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The Evolution and Convergence of OECD Tax Systems

This paper considers theory-based expectations on the evolution of tax structures in developed countries and confronts them with stylised facts from aggregate tax revenue data. A bilateral similarity index is introduced which allows the measurement of the similarity of tax systems conditional on country characteristics. A slow but steady convergence in tax revenue structures is found which depends on the proximity, similarity and exchange between a given pair of countries.

Modern tax systems are in a process of permanent reform. The way in which the public sector finances itself is adapting to new challenges. Many of these new challenges are related to a process conventionally referred to as globalisation and are assumed to affect most countries in a similar way. The growing international exchange of products and factors, of information and financial funds makes it hard to pursue policies that do not take the neighbouring countries' policy choices into account. This raises the question whether there is an equivalent to a "best response" to these new challenges. One could expect tax systems to become more similar over time. Understanding these patterns of adaptation could help answer another important question: what is the future of the tax system? Is there something like a "law of one price" in international tax competition? Or, alternatively, should we expect countries to search for profitable specialisations, like tax havens which offer special tax treatments for specific transactions?

In this paper, we consider theoretically based expectations on tax structure evolution over time, confront them with time series data from OECD countries and discuss whether past developments allow the formulation of hypotheses on future tax revenues. In a second step, we examine whether there are indications of tax structure convergence, i.e. if the tax systems under considerations have become more similar over time. For this purpose, we introduce a new measure of tax system similarity, adopted from the trade literature.

What should we expect future tax systems to look like?[1] There is some theory which accounts for the effects of growing degrees of openness and relates it to domestic fundamentals. A general result in this literature is that country heterogeneity will probably prevent tax systems from absolute convergence; characteristics like country size, natural resources etc. will plausibly render convergence conditional.[2] An important shortcoming of this literature is, though, that – to the best of our knowledge – theory only predicts future development for specific tax types, like the corporation tax, the value added tax (VAT) and tariffs. More specifically, taxation of mobile factors is expected to be reduced and replaced by less costly ways of taxation, e.g. the VAT. The public debate has adopted these two predictions: corporate taxes are expected to go down, and direct taxes are assumed to be replaced by indirect taxes. We examine whether these predictions are in line with recent trends in the tax structures of developed countries.

A noticeable recent strand of literature deals with tax policy in developing countries and shows that the nature and structure of the tax system heavily depend on the degree of development.[3] Whereas developing countries are characterised by heavy reliance on tariffs

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[1] Most of the theoretical contributions predicting future changes in the tax mix are based on optimal tax models of open economies. An implicitly stated axiom in this literature is that governments act rationally and efficiency-oriented. This view is not without alternative; political scientists have expressed the view that governments just learn from each other, even though no absolute benchmark exists; cf. e.g. D. Swank, S. Steinmo: The New Political Economy of Taxation in Advanced Capitalist Democracies, in: American Journal of Political Science, Vol. 46, No. 3, 2002, pp. 642-655; and S. Steinmo: The Evolution of Policy Ideas: Tax Policy in the 20th Century, in: British Journal of Politics and International Relations, Vol. 5, No. 2, 2003, pp. 206-236.

[2] From a policy-maker's viewpoint, tax policy convergence is often regarded as desirable as it reduces some of the opportunities to avoid taxation through multinational transactions. It may therefore be that policy coordination, e.g. within the EU, attains higher levels of convergence than one should expect under conditions of tax competition.

[3] Cf. R. H. Gordon, Wei Li: Tax Structure in Developing Countries: Many Puzzles and a Possible Explanation, in: NBER Working Papers: 11267, 2005; cf. R. H. Gordon, Wei Li: Puzzling Tax Structures in Developing Countries: A Comparison of Two Alternative Explanations, in: NBER Working Papers: 11661, 2005.

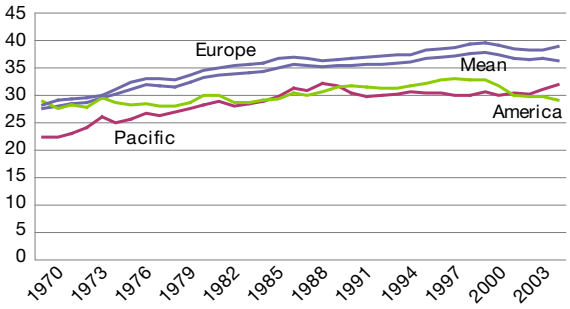
and capital taxes, more developed countries receive the largest part of their revenue from indirect taxes, like the VAT, and social security contributions. These contributions may open the door for a larger research programme which looks for a life-cycle model of the tax system.

The OECD Tax Mix: Hypotheses and Stylised Facts

We now highlight the general trends of the OECD tax mix and establish a series of stylised facts regarding the development of the observed tax revenue components. The stylised facts are discussed from the perspective of theory-based expectations regarding tax structure development. The analysis is based on the OECD tax revenue data. We use data from those 23 OECD countries for which data is available for the period from 1970 to 2005.[4] To differentiate between the different types of tax revenue, the common OECD classification is used. The OECD categorises six types of tax revenue sources: taxes on income, capital gains and profits (1000), social security contributions (2000),[5] taxes on payroll and workforce (3000),[6] taxes on property (4000),[7] taxes on goods and services (5000)[8] and other taxes (6000). Next to the major OECD classification categories, this study focuses on the subgroups; revenues from personal income and capital gains (1100), revenues from corporate income and capital gains (1200) and revenues originating from the value added tax (VAT, 5111).

A common theme in the public debate on the future of public finance is that globalisation and technological progress have rendered taxation more difficult and more costly.[9] Thus, it can be expected that countries respond to globalising economies by privatisation and cuts in public expenditure. Figure 1 displays the evolution of OECD total tax revenue levels as a percentage of total GDP (unweighted average) and selected subsamples. There is a largely unbroken upward trend in the unweighted average of the 23 OECD countries' total tax revenue as a percentage of GDP. The integrated sub-samples show OECD-Europe as the country grouping with the highest tax burden, peaking at nearly 40% of GDP in 2000. OECD-America and OECD-Pacific share similar average levels that are significantly lower than the OECD total. However, while tax revenue in OECD-Europe and OECD-Pacific mainly grew over time, OECD-America does not seem to emulate the same developments.

Figure 1
Development of OECD Total Tax Revenues in %, 23 OECD Countries, 1970-2005



Source: OECD Revenue Statistics, 2007.

The aggregate picture hides significant country differences. Countries where total tax revenue as a percentage of GDP was below 20% in the mid-1970s (e.g. Turkey and Spain) largely increased their total tax revenue to GDP ratios, while substantial reductions in the tax to GDP ratio have been recorded in the United States and Germany in the last five years. The Netherlands, for example, reports a tax to GDP ratio which is lower than its 1975 levels, while Japan and New Zealand have reduced their tax ratios from their respective peaks in 1985 and 1990. Yearly variation in overall tax revenue has slightly but steadily increased during the 1970s. During the 1980s, the variation in collected tax revenue as a percentage of GDP remained fairly constant. A decrease in variation only started to take place by the beginning of the 1990s but at a slow and hardly perceptible rate.

[4] These are Australia, Austria, Belgium, Canada, Denmark, Germany, Finland, France, Greece, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States.

[5] Social security contributions are compulsory payments that confer an entitlement to receive a future social benefit. They are usually earmarked to finance social benefits. These include: unemployment insurance benefits and supplements, accident, injury and sickness benefits, old-age pensions etc. They may be levied on both employees and employers.

[6] This group covers taxes paid by employers, employees or the self-employed either as a proportion of payroll or as a fixed amount per person, and which do not confer entitlement to social benefits. Examples of taxes classified here are the United Kingdom national insurance surcharge (introduced in 1977) and the Swedish payroll tax (1969–1979).

[7] This heading covers recurrent and non-recurrent taxes on the use, ownership or transfer of property. These include taxes on immovable property or net wealth, taxes on the change of ownership of property through inheritance or gift and taxes on financial and capital transactions.

[8] Taxes on goods and services include all taxes levied on the production, extraction, sale, transfer, leasing or delivery of goods, the rendering of services, or in respect of the use of goods or permission to use goods or to perform activities. This also entails trade taxes and excise.

[9] For a thorough discussion cf. Axel Dreher: The Influence of Globalization on Taxes and Social Policy: An Empirical Analysis for OECD Countries, in: European Journal of Political Economy, Vol. 22, No. 1, 2006, pp. 179-201.

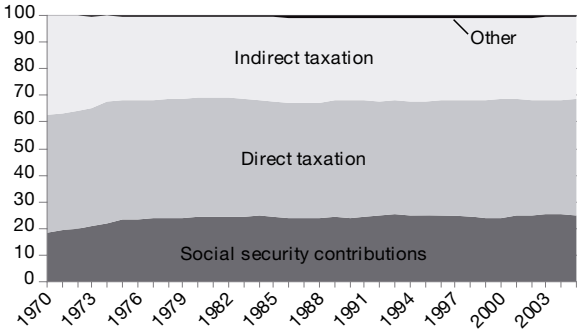
Stylised fact 1: On average, total tax revenue as a percentage of GDP shows a moderate upward trend during the observed time span.

Thus, as a first result we may state that the public concern that globalisation would drive down tax revenues cannot be justified by the aggregate picture so far.[10] The literature following Rodrik[11] and Alesina & Wacziarg[12] sets out to explain the counter-intuitive finding that more open economies have bigger governments (which is just the other side of larger revenues). One important argument is that more open countries have greater needs for redistribution and social insurance. In contrast, Dreher[13] measures the causal effect of globalisation (measured by a summary indicator) and finds no effect on overall government spending.

However, it may be that the pressures of globalisation affect only specific types of revenue and leave others unaffected. In this case, globalisation would affect the tax structure and not so much the overall level of tax revenue. There are only very few studies analysing the relationship between openness and the tax mix. One of the few exceptions is the study by Haufler, Klemm & Schjelderup[14] presenting a political economy model which endogenises the shares of wage tax and corporate tax revenue. Their empirical analysis lends support to the hypotheses that an increase in the size of the multinational sector decreases corporate tax rates.

The raw data shows that the aggregate tax mix has not changed very much over time, though. Most OECD countries rely primarily on tax revenue from personal and corporate income taxation, social security contributions and consumption taxation, more specifically VAT. According to the data, average reliance on these tax sources has on average exceeded the 70% margin of total taxation. Figure 2 shows the development of the overarching categories direct and indirect taxation and social security contributions as a share of total taxation over the observed time span.

Figure 2
OECD Tax Component Reliance Levels, in % of Total Taxation, 1970-2005*



* Balanced panel of 23 OECD countries

Source: OECD Revenue Statistics, 2007.

The indirect taxation category includes revenues originating from VAT and revenues from taxes on goods and other services, while the direct taxation category comprises revenues from both personal and corporate income taxation and property taxation. Next to social security contributions, the remaining category "other" includes unallocated tax revenues and revenues from payroll taxation. The initial observation of tax component trends markedly shows very few changes over the observed time span. Most obvious is the increase in social security contributions as a share of total taxation during the 1970s, which was accompanied by a noticeable decrease in the total tax share of indirect taxation. For the remainder of the observed time span, the categories are characterised by a persistent stability in the observed tax shares.

While the Nordic countries (e.g. Denmark, Finland and Sweden) rely primarily on direct taxation, southern European countries (e.g. Spain and Greece) collect more revenue from indirect taxation. Overall, countries of the European Union tend to report higher shares of indirect taxation and fewer revenues originating from income taxes in comparison to the reported OECD averages. The United States, on the other hand, collects a higher share of income and property taxes but less in consumption taxes and social security contributions.

The extent and direction of shifts in taxation have varied across countries. While some countries (i.e. Germany, Canada and the United States) have experienced only minor changes to their tax mix, other countries (i.e. Italy, Ireland and Sweden) have shown substantial changes. However, the overall picture suggests that, so far, the pressures from globalisation

[10] Of course, it is not surprising that the absolute amount of tax revenue increases as globalisation is likely to increase overall output. However, this argument does not help in understanding why tax revenue measured as a fraction of national income has increased over time.

[11] Dani Rodrik: Why Do More Open Economies Have Bigger Governments?, in: Journal of Political Economy, Vol. 106, No. 5, 1998, pp. 997-1032.

[12] A. Alesina, R. Wacziarg: Openness, Country Size and Government, in: Journal of Public Economics, Vol. 69, No. 3, 1998, pp. 305-321.

[13] Cf. Axel Dreher, op. cit.

[14] A. Haufler, A. Klemm, G. Schjelderup: Globalisation and the Mix of Wage and Profit Taxes, in: Public Choice, forthcoming.

have not led to a substantial shift from direct taxation to indirect taxes.

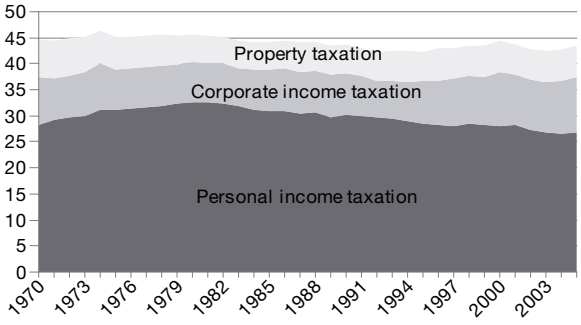
Stylised fact 2: The overall tax mix remained intriguingly stable over time.

While economic theory has no strong prediction on the response of the overall tax mix (i.e. direct versus indirect taxation) to the increasing pace of globalisation, there is a strong theory on taxes on capital and corporate profits. As a baseline result, capital taxes are expected to be zero in the long run.[15] More recent contributions have tried to test empirically for the strategic tax setting of countries competing for international capital (and profits).[16] Although not perfectly unanimous, these contributions show quite convincingly that countries react to tax cuts by neighbouring countries by cutting taxes themselves.

The data show that personal and corporate income taxation are reported to be the main source of revenue for government spending in fourteen OECD countries. In 2005, Australia, Canada, Denmark, New Zealand and Norway all reported figures for personal and corporate income tax shares which exceeded 45% of total taxation. At the other end of the spectrum, countries like France, Greece and Turkey generally characterised by a low reliance on direct taxation reported only 20% of total taxation revenue originating from personal and corporate income taxation.

Given a constant share of direct taxes, we would expect to observe a shift from corporate tax reliance to taxes on personal income, since the latter is levied upon less mobile production factors like labour.[17] Figure 3 shows that, on average, the personal income tax share of total tax revenue remains greater than any other individual tax source. However, from 1980, there is a considerable decline in terms of tax revenue from this source. In addition, revenue from corporate income remained stable until the 1990s, and then increased, counter to intuition. This rise in corporate tax revenues compensated the decrease reported for personal income taxation. Taxes on immovable properties remained stable,[18] while tax revenue from capital gains never exceeds 0.5% of total taxation.

Figure 3
OECD Direct Taxation Levels in % of Total Taxation, 1970-2005*



* Balanced panel of 23 OECD countries

Source: OECD Statistics, 2007.

Thus, again, the expectations based upon economic theory on the development of tax revenue reliance have not been proven correct. In line with this aggregate picture, Dreher[19] does not find any causal relationship of globalisation on wage taxes, but shows that average tax rates on capital have increased in response to larger degrees of openness. It is generally considered as puzzling that, despite reduced corporate tax rates, corporate tax revenue remained high or has even been increased.[20] Possible solutions to this are offered by Auerbach[21] and de Mooij & Nicodème.[22] Auerbach demonstrates that the cut in statutory tax rates has been (over-)compensated by the restriction of loss-offsets. De Mooij & Nicodème show that part of the increase in corporate tax revenue can be attributed to a significant increase in the incorporation of firms. Huizinga & Nicodème argue that increasing foreign ownership of firms raises the incentive for domestic governments to tax corporate profits. This story is

[15] Cf. e.g. R. H. Gordon: Taxation of Investment and Savings in the World Economy, in: American Economic Review, Vol. 76, No. 5, 1986, pp. 1086-1102. There is, however, an important body of literature which sets out to provide reasons why one should not expect zero rates, e.g. Huizinga & Nielsen highlighting the role of foreign firm ownership, cf. H. Huizinga, S. B. Nielsen: Capital Income and Profit Taxation with Foreign Ownership of Firms, in: Journal of International Economics, Vol. 42, No. 1-2, 1997, pp. 149-165; and Haufler & Schjelderup who analyse the implications of profit shifting opportunities, cf. A. Haufler, G. Schjelderup: Corporate Tax Systems and Cross Country Profit Shifting, in: Oxford Economic Papers, Vol. 52, No. 2, 2000, pp. 306-325.

[16] Evidence is provided by – among others – Slemrod, Devereux, Lockwood & Redoano and Overesch & Rincke.

[17] Cf. A. Haufler, A. Klemm, G. Schjelderup, op. cit.

[18] Immovable property taxes are imposed in most OECD countries and revenues are generally accrued by subordinate levels of government. The contribution of those taxes to government tax revenues varies greatly among countries, ranging from 5 to 10% in Australia, Japan, Canada, the United Kingdom and United States to less than 2% in Germany, Mexico, Netherlands, Spain and Sweden.

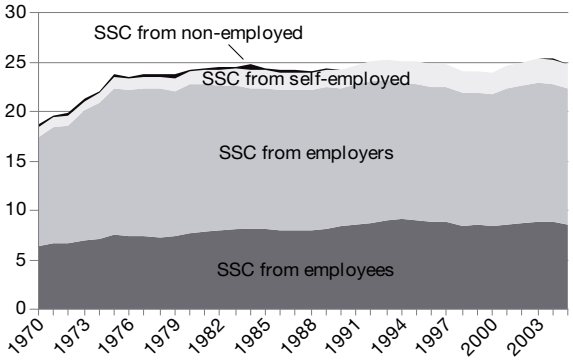
[19] Cf. Axel Dreher, op. cit.

[20] Cf. K. Clausing: Corporate Tax Revenues in OECD Countries, in: International Tax and Public Finance 14, 2007, pp. 115-133.

[21] Cf. A. J. Auerbach: Why Have Corporate Tax Revenues Declined? Another Look, in: CESifo Economic Studies, Vol. 53, No. 2, 2007, pp. 153-171.

[22] Cf. R. de Mooij, G. Nicodème: Corporate Tax Policy and Incorporation in the EU, in: International Tax and Public Finance, Vol. 15, No. 4, 2008, pp. 478-498.

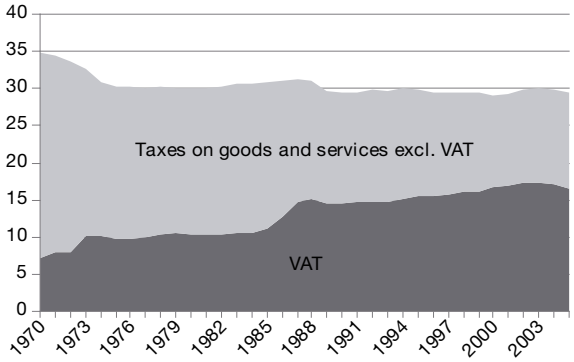
Figure 4
OECD Social Security Contributions, in % of Total Taxation, 1970-2005*



* Balanced panel of 23 OECD countries.

Source: OECD Revenue Statistics, 2007.

Figure 5
OECD Indirect Taxation Levels, in % of Total Taxation,1970-2005*



* Balanced panel of 23 OECD countries.

Source: OECD Revenue Statistics, 2007.

also in line with the finding in Becker & Fuest[23] that the more open German Länder have a larger business tax revenue.

Stylised fact 3: There is a moderate shift from personal income taxes to corporate taxes.

An analysis of social security contribution levels demonstrates high heterogeneity amongst the observed countries. Continental European countries report relatively high social security contributions. Australia and New Zealand, on the other hand, do not levy any social security contributions and finance social benefits through other taxes. Breaking down revenues collected as social security contributions according to their origin, Figure 4 shows only noticeable increases in overall reliance on social security contributions at the beginning of the 1970s, which were mainly triggered by increases in the share of social security contributions collected from employers. Starting in 1974, however, increases in the share of social security contributions have been much slower, with only minor and gradual increases in the contributions levied from the self-employed and employees.

Stylised fact 4: Social security contributions as a share of total taxation increased sharply until the mid-1970s and then remained stable.

VAT has become the general consumption tax of every OECD country except the USA. Consumption taxes are already the single most important source of revenue in eight OECD countries – Greece, Hungary, Iceland, Korea, Mexico, Norway, Poland and Turkey. The calculated yearly variation for this particular source of revenue has been steadily declining, implying a convergence of reliance on tax revenue from goods and services. The reason for such continuous convergence might be the strong coordination between EU countries and the existence of a European common market and a common minimum rate.[24]

Figure 5 illustrates the sub-aggregate of indirect taxes. It shows a rising share of reliance on VAT that has compensated the waning importance of tax revenue originating from excises and trade taxes. Particularly during the 1990s, countries either introduced some kind of VAT or changed its rate if the tax was already in place.[25]

One reason why indirect taxes have not replaced direct taxes may be that indirect taxes have efficiency costs which are not much lower than those of direct taxes. This is suggested by recent studies showing taxes other than corporate taxes affecting the location and the volume of foreign direct investment.[26] In contrast, the shift from excise taxes to VAT can be explained by economic theory, which claims that uniform consumption taxes like VAT (although it is not perfectly uniform in most countries) are less costly to collect. However, even for VAT, fraud and evasion is reported.[27]

[23] Cf. J. Becker, C. Fuest: Internationalization and Business Tax Revenue - Evidence from Germany, Paper prepared for the European Tax Policy Forum, 2007.

[24] Cf. K. Messere, F. de Kam, C. Heady: Tax policy: Theory and Practice in OECD Countries, Oxford and New York 2003, Oxford University Press, p. 22.

[25] For a review on the development and spread of VAT, cf. M. Keen: VAT attacks!, in: International Tax and Public Finance, Vol. 14, No. 4, 2007, pp. 365-381.

[26] Cf. e.g. M. Desai, C. F. Foley, J. R. Hines: Foreign Direct Investment in a World of Multiple Taxes, in: Journal of Public Economics, Vol. 88, No. 12, 2004, pp. 2727-2744; T. Buettner, G. Wamser: The Impact of Non-Profit Taxes on Foreign Direct Investment: Evidence from German Multinationals, in: International Tax and Public Finance, forthcoming.

[27] Cf. M. Keen, op. cit.

Table 1
Similarity Index

	2004			2005		
	DEU	USA	Min TS	DEU	USA	Min TS
Personal income taxation	22.83	34.21	22.83	23.30	35.13	23.30
Corporate income taxation	4.50	9.49	4.50	4.94	11.35	4.94
Unallocated income taxation	0	0	0	0	0	0
Social security contributions	40.73	26.00	26.00	39.93	24.67	24.67
Taxes on payroll	0.00	0.00	0.00	0.00	0.00	0.00
Taxes on property	2.47	12.07	2.47	2.46	11.42	2.46
Consumption taxes	29.46	18.22	18.22	29.03	17.43	17.43
Other taxes	0.02	0	0	0.33	0	0
SSI	100	100	74.02	100	100	72.80

The fact that the European Union made considerable efforts to partially harmonise VAT policies across its member states further suggests that there is some cost involved due to international arbitrage.

Stylised fact 5: Within the indirect tax category, there is a considerable shift from excise taxes to general consumption taxes like VAT.

Payroll taxes play only a minor role in the tax component structure of most OECD countries.[28] With a stable average tax share of around 1% of total taxation, the average reliance on payroll taxation seems to be unchanging.

The average tax structures of OECD countries highlighted in this section show a remarkable stability over time. The only significant trends concern corporate tax revenue replacing personal income taxes, and VAT replacing excise taxes. However, the aggregate picture may blur developments in individual countries or country subgroups in response to globalisation which in sum net out. Therefore, we continue by analysing bilateral country data. The idea behind this approach is that we expect countries facing similar domestic determinants (e.g. similar levels of economic development or similar cultural backgrounds and legal traditions) to show similar trends and developments with regard to the tax component structure.

Relative Country Similarity

In order to measure the similarity of tax systems across countries, this section develops an index of tax structure country similarity. It thus shifts the focus of the paper away from the unweighted OECD average trends to the developments of OECD country pairs. For this purpose, we calculate the Structural Similarity Index (SSI)[29] which measures how much two partner countries rely on the same sources of tax revenue. The level of the SSI for the partner countries A and B in year t is computed by the summation of the minimum tax shares of each tax type of the observed country pair A, B in year t:

$$SSI_{AB,t} = \sum \min(TS_{A,t}, TS_{B,t})$$

TS denotes the tax shares of the introduced tax types as a percentage of the observed country's total taxation. Consequently, the index is bounded by 0 and 100. $SSI_{AB,t}$ equals zero if countries A and B levy their taxes from completely different sources, resulting in the minimum of all tax shares being zero. $SSI_{AB,t}$ equals 100 if countries A and B have the same tax component structure resulting in the identical reliance on all tax components. For the calculation of the Structural Similarity Index, we utilise the OECD Revenue Statistics (2007) data already used above.[30]

For better illustration, Table 1 presents the calculated SSIs for the country pair Germany and the United States for the years 2004 and 2005 by adding the minimum share of each tax type to determine the level of revenue component overlap. In this case, the SSI decreased from 74.02 in 2004 to 72.8 in 2005. According to Table 1, this decline was mainly triggered by a decrease in US social security contributions.

[28] During the observed time period the exception to this rule is Austria, which has a consistently higher reliance on payroll taxation than any other observed OECD country. Its average reliance on payroll taxation amounts to 6.6 % of total taxation.

[29] Here, we modify the Export Similarity Index (ESI) developed by Finger and Kreinin which measures the similarity of export bundles of any two countries (or groups of countries) to a third market. Cf. J. M. Finger, M. E. Kreinin: A Measure of 'Export Similarity' and Its Possible Uses, in: Economic Journal, Vol. 89, 1979, pp. 905-912.

[30] The tax components used for the construction of the SSI are the revenue shares originating from personal income taxation (1100), corporate income taxation (1200), from other revenues from income and capital gains (1300), social security contributions (2000), from taxes on payroll (3000) and property (4000), from VAT (5111) and other taxes on goods and services (5000). Mainly using the detailed subaggregates of the categories on income and capital gains and social security contributions, we use the higher tax category heading if the data are missing.

Table 2
Development of the Structural Similarity Index, 23 OECD countries, 1970-2005

Year	OECD mean	Standard deviation	Minimum observation
1970	71.7374	10.8126	42.5085
1971	72.1204	11.2454	40.2801
1972	72.3721	11.0033	41.0266
1973	72.5741	10.4303	41.4479
1974	71.3757	10.4971	40.7716
1975	71.8969	10.6069	39.6628
1976	71.9501	10.5356	40.0766
1977	71.9809	10.4315	39.5406
1978	72.0434	10.4324	39.8139
1979	72.4805	10.3141	38.6692
1980	72.9899	10.2798	38.5299
1981	73.0241	10.2678	39.5013
1982	73.3414	10.3036	39.9366
1983	73.6877	10.2580	40.5919
1984	73.9114	9.90428	41.5331
1985	73.3053	10.1233	41.6230
1986	73.4178	10.1555	42.482
1987	73.9438	9.80134	42.7807
1988	74.0780	9.92711	43.2201
1989	74.2365	9.73056	43.0537
1990	74.2218	9.62946	42.2362
1991	74.3014	9.71055	42.7608
1992	74.2053	9.87328	43.3134
1993	74.2495	9.72544	43.2738
1994	73.9449	9.75076	44.3085
1995	73.6921	9.82979	44.4611
1996	73.1262	9.84029	44.6567
1997	73.5516	9.50325	46.1147
1998	74.8349	9.04464	49.5061
1999	75.080	9.11794	49.9064
2000	75.9001	8.21255	53.8045
2001	76.0715	8.33914	52.5448
2002	75.0059	8.73831	50.6191
2003	75.6711	8.70461	50.1457
2004	75.7383	8.83054	50.3924
2005	75.86	8.78375	51.2601

Source: OECD Revenue Statistics, 2007.

A reaction of the Similarity Index to changes in the tax structure is only triggered by changes in the minimum tax shares of each country pair. A decrease in the calculated distance between the respective country pair tax shares by one percentage point increases the Similarity Index by 1 if the shift in tax reliance originated from a tax type previously not accounted for in the Similarity Index calculation due to its not being the minimum amount for its tax category. If the increase in the tax share originated from a shift in tax reliance from a tax share already accounted for in the SSI, the Similarity Index remains constant.

The descriptive analysis uses the indices for the same 23 OECD countries from 1970 to 2005 as above. According to Table 2, average structural similarity has slightly increased over the observed time span; with the SSI-mean amounting to 71.7 in 1970 and increasing to over 76 in 2001. The minimum observation per year, corresponding to the least similar pair of countries, increased considerably more strongly than the mean: from around 40 in the 1970s to above 50 in 2005. The standard deviation also decreased significantly over time.

Stylised fact 6: Relative country similarity of government revenue structures increased slowly but steadily over time.

Over the entire time period, Switzerland and Belgium share the highest structural similarity with the rest of the observed countries. Their average SSI levels amount to 78 for Switzerland and 79 for Belgium followed by Germany and the United States both with an average of 76. The countries with the least similarity regarding the constructed country pairs are Australia and New Zealand, which report an overall average of 65 and 66 respectively in structural similarity.

One can assume that countries with high average SSI-levels represent the average tax structure with a high level of similarity with the remaining countries. One question which arises is whether such countries might serve as role models for the remaining country group. This notion arises when reviewing the SSIs for Germany or the United States. Countries with the lowest average SSI levels, on the other hand, represent a unique form of tax reliance. The fact that Australia and New Zealand, levying next to no social security contributions, have the lowest average levels of similarity with all others countries in the sample might also suggest that geographical distance may play a role. A more general question is: which countries should we expect to be similar to each other?

Besides geographical distance,[31] several more bilateral variables are possible candidates for correlation: differences in country size, measured by GDP, and levels of economic development measured by the absolute difference in GDP per capita should drive down the similarity index, while common borders and common language should increase it. EU membership is expected to have a positive effect on country pair similarity, e.g. since the EU actively harmonises VAT tax rates in its member states. Furthermore, we consider a bilateral openness indicator which measures the extent to which two countries interact economically with each other. The bilateral trade-based

[31] We use the CEPII Database for distances measures to include a distance variable (in km). The geodesic distances are calculated using the latitudes and longitudes of the most important cities/agglomerations in terms of population for each observed country pair.

Table 3
Fixed Effects Regression Analysis

	(1)	(2)	(3)	(4)
	Year fixed effects		Country and year fixed effects	
Distance	-0.000484***	-0.0004874***	-	-
	(0.0000166)	(0.0000167)		
GDPDIFF	0.000355***	0.000373***	-0.000185***	-0.000202***
	(0.0000474)	(0.0000485)	(0.0000472)	(0.0000476)
GDPCAPDIFF	0.0001188***	0.0001181***	-0.0000379***	-0.0000372***
	(0.0000102)	(0.0000102)	(0.00000963)	(0.00000963)
Common EU membership	-0.4858474**	-0.429234	1.704767***	1.649472***
	(0.2179648)	(0.2203086)	(0.1630103)	(0.164005)
Bilateral trade openness	-	-53.33785	-	145.0789***
		(30.26296)		(48.05851)
Common Language	4.001319***	4.069863***	-	-
	(0.2932607)	(0.2958142)		
Common Border	2.293631***	2.503448	-	-
	(0.3296119)	(0.3504363)		
R^2	0.0712	0.0713	0.0647	0.0651
Number of observations	21948	21948	21948	21948

Standard deviations are shown in parentheses.

**5% significance level, ***1% significance level.

openness measure is calculated by adding imports and exports of the reporting country from/to the partner country and relating the outcome to the reporting country's GDP: $BiTrade_{AB,t}=(IMP_{AB,t}+EXP_{AB,t})/GDP_{A,t}$. We expect high shares of bilateral trade to correlate positively with higher Similarity Index levels.

The following presentation of results is not intended to suggest any causal relationship between indicators and SSI. The empirical literature on tax policy, tax revenue and its determinants convincingly shows that interdependencies are important and demonstrates why full accountancy of the resulting endogeneity problem is beyond the scope of this short paper.

The results of the correlation analysis are presented in Table 3. Here, we use year fixed effects to account for periodical shocks affecting all countries similarly and country fixed effects to abstract from country heterogeneity. The presented regressions attempt to individually analyse both dimensions of the data presented. The first two columns use only year fixed effects to enable an isolated analysis of the cross-sectional dimension of the data. By including country fixed effects, the regressions in columns (3) and (4) abstract from possible bias due to country level heterogeneity.

As intuitively expected, columns (1) and (2) show a highly significant and robust negative relationship between the distance between the country pairs and the SSI. The dummy variables for common border and common language also show the expected positive coefficient estimates. In fact, country pairs sharing a common language are estimated to significantly correlate with an SSI level that is 4 points higher than that of countries that do not share a common language. On the other hand, countries sharing borders are estimated to have a 2.5 points higher level of SSI than countries not sharing any geographical borders.

If and how country size and level of economic development correlate with the SSI is analysed by the inclusion of the variables GDPDIFF denoting the difference in GDP (in US$ billion) and GDPCAPDIFF denoting the difference in GDP per capita (in US$/capita). Surprisingly, the pure cross-sectional dimension shows that the gap in country size and the difference in the level of economic development both correlate significantly positively with country pair similarity. Similarly surprising is the negative coefficient for EU membership.

The surprising correlation of GDPDIFF, GDPCAPDIFF and common EU membership with the SSI may be driven by unobserved factors of country heteroge-

neity. It may be that EU countries are heterogeneous in country characteristics but relatively similar in tax structures. This would explain part of these counter-intuitive coefficient estimates. Therefore, we eliminate time-constant country level heterogeneity by adding country fixed effects (see columns (3) and (4)). It turns out that there is a distinct negative relationship between the widening levels of GDP and GDP per capita and the SSI. This implies that countries growing closer together with regard to GDP and GDP per capita levels are correlated with an increase in the SSI levels. New EU accession is also estimated to correlate with an increase in SSI levels.

With regard to international pressure and international coordination, the inclusion of the bilateral openness measure is expected to show a positive correlation between high structural similarity levels and high bilateral openness. This, however, is not the case on the purely cross-sectional dimension where the bilateral trade openness measure does not show any significant correlations. However, when including country fixed effects, the bilateral trade measure is estimated to correlate significantly with the computed SSI. In this case, the assumed pressure towards similarity in relation to increased bilateral openness is supported by the estimated correlations. An increase in the bilateral trade openness measure by 0.1 percentage points of the reporting country's GDP is estimated to correlate significantly with an increase in the SSI levels by 14.5 points. This implies that countries in the process of increasing their bilateral trade openness are prone to show increasing similarities with regard to the tax component structure of the observed country pairs.

Stylised fact 7: Similarity of government revenue structures significantly correlates with similarity in country characteristics and bilateral trade flows.

Again, it is worth noting that the above fact is not meant to suggest any causal relationship. Revenue structures may become similar at high bilateral trade flow levels; in contrast, similar tax structures may induce large trade flows. A thorough test of causality is beyond the scope of this paper, but seems to be a promising issue for future research.

Summary and Conclusions

The descriptive analysis in the first part of the paper allowed the establishment of some stylised facts on the evolution of OECD tax systems. During the observed time span, total tax revenue as a percentage of GDP has shown a moderate upward trend (stylised fact 1). Both direct and indirect taxation categories have shown considerable stability (stylised fact 2). With regard to the direct taxation category, the data show a moderate shift from personal income taxes to corporate income taxes (stylised fact 3). The remaining welfare-oriented tax category also shows social security contributions to rise sharply only during the 1970s and to remain stable afterwards (stylised fact 4). Within the indirect tax category, there is a considerable shift from excise taxes to general consumption taxes like VAT (stylised fact 5).

Has there been any convergence? Shifting the focus away from the aggregate OECD picture, the introduction of the Structural Similarity Index as a measure for country pair tax structure similarity presented the possibility of identifying individual country or country group developments. Mainly concentrating on possible overlap in government tax revenue, the newly computed SSI is shown to slowly but steadily increase over time (stylised fact 6). This implies a slight convergence in OECD tax systems.

With country heterogeneity preventing tax systems from absolute convergence, this paper has identified several candidates for correlation that can plausibly render convergence conditional. We found geographical proximity, common borders and common language to correlate positively with tax structure similarity. Moreover, panel analysis showed that country size and income per capita as well as EU membership and bilateral trade flows increase with the similarity indicator (stylised fact 7).

It is important to note that the above results should be interpreted as observable correlations and not as causal linkages. The observed convergence can – in principle – have two causes: convergence in policies and/or convergence in the underlying economic structure.[32] The results presented in this paper show that the sum of these two effects leads to a slow but steady convergence in tax structures.

Given the high attention that tax policy receives in the public debate, it seems surprising that economic theory has so little to say about the future of tax structures. Therefore, it would be desirable to have theories which, firstly, build the foundations for quantifying tax structures (and go beyond the simple similarity index presented in this paper), which, secondly, link tax structures to economic and political country characteristics and which, thirdly, allow the forecasting of future tax structure developments conditional on country characteristics and degrees of international exchange.

[32] Cf. J. Slemrod, op. cit.