluster 3	0.182	0.177	0.182	0.218	0.251	0.197	0.016
Cluster 4	0.198	0.194	0.153	0.125	0.108	0.178	-0.021

Table A3.30. Distance of clusters 2, 3 and 4 to cluster 1 in terms of social security contributions and payroll taxation (% of total revenues), 1995-2018

	1995	2000	2005	2010	2015	2018	Change 1995-2018
Mean:							
Cluster 1	12.69	11.45	12.27	14.12	13.18	13.37	
Cluster 2	35.29	36.12	35.35	36.32	34.97	35.87	
Cluster 3	39.32	37.70	37.40	39.44	38.20	37.80	
Cluster 4	25.16	23.42	24.17	25.38	25.84	25.27	
Distance to cluster 2:							
Cluster 1	22.59	24.66	23.07	22.21	21.79	22.50	-0.09
Cluster 3	4.03	1.58	2.06	3.12	3.23	1.94	-2.09
Cluster 4	10.12	12.70	11.18	10.94	9.13	10.60	0.47
Distance to cluster 2 as a fraction of the mean:							
Cluster 1	0.801	0.899	0.839	0.767	0.773	0.796	-0.005
Cluster 3	0.143	0.058	0.075	0.108	0.115	0.068	-0.074
Cluster 4	0.359	0.463	0.406	0.378	0.324	0.375	0.016

Table A3.31. Distance of clusters 2, 3 and 4 to cluster 1 in terms of property taxation (% GDP), 1995-2018

	1995	2000	2005	2010	2015	2018	Change 1995-2018
Mean:							
Cluster 1	2.61	2.71	2.81	2.71	2.75	2.74	
Cluster 2	0.82	1.00	0.90	0.87	1.09	1.05	
Cluster 3	1.84	1.88	2.04	1.83	2.04	2.05	
Cluster 4	1.61	1.88	1.95	1.85	2.16	2.22	
Distance to cluster 2:							
Cluster 1	1.79	1.71	1.91	1.83	1.66	1.70	-0.10
Cluster 3	1.02	0.88	1.14	0.96	0.96	1.01	-0.02
Cluster 4	0.80	0.88	1.05	0.97	1.07	1.17	0.37
Distance to cluster 2 as a fraction of the mean:							
Cluster 1	1.085	0.946	1.031	1.048	0.852	0.870	-0.215
Cluster 3	0.620	0.487	0.615	0.548	0.491	0.516	-0.104
Cluster 4	0.483	0.489	0.565	0.557	0.552	0.600	0.116

Table A3.32. Distance of clusters 2, 3 and 4 to cluster 1 in terms of property taxation (% of total revenues), 1995-2018

	1995	2000	2005	2010	2015	2018	Change 1995-2018
Mean:							
Cluster 1	8.53	8.42	8.90	9.44	9.21	9.14	
Cluster 2	2.49	3.05	2.81	2.72	3.14	2.93	
Cluster 3	5.54	5.49	5.90	5.40	5.49	5.41	
Cluster 4	3.99	4.50	4.65	4.46	5.15	5.24	
Distance to cluster 2:							
Cluster 1	6.04	5.38	6.09	6.73	6.07	6.21	0.17
Cluster 3	3.04	2.45	3.10	2.69	2.36	2.48	-0.56
Cluster 4	1.49	1.45	1.84	1.74	2.01	2.31	0.82
Distance to cluster 2 as a fraction of the mean:							
Cluster 1	1.222	1.034	1.136	1.265	1.088	1.129	-0.093
Cluster 3	0.616	0.471	0.577	0.505	0.423	0.451	-0.165
Cluster 4	0.302	0.279	0.344	0.328	0.360	0.420	0.118

Table A3.33. Distance of clusters 2, 3 and 4 to cluster 1 in terms of general consumption taxation (% GDP), 1995-2018

	1995	2000	2005	2010	2015	2018	Change 1995-2018
Mean:							
Cluster 1	5.66	6.01	6.22	5.49	5.61	5.69	
Cluster 2	7.80	7.55	7.90	7.80	8.35	8.64	
Cluster 3	5.63	6.09	6.10	6.04	6.47	6.56	
Cluster 4	7.18	7.44	7.60	7.75	7.86	8.02	
Distance to cluster 2:							
Cluster 1	2.15	1.54	1.68	2.31	2.74	2.95	0.80
Cluster 3	2.17	1.45	1.80	1.77	1.88	2.08	-0.09
Cluster 4	0.62	0.11	0.30	0.05	0.49	0.62	0.00
Distance to cluster 2 as a fraction of the mean:							
Cluster 1	0.321	0.225	0.238	0.336	0.381	0.402	0.080
Cluster 3	0.325	0.212	0.256	0.257	0.262	0.283	-0.042
Cluster 4	0.093	0.016	0.043	0.008	0.068	0.084	-0.009

Table A3.34. Distance of clusters 2, 3 and 4 to cluster 1 in terms of general consumption taxation (% of total revenues), 1995-2018

	1995	2000	2005	2010	2015	2018	Change 1995-2018
Mean:							
Cluster 1	17.91	18.30	18.63	18.63	18.39	18.33	
Cluster 2	22.52	22.71	24.30	24.08	24.42	24.81	
Cluster 3	15.17	16.36	16.72	16.78	17.09	16.97	
Cluster 4	16.99	16.98	17.66	18.49	18.58	18.88	
Distance to cluster 2:							
Cluster 1	4.61	4.42	5.67	5.46	6.03	6.48	1.88
Cluster 3	7.35	6.36	7.57	7.30	7.33	7.84	0.49
Cluster 4	5.54	5.74	6.64	5.59	5.85	5.93	0.40
Distance to cluster 2 as a fraction of the mean:							
Cluster 1	0.248	0.233	0.287	0.274	0.301	0.321	0.073
Cluster 3	0.396	0.335	0.383	0.367	0.366	0.388	-0.008
Cluster 4	0.298	0.303	0.336	0.281	0.292	0.294	-0.005

Table A3.35. Distance of clusters 2, 3 and 4 to cluster 1 in terms of specific consumption taxation (% GDP), 1995-2018

	1995	2000	2005	2010	2015	2018	Change 1995-2018
Mean:							
Cluster 1	3.80	3.38	3.06	2.73	2.52	2.40	
Cluster 2	4.85	4.21	3.93	4.13	4.15	4.04	
Cluster 3	3.27	3.09	3.02	2.77	2.89	2.84	
Cluster 4	4.76	4.22	3.97	3.62	3.50	3.48	
Distance to cluster 2:							
Cluster 1	1.05	0.82	0.87	1.40	1.63	1.63	0.59
Cluster 3	1.58	1.11	0.91	1.36	1.26	1.20	-0.38
Cluster 4	0.09	0.01	0.04	0.51	0.65	0.56	0.47
Distance to cluster 2 as a fraction of the mean:							
Cluster 1	0.246	0.218	0.245	0.414	0.487	0.501	0.255
Cluster 3	0.373	0.295	0.258	0.400	0.378	0.368	-0.004
Cluster 4	0.020	0.004	0.012	0.150	0.195	0.171	0.151

Table A3.36. Distance of clusters 2, 3 and 4 to cluster 1 in terms of specific consumption taxation (% of total revenues), 1995-2018

	1995	2000	2005	2010	2015	2018	Change 1995-2018
Mean:							
Cluster 1	12.33	10.49	9.46	9.46	8.48	7.98	
Cluster 2	13.97	12.66	12.13	12.79	12.12	11.55	
Cluster 3	9.15	8.53	8.47	7.87	7.60	7.49	
Cluster 4	11.48	9.78	9.33	8.69	8.22	8.18	
Distance to cluster 2:							
Cluster 1	1.65	2.17	2.67	3.33	3.64	3.57	1.92
Cluster 3	4.82	4.13	3.67	4.92	4.52	4.05	-0.77
Cluster 4	2.49	2.88	2.80	4.09	3.89	3.36	0.87
Distance to cluster 2 as a fraction of the mean:							
Cluster 1	0.137	0.205	0.266	0.334	0.388	0.395	0.257
Cluster 3	0.403	0.390	0.365	0.493	0.482	0.448	0.046
Cluster 4	0.208	0.272	0.279	0.410	0.416	0.372	0.164

Table A3.37. Distance of clusters 2, 3 and 4 to cluster 1 in terms of top statutory personal income tax rates, 1995-2018

	1995	2000	2005	2010	2015	2018	Change 1995-2018
Mean:							
Cluster 1	45.39	44.74	42.79	45.15	45.29	45.20	
Cluster 2	40.00	37.78	34.22	30.76	31.94	32.93	
Cluster 3	57.11	52.39	48.06	47.35	49.99	50.80	
Cluster 4	55.31	54.15	50.75	48.63	49.73	49.79	
Distance to cluster 2:							
Cluster 1	5.39	6.96	8.57	14.39	13.34	12.27	6.88
Cluster 3	17.11	14.61	13.84	16.58	18.04	17.86	0.75
Cluster 4	15.31	16.37	16.53	17.86	17.79	16.86	1.56
Distance to cluster 2 as a fraction of the mean:							
Cluster 1	0.111	0.150	0.199	0.343	0.309	0.281	0.170
Cluster 3	0.353	0.315	0.321	0.395	0.418	0.409	0.057
Cluster 4	0.315	0.353	0.383	0.426	0.412	0.386	0.071

Table A3.38. Distance of clusters 2, 3 and 4 to cluster 1 in terms of top statutory corporate income tax rates, 1995-2018

	1995	2000	2005	2010	2015	2018	Change 1995-2018
Mean:							
Cluster 1	36.53	33.25	28.14	26.73	25.17	23.16	
Cluster 2	34.43	28.80	22.61	20.28	21.06	20.83	
Cluster 3	41.21	39.04	34.06	30.66	29.65	28.18	
Cluster 4	35.24	33.70	30.23	28.47	26.71	24.34	
Distance to cluster 2:							
Cluster 1	2.09	4.45	5.53	6.45	4.12	2.33	0.24
Cluster 3	6.78	10.24	11.45	10.38	8.59	7.34	0.57
Cluster 4	0.81	4.90	7.62	8.19	5.66	3.51	2.70
Distance to cluster 2 as a fraction of the mean:							
Cluster 1	0.057	0.134	0.196	0.249	0.163	0.098	0.041
Cluster 3	0.185	0.309	0.407	0.400	0.341	0.309	0.124
Cluster 4	0.022	0.148	0.271	0.316	0.225	0.148	0.125

Data

Table D.1. Summary statistics

VARIABLES	Mean	Std. dev.	Min	Max
Total taxation, % GDP	35.32	6.15	20.75	50.81
Personal income taxation				
- % GDP	9.49	4.49	0.87	26.25
- % total revenues	26.60	10.70	2.57	61.61
Corporate income taxation				
- % GDP	2.87	1.52	0.26	12.59
- % total revenues	8.29	4.44	0.60	29.40
Social security contributions and payroll taxation				
- % GDP	9.70	4.98	0.00	20.40
- % total revenues	27.21	12.61	0.00	48.55
Property taxation				
- % GDP	1.83	1.12	0.22	17.37
- % total revenues	5.38	3.40	0.68	34.18
General consumption taxation				
- % GDP	6.55	2.20	0.00	11.92
- % total revenues	18.42	5.73	0.00	37.92
Specific income taxation				
- % GDP	3.88	1.28	1.55	9.53
- % total revenues	11.21	4.18	4.21	30.79
Top statutory personal income tax rate	48.74	12.93	15.00	89.65
Top statutory corporate income tax rate	33.55	11.03	9.00	62.73
Ratio of personal income taxation to sum of social security contributions and general consumption taxation	0.73	0.75	0.15	5.59
Government ideology	17.04	10.56	-15.60	48.01
GDP per capita	37579	20244	5139	111968
Trade openness	91.52	55.41	16.68	408.36
Budget surplus	-2.25	4.57	-32.02	18.67

Tax revenues (% GDP and share of total revenues)

- Source: OECD (2019)
- URL: https://stats.oecd.org/Index.aspx?QueryId=78518
- Data years: 1980-2018
- Note: for 2018, Japan has missing data for total taxation and social security contributions, and Australia has missing data for all categories; the values are assumed to be the same as 2017.

- The following categories are used: total tax revenues; heading 1100 for personal income taxes; heading 1200 for corporate income taxes; the sum of headings 2000 and 3000 for social security contributions and payroll taxes; heading 4000 for property taxes; heading 5110 for general consumption taxes; heading 5120 for specific consumption taxes. For definitions, see the interpretative guide in Annex A in OECD (2019).

Statutory corporate tax rates

- Sources, unless country-specific sources are stated below:
    - OECD Tax Database, corporate tax rates, table II.1
    - Historical tables from the OECD Tax Database (see: Johansson, 2008)
    - Corporate tax rate dataset by Devereux et al. (2002)
- URLs: http://search.oecd.org/tax/tax-policy/tax-database; https://www.ifs.org.uk/publications/3210
- Data years: 1982-2018 (for most countries)
- Country-specific notes and additional sources:
    - Estonia: data were partially retrieved from Kasperowicz-Stepień (2014).
    - Iceland: data were partially retrieved from a publication of the Icelandic Ministry of Finance, "Principal tax rates 2007" (https://www.government.is/media/fjarmalaraduneyti-media/media/Taxes/Principal_tax_rates_2007.pdf).
    - Luxembourg: data were partially retrieved from the KPMG Corporate tax surveys 1996 and 1997 and the OECD Economic Surveys 1994 (https://www.oecd-ilibrary.org/economics/oecd-economic-surveys-luxembourg-1994_eco_surveys-lux-1994-en). For 1990-1995, rates are estimated based on the assumption of a municipal tax rate of 7,5 percent.
    - Poland: data were partially retrieved from Appel (2006) and Zimny (2010: 6).
    - Slovenia: data were partially retrieved from the Slovenian version of the OECD Economic Surveys, Slovenia 2009, p. 95.

Statutory personal income tax rates

- Sources, unless country-specific sources are stated below:
    - OECD Tax Database, personal income tax rates, table I.7
    - Historical tables from the OECD Tax Database (see: Johansson, 2008)
    - Dataset by Piketty et al. (2014)

- URLs: http://search.oecd.org/tax/tax-policy/tax-database and https://www.openicpsr.org/openicpsr/project/114850/version/V1/view
- Country-specific notes and additional sources:
    - Belgium: for 1981-1999, the combined rate is estimated by taking the central rate and adding 2,5% for local taxes (the representative rate of local taxes is 6-7% of payable tax net of tax credits).
    - Denmark: data were partially retrieved from the historical overview on the website of the Ministry of Finance (https://www.skm.dk/skattetal/statistik/tidsserieoversigter/skraat-skatteloft-en-historisk-oversigt) and Ganghof (2006). Rates include pension contributions that are included under the tax ceiling (skatteloft) and exclude labour market surcharge (arbejdsmarkedsbidrag); OECD data from 2009 onwards are corrected for this, for the sake of compatibility.
    - Germany: rates exclude church tax.
    - Estonia: data were partially retrieved from Kasperowicz-Stępień (2014).
    - France: for the sake of compatibility of pre- and post-2000 data, rates do not include social security contributions; rates do however include the exceptional contribution on high revenues of 4%, applicable since 2011.
    - Iceland: data were partially retrieved from a publication of the Icelandic Ministry of Finance, "Principal tax rates 2007" (https://www.government.is/media/fjarmalaraduneyti-media/media/Taxes/Principal_tax_rates_2007.pdf).
    - Ireland: rates include health levy, the 2009-2010 income levy, and Universal Social Charge.
    - Luxembourg: data were partially retrieved from Gwartney et al. (2018). Data from 1980 to 1999 are available only every five years, and are interpolated.
    - Norway: data were partially retrieved from yearly publications from 1980 through 1992 by the Statistisk Sentralbyrå (Statistics Norway), Akutelle Skattetal, (https://www.ssb.no/a/histstat/rapp/).
    - Portugal: for the sake of compatibility, rates do not include social security contributions.
    - Slovenia: data were partially retrieved from the Slovenian version of the OECD Economic Surveys, Slovenia 2009, p. 95.

- Sweden: data were partially retrieved from yearly publications from 1980 through 1992 by the Statistisk Sentralbyrå (Statistics Norway), Akutelle Skattetal, (https://www.ssb.no/a/histstat/rapp/).
- United States: the OECD and Piketty datasets are not fully compatible as they use a different average of state taxes; the resulting difference in total tax rates, however, is small (approximately 0,3 percentage points). Piketty data are used through 2010; OECD data are used from 2011 onwards.

Political ideology

- Source: Seki-Williams Annual Government Partisanship dataset (Seki & Williams, 2014)
- URL: http://faculty.missouri.edu/williamslaro/govtdata.html
- Data years: 1994-2014
- Method of calculation:
  - The dataset is based on data from the Comparative Manifesto Project (CMP), conducted by the Manifesto Research Group (described in Budge et al., 2001). The CMP has coded the wording of election manifestos, producing 142 variables that indicate the frequency of sentences and phrases in a manifesto in a certain policy category, such as 'Environment' or 'Welfare state expansion'. These allow for the construction of an ideology index showing any programmatic dimension, by picking a specific subset of variables. The Seki-Williams Annual Government Partisanship dataset describes the composition of national governments, and provides for each country a yearly average of the governing parties' values of all CMP variables, based on the governing parties' manifestos for the preceding election. In case of a coalition government, the average is weighted with respect to the relative number of parliamentary seats of each party during the government's instance. In case of multiple governments in one year, the average is weighted by the percentage of the year that a government lasted.
  - An index for left-wing ideology is constructed that is merely based on economic policy preferences, in order to exclude categories that likely have little influence on tax rate setting, such as the upholding of traditional social values or parties' positions with respect to the military. The index is calculated by adding up governments' values for categories that are associated with left-wing ideology, and subtracting values for those that are associated with right-wing ideology

(including mentioning left-wing categories in a negative sense). A higher value in the index thus means a higher degree of left-wing economic policy preferences. The index' range is -100 to 100, where 100 in this case would mean that a party dedicates its complete manifesto to positively mentioning economically left-wing topics. Conversely, a large negative index number would indicate that the party spends a large part of its manifesto negatively mentioning these topics and/or promotes right-wing ideas instead. An index number close to 0 could either mean that expressions of right-wing and left-wing ideas keep each other in balance, or that a party rarely mentions topics related to the economic left-right spectrum; the latter situation seems unlikely given the importance of economic policy in national politics.

- The following variables/categories are used:
  - Subtracted: 401 (free market and free market capitalism as an economic model)
  - Subtracted: 402 (supply side oriented economic policies; assistance to businesses rather than consumers)
  - Added: 403 (market regulation)
  - Added: 404 (long-standing economic planning)
  - Added: 405 (corporatism in the sense of the cooperation of government, employers, and trade unions simultaneously)
  - Added: 406 (extending or maintaining the protection of internal markets)
  - Subtracted: 407 (negative mentions of protectionism as defined in variable 406)
  - Added: 409 (Keynesian demand side oriented economic policies; assistance to consumers rather than businesses)
  - Added: 412 (direct government control of economy)
  - Added: 413 (government ownership of industries)
  - Subtracted: 414 (reduction of budget deficits; retrenchment in crisis; thrift and savings in the face of economic hardship; support for traditional economic institutions such as stock market and banking system)
  - Added: 415 (Marxist-Leninist ideology and terminology)
  - Added: 503 (protection for underprivileged social groups; removal of class barriers; need for fair distribution of resources)

- Added: 504 (introducing, maintaining or expanding any public social service or social security scheme)
- Subtracted: 505 (limiting state expenditures on social services or social security)
- Added: 506 (expanding and/or improving educational provision at all levels, financed by the state)
- Subtracted: 507 (limiting state expenditure on education; introduction or expansion of study fees at all educational levels; increasing the number of private schools)
- Added: 701 (favourable references to all labour groups, the working class, and unemployed workers in general; support for trade unions and calls for the good treatment of all employees)
- Subtracted: 702 (negative references to labour groups and trade unions; mentions of the danger of unions 'abusing power')

GDP per capita

- Source: World Bank Data Catalogue. Data originate from World Bank national accounts data, and OECD National Accounts data files.
- URL: https://data.worldbank.org/indicator/NY.GDP.PCAP.KD
- Data years: 1995-2015

Trade openness (sum of exports and imports, % GDP)

- Source: World Bank Data Catalogue. Data originate from World Bank national accounts data, and OECD National Accounts data files.
- URLs: https://data.worldbank.org/indicator/NE.EXP.GNFS.ZS and https://data.worldbank.org/indicator/NE.IMP.GNFS.ZS
- Data years: 1995-2015
- The variable is calculated by adding up exports as a percentage of GDP and imports as a percentage of GDP

Budget surplus of the central government

- Source: OECD National Accounts Statistics: National Accounts at a Glance (part VI; table 'Net saving of general government, percentage of GDP'); old dataset (with reference year 2010), retrieved before 3 December 2019.

- URL: https://www.oecd-ilibrary.org/economics/data/oecd-national-accounts-statistics/national-accounts-at-a-glance_data-00369-en
- Data years: 1995-2015
- Budget surplus of the central government defined as net saving, which is calculated as net disposable income minus general government final consumption. This indicator is measured as a percentage of GDP.
- For Iceland and Japan, World Bank Data on net lending / net borrowing are used; see https://databank.worldbank.org/reports.aspx?source=2&series=GC.NLD.TOTL.GD.ZS&country=.

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