Tax harmonization in the European Union and the eurozone: a multilateral analysis of tax systems

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Abstract

This exploratory study takes a new look at the tax systems of countries in the Organisation of Economic Co-operation and Development (OECD). We measure a country's tax system using time-series cross-sectional data on tax collection variables as well as a cross-sectional metric assessing tax administration and enforcement. More specifically, we examine the countries' (i) overall tax burden, (ii) income tax reliance, and (iii) fiscal decentralization as well as some "non-rate" variables related to tax administration and enforcement. The purpose is to compare European Union (EU) member states and those countries in the eurozone with other OECD countries and over time in order to test (1) whether EU member states and eurozone countries have tax systems that are more similar to each other than to other countries, and (2) whether some tax harmonization is taking place – within the EU (eurozone) and other countries. The descriptive analysis and graphical representation, as well as first empirical tests, show that the tax systems of EU member states and eurozone countries are significantly different from other countries' tax systems. Yet, we do not find much tax harmonization in the EU (eurozone) countries over time. Future research might delve more into the question what drives harmonization with the intention of eventually formulating policy strategies.

Keywords: tax harmonization, tax burden, European Union, eurozone, fiscal decentralization, tax systems

1 INTRODUCTION

Tax policy management and harmonization have always been a topic of concern for the European Union and its member countries. The European debt crisis reinvigorated efforts within the EU to coordinate tax policies across the different member nations. Accordingly, the purpose of this research is to take a new look at the effects of past tax policy coordination in Europe. More specifically, we examine countries within the EU and countries that have joined the common currency system (the eurozone) and are evaluating whether these tax systems are more similar, or are becoming more similar, to each other than they are to the tax structures of other countries. In our analysis we use several dimensions that measure the overall tax burden, the importance of different types of taxes within the tax system, the decentralization of tax collection, the tax administration and enforcement. We focus on tax collection (in relationship to other economic measures) as well as administration and enforcement because in our opinion although both factors are important in the evaluation of a country's tax policy, academic research, especially in the economics literature, has been less focused on these particular aspects of tax systems. In the second part of the study, we attempt to isolate factors that impact tax system similarities and differences as well as tax system harmonization within the EU and in eurozone member countries, with the ultimate intention to formulate a number of tax policy strategies.

We base our analysis on the concept of fiscal competition, which suggests that governments – at any level – compete with each other for a tax base and on theo-

ries concerning the notion that (national) political culture affects "national styles of taxation". The tax competition theory suggests that countries will try to lower their effective tax rate below those of other countries in order to attract taxpayers, which speaks against the synchronization of different tax systems.[1] This anti-harmonization effect will be stronger for certain taxes than others and for certain countries than others, due to the relative mobility of the tax base. For example, it is easier for corporations to move their headquarters from one country to another than for individuals to leave their home country. Further, moving within the EU is generally easier than from EU to non-EU countries and vice-versa. Thus, we expect to see the effects of tax competition more for corporate income tax (and within the EU) and much less for real estate property taxes (and outside the EU). On the other hand, culture has been shown to impact accounting and tax systems, which would indicate that as countries' cultures change and move towards an understanding of global citizenship, tax systems will become more similar to each other as well. This concept also suggests that countries with similar histories and therefore similar cultures will have similar tax systems.

We gather the information for each country's tax system from the Organisation of Economic Co-operation and Development database. In the first part of the study, we compare the following tax system dimensions across the different countries and decades: *tax burden (years 1965-2012)*, *income tax reliance (years 1965-2012),* and *fiscal decentralization (years 1973-2012)*. For the *tax administration and enforcement* metrics only cross-sectional – no time-series – data are available. In addition to using descriptive metrics, such as correlation analysis, we also visualize which countries' systems are closest to each other.

In the second part of the study, we employ regression analysis to determine which factors affect the harmonization of tax systems within the EU and the eurozone compared to other OECD countries. We develop a harmonization metric by using the scaled absolute difference to the mean (of each tax system measure) as dependent variable and five-year increments as independent variables. The EU and eurozone membership for each country and year is measured using indicator variables. Interactions between EU and eurozone membership and the time variables measure whether harmonization is significantly different within the EU and the eurozone. Additional factors potentially impacting harmonization, such as common versus code law legal system, country size as well as economic and demographic controls, are also included as the regression model's explanatory variables.

Our study contributes to the current literature by taking a new look at how tax systems compare within the EU and with other non-EU countries' systems. We focus on tax collection variables, which allows us to examine a long time period

[1] Although tax competition theory focuses on tax policy (i.e., the political process of setting tax base and tax rates), the end goal of these strategies is to maximize government revenues, which is the product of total tax base x average tax rate for each individual tax. Thus, our variables are revenue-oriented and do not include more direct tax policy measures such as marginal or average tax rates and/or tax base. Additionally, the use of revenue metrics has the advantage that a large cross-sectional time-series dataset is available.

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and a relatively large dataset of different countries. However, we also take a look at a cross-sectional dataset of tax administration/enforcement metrics. We further examine a list of potential factors affecting the harmonization of tax policies within and outside the EU and include non-rate factors in our analysis.

The remainder of this paper is structured as follows: the next section provides background – including some literature review – and our research question. Section three describes the methodology and the data used for the study. Section four presents our results and section five concludes.

2 BACKGROUND AND RESEARCH QUESTIONS

Tax systems have been compared across and within countries by looking at tax burdens and tax mix across time and countries, the impact of culture on the development of tax systems as well as non-rate factors (e.g., Robinson and Slemrod, 2011; Richardson, 2007; Bach, Seidel and Teichmann, 2002). Researchers have found that tax systems vary significantly, that there is some indication of national culture affecting the development of different tax structures (Pippin et al., 2010), and that non-rate factors of tax systems, i.e. factors related to procedure and enforcement, can also have a significant economic impact (Robinson and Slemrod, 2011). Similarly, studies examining the conflicting effects of tax harmonization efforts versus tax competition are plentiful (e.g., Lamaanen, Simula and Torstila, 2012; Devereux, Lockwood and Redoano, 2008; Florin, 2010; Gravelle, 1986). Culture has also been found to be one of the explanatory factors in the development of national accounting systems (Roberts and Salter, 1999), as well as in the adoption of international accounting standards (IFRS) (Lasmin, 2012). The recent debt crisis in Europe has reinvigorated efforts within the EU to coordinate tax policies across the different member nations (e.g., van der Made, 2011; Tofan, 2011; Matei and Pirvu, 2010); one example of this is the proposal of the Common Consolidated Corporate Tax Base.

As stated above, the purpose of the study is to first analyze and demonstrate how (and which) countries' tax systems differ from each other. We select three tax-rate factors, each measuring a different aspect of tax collection/government revenues, to examine these differences and similarities. In addition, we also compare non-rate factors (Robinson and Slemrod, 2011). The three tax rate factors measure overall tax burden, income tax reliance, and fiscal decentralization. Overall tax burden is the primary indicator of most tax system comparisons. It is measured as tax revenues as a percentage of gross domestic product (GDP). While experts disagree on the progressivity of other taxes, such as levies on consumption and property, income taxes are generally designed to be progressive (Richardson, 2007; Robinson and Slemrod, 2011). Thus, for the tax system's second factor we focus on each country's reliance on income taxes to generate revenues as a proxy for progressivity. The variable is determined by dividing the tax revenues from income taxes into total tax revenues. The third tax rate variable focuses on the level of government responsible for tax collection. Tax policy makers who follow

the principle of subsidiarity believe that economic, political, and social issues should be dealt with at the most immediate level consistent with their resolution. According to this principle it is advantageous to handle taxes (and spending) at the local (or state) level because local authorities are more familiar with the community's needs, governments are more likely to be held accountable, and taxpayers are more likely to report and submit their taxes because of the reduced anonymity (e.g., Chu and Yang, 2012; Buser, 2011). However, as with the economies of scale argument, a central tax administration may have the advantage of reducing costs by handling a large volume of tax filings under one roof. That is, a centralized system, where decisions presumably are made by experts, may have the benefit of fewer errors in judgment and lower overall cost of collection. Additionally, it might be a means to reduce tax competition at the sub-national level. Historically, nations have adopted different strategies with some being more and some less centralized with regard to political decision making and government responsibilities. We expect that the level of government responsible for tax collection will vary depending on a country's historical, political, and cultural background.[2] Fiscal decentralization or centralization (with regard to the level of tax collection) is therefore another key characteristic of any tax system. Using these three tax system variables, tax burden, income tax reliance, and fiscal decentralization, we examine fiscal differences, similarities, and harmonization within and outside the EU. In addition to that, we also compare these "rate variables" with the non-rate tax system metrics described in the Robinson and Slemrod (2011) paper.[3]

Our research questions can therefore be summarized as follows:

1) Are taxes/tax systems within the EU and within the eurozone significantly different from other taxes/tax systems?
2) In what dimensions are tax systems within the EU and within the eurozone most similar?
3) Are countries within the EU and within the eurozone coordinating their tax systems over time? and
4) Is there a stronger tax system coordination within the EU and within the eurozone than in other countries?

Tax harmonization and coordination have been subject to various debates within the EU since the 1970s. The two main competing arguments are that tax competition leads to governments being more efficient, thus harmonization and consolidation of tax systems are not necessarily desirable. On the other hand, governments aiming at harmonization have to worry about an eroding tax base due to the infamous "race to the bottom". Two directives (from 1977 and 2006) concerning indirect taxation address the minimum VAT levy, currently 15%. Another directive

[2] UCLG – United Cities and Local Governments (2010) provide a detailed overview of fiscal decentralization in different world regions.

[3] Note that due to limitations related to data availability this study concentrates on the rate factors of the various tax systems. These datasets can be compiled for over 40 years while for non-rate factors we can only find a cross-section for the years 2006-2008. Hopefully, future research can expand the analysis using time-series information of non-rate tax system information.

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from 2003 deals with taxes on interest and royalties. Similarly, the creation of a common consolidated corporate income tax base (CCCBT) which should prevent companies from "tax haven shopping" by moving to the jurisdiction that offers the most tax incentives has been discussed at various occasions (Quéré, Trannoy and Wolff, 2014). We believe that in light of these discussions an analysis of the current status of tax harmonization within the EU and within the eurozone should be of interest to academics and policy makers. Therefore, in addition to the descriptive analysis comparing different dimensions of tax systems within and outside the EU (eurozone) and over time, this study also makes an attempt to explore what factors – other than EU and eurozone membership – affect tax system similarities/differences and fiscal coordination.

3 DATA AND METHODOLOGY

We gather the information for each country's tax system from the OECD database for all countries in the OECD and for the years 1965 through 2012. For the first part of the study we use descriptive statistics to analyze and compare the following tax system dimensions across the different countries and across time:

1) The country's total *tax burden* measured as the country's total tax revenue as a percentage of its gross domestic product (years 1965-2012).
2) The country's *income tax reliance* measured as the country's share of revenue collected from income taxes (at any level of government) as a percentage of its total tax revenues (years 1965-2012).
3) The country's *fiscal decentralization* measured as the country's share of revenue collected at the local and state level as a percentage of its total tax revenues (years 1973-2012).

Average values for each tax rate variable, year, and dataset (all countries, EU member countries, and eurozone countries) are presented in tables 1 through 3. The summary statistics suggest, and simple t-tests (not tabulated), confirm that EU member countries and countries in the eurozone have a higher tax burden, lower income tax reliance, and – depending on the year – marginally higher or lower fiscal decentralization than other countries.[4]

Table 1

Average tax burden, income tax reliance, and fiscal decentralization for all countries (years 1965-2012), in %

Year	Tax burden	Income tax reliance	Fiscal decentralization
1965	25.45	34.64	
1966	25.98	35.52	
1967	26.88	35.46	
1968	27.18	35.61	
1969	27.76	36.34	
1970	27.49	36.32	

[4] It is interesting to note that in the later years (starting in the 1990s) the EU and euro-zone countries appear to have more centralized tax collections which is due to the "new countries" (mostly former East bloc countries) within the Union.

Year	Tax burden	Income tax reliance	Fiscal decentralization
1971	28.00	36.76	
1972	27.68	36.82	
1973	27.82	37.41	28.91
1974	28.68	39.15	28.62
1975	29.35	37.11	33.00
1976	30.31	38.14	28.95
1977	31.03	38.25	29.39
1978	30.92	38.62	29.09
1979	30.84	38.98	28.71
1980	30.92	38.18	24.93
1981	31.62	38.12	24.53
1982	32.03	37.75	25.17
1983	32.19	37.75	25.62
1984	32.38	36.80	25.11
1985	32.51	36.89	26.11
1986	33.15	36.81	25.69
1987	33.62	36.29	25.60
1988	33.61	37.00	25.51
1989	33.45	37.43	23.40
1990	33.10	37.10	23.90
1991	33.57	35.84	24.08
1992	33.78	35.42	24.25
1993	34.27	35.01	24.61
1994	34.23	34.89	24.31
1995	34.58	33.98	22.44
1996	34.96	33.71	22.27
1997	34.94	34.17	22.26
1998	34.93	34.69	22.26
1999	35.21	34.24	22.58
2000	35.30	35.00	21.59
2001	34.84	34.63	21.87
2002	34.55	33.83	23.62
2003	34.48	33.46	23.90
2004	34.43	33.60	24.14
2005	35.02	34.35	24.14
2006	35.14	35.26	24.35
2007	35.20	35.93	24.49
2008	34.62	35.32	24.64
2009	33.78	33.48	25.31
2010	33.76	33.11	24.55
2011	34.12	33.52	24.97
2012	35.44	33.98	30.16

Notes: Countries in the sample – Australia (excluding year 2012), Austria, Belgium, Canada, Chile (starting 1990), Czech Republic (starting 1993), Denmark, Estonia (starting 1995), Finland, France, Germany, Greece, Hungary (starting 1991), Iceland (starting 1980), Ireland, Israel (starting 1995), Italy, Japan, Korea (starting 1972), Luxembourg, Mexico (starting 1980), Netherlands, New Zealand, Norway, Poland (starting 1991), Portugal, Slovak Republic (starting 1995), Slovenia (starting 1995), Spain, Sweden, Switzerland, Turkey, United Kingdom, and United States. Tax burden is measured as total tax revenues as percentage of GDP; income tax reliance is measured as total revenues from income taxes as percentage of total tax revenues; fiscal decentralization is measured as total revenues collected at the local (municipal or county) and state level as percentage of total tax revenues (data only available after 1972).

Table 2

Average tax burden, income tax reliance, and fiscal decentralization for EU countries (years 1965-2009), in %

Year	Tax burden	Income tax reliance	Fiscal decentralization
1965	30.48	27.80	
1966	31.05	28.13	
1967	31.66	28.01	
1968	31.90	28.14	
1969	32.05	29.39	
1970	30.73	29.18	
1971	31.63	29.27	
1972	32.19	29.97	
1973	32.74	34.64	32.27
1974	33.70	36.81	32.65
1975	34.47	35.88	31.29
1976	35.36	35.94	31.16
1977	36.09	36.56	31.84
1978	36.10	37.05	31.86
1979	36.01	36.74	31.70
1980	37.23	36.65	31.71
1981	36.01	34.90	30.69
1982	37.12	34.52	30.61
1983	37.98	34.04	30.55
1984	38.02	34.26	30.56
1985	38.20	34.60	30.81
1986	36.72	32.41	20.83
1987	37.12	32.63	20.56
1988	36.91	33.05	20.98
1989	36.28	33.55	15.81
1990	36.31	33.83	16.19
1991	36.51	33.91	15.72
1992	37.05	33.39	15.74
1993	37.50	33.51	16.14
1994	37.55	33.05	16.12
1995	38.83	33.52	13.72
1996	39.83	33.54	13.91
1997	39.85	34.11	14.41
1998	39.90	34.47	14.73
1999	40.29	34.44	14.82
2000	40.35	35.16	14.54
2001	39.66	34.80	14.28
2002	39.14	34.05	17.35
2003	38.93	33.33	17.88
2004	37.64	30.04	18.39
2005	38.07	30.27	18.58
2006	38.05	30.80	19.02
2007	38.17	31.42	19.13
2008	37.75	31.25	19.33

Year	Tax burden	Income tax reliance	Fiscal decentralization
2009	37.35	29.78	19.43
2010	37.19	29.18	17.97
2011	37.37	29.26	19.31
2012	38.17	30.20	21.60

Notes: Countries in the EU are Austria (joined 1995), Belgium, Czech Republic (joined 2004), Denmark (joined 1973), Estonia (joined 2004), Finland (joined 1995), France, Germany, Greece (joined 1981), Hungary (joined 2004), Ireland (joined 1973), Italy, Luxembourg, Netherlands, Poland (joined 2004), Portugal (joined 1986), Slovenia (joined 2004), Slovak Republic (joined 2004), Spain (joined 1986), Sweden (joined 1995), and United Kingdom (joined 1973). Tax burden is measured as total tax revenues as percentage of GDP; income tax reliance is measured as total revenues from income taxes as percentage of total tax revenues; fiscal decentralization is measured as total revenues collected at the local (municipal or county) and state level as percentage of total tax revenues (data only available after 1972).

Table 3

Average tax burden, income tax reliance, and fiscal decentralization for eurozone countries (years 1999-2012), in %

Year	Tax burden	Income tax reliance	Fiscal decentralization
1999	39.51	32.07	14.82
2000	39.47	32.72	14.54
2001	38.41	32.09	14.28
2002	38.10	31.44	17.35
2003	37.82	30.53	17.88
2004	37.59	30.33	18.39
2005	37.96	30.60	18.58
2006	38.17	31.05	19.02
2007	38.16	31.14	19.13
2008	37.77	30.96	19.33
2009	36.63	28.71	19.43
2010	36.84	28.40	17.97
2011	37.19	28.90	19.31
2012	37.76	29.47	21.60

Notes: Countries in the eurozone are Austria, Belgium, Finland, France, Germany, Greece (joined 2001), Ireland, Italy, Luxembourg, Netherlands, Portugal, Slovenia (joined 2007), Slovak Republic (joined 2009), and Spain. Tax burden is measured as total tax revenues as percentage of GDP; income tax reliance is measured as total revenues from income taxes as percentage of total tax revenues; and fiscal decentralization is measured as total revenues collected at the local (municipal or county) or state level as percentage of total tax revenues.

Of the three tax system variables, burden and income tax reliance are positively correlated for all OECD countries, and the sub-samples of all EU member countries and all eurozone countries. Tax burden and fiscal decentralization are not significantly correlated for all OECD countries, but negatively correlated for the sub-samples of EU countries as well as the sub-sample of eurozone countries. Income tax reliance and fiscal decentralization are positively related for all OECD countries, not significantly correlated in the case of the EU countries, but negatively correlated for the eurozone countries. On a yearly basis, the correlations coefficients between the three tax system variables are marginally or not significant.

The tax administration and enforcement measures were compiled from three OECD studies (Robinson and Slemrod, 2011; OECD, 2006; 2007; 2008) and not available across time. The Robinson and Slemrod (2011) measures are presented in table 4.

TABLE 4

Tax administration and enforcement measures (Robinson and Slemrod, 2011)

	Tax administration					Enforcement					
	Self- vs. third-party assessment of tax liability	Withholding (for number of income categories)	Withholding type (zero, non-cumulative, cumulative)	Reporting (for # of income categories) by 3rd parties	Matching of information (by use of taxpayer identification)	Collection (rating of power to enforce tax payment)	Verification (information access of tax officials)	Penalty (maximum penalty tax rate)	Coverage of enforcement (relative to country size)	Access to bank information of taxpayers	Dispersed responsibility (combined factor)
Australia	1	1	1	3	5	10	8	0.9	1.55	1	-0.664
Austria	0	3	2	2	2	10	8	2	1.44	0	-0.886
Belgium	0	5	1	4	4	9	6	2	2.54	0	-0.992
Canada	1	2	1	8	6	9	8	0.5	1.69	1	-0.100
Chile	1	4	2	8	4	5	8	3	0.36		
Czech R.	0	3	2	1	6	9	9	0.2	2.17	1	-0.774
Denmark	0	5	2	7	5	13	6	2	2.47	1	0.635
Estonia	1	3	2	4	5	10	5		2.23		
Finland	0	5	1	5	6	9	6	0.3	1.7	1	-0.415
France	0	0	0	9	1	9	6	0.8	3.12	1	-1.108
Germany	0	4	2	3	2	12	7		2.04	1	
Greece	0	9	1	9	3	12	9	2	1.94	1	0.761
Hungary	1	6	1	5	6	12	8	0.5	1.96	1	0.277
Iceland	0	5	1	7	5	8	8	0.25	0.5	1	-0.216
Ireland	1	5	2	6	4	9	8	1	2.43	1	0.246
Israel											
Italy	1	5	2	7	6	10	7	2	0.85	1	0.754
Japan	1	7	2	9	0	6	6	0.4	0.67	1	0.504
Korea	1	7	2	8	6	12	5	0.4	0.49	1	1.274
Luxembourg	0	4	2	2	5	9	3	0.4	2.91	0	-1.016
Mexico	1	9	2	10	5	12	5	0.75	0.49	1	1.701
Netherlands	0	5	2	4	5	9	7	2	2.81	1	-0.215
New Zealand	1	3	2	3	5	9	8	1.5	2.2	1	-0.231
Norway	0	1	1	5	6	11	5	0.6	2.01	1	-0.607
Poland	1	6	2	6	5	10	9		1.86	1	
Portugal	0	7	1	8	5	10	7		1.64	1	
Slovak R.	1	4	2	4	1	8	4	0.15	1.5	1	-0.213
Slovenia	0	7	1	7	4	9	7		1.8		
Spain	1	8	2	10	6	10	6	1.5	0.99	1	1.379
Sweden	0	3	1	6	5	11	4	0.2	1.68	1	-0.294
Switzerland	0	3	0	1	0	9	6		0.18	0	
Turkey	1	6	2	7	4	13	7	1	0.91	1	1.088
UK	1	9	2	8	4	8	6	1	2.21	1	0.807
United States	1	1	1	5	5	9	5	0.75	0.46	1	-0.425

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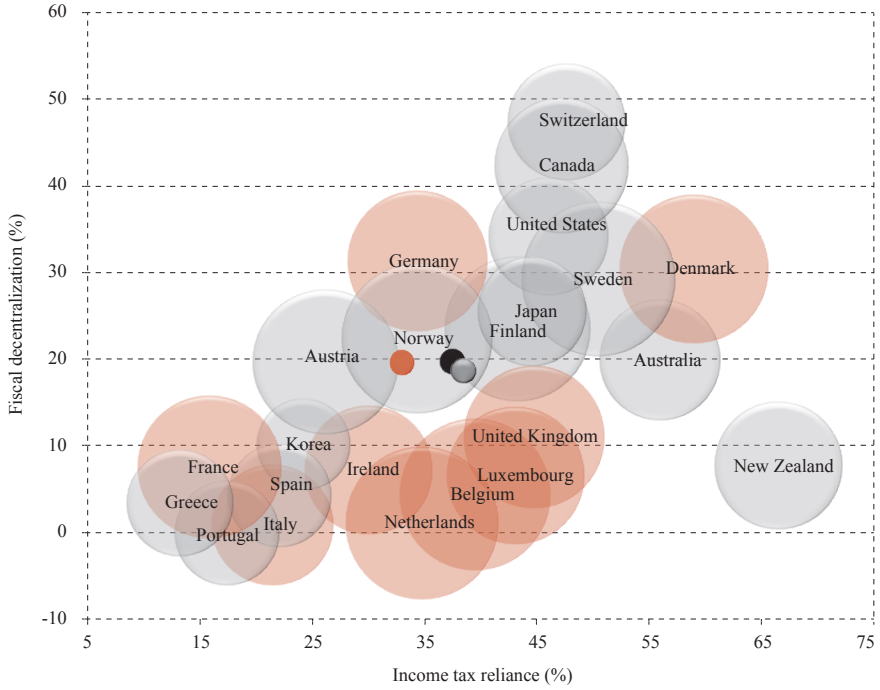
FIGURE 1

Tax burden, income tax reliance, and fiscal decentralization for EU and non-EU member countries in the year 1975



Notes: EU member countries are red; non-EU member countries are gray; overall mean (black), EU member country mean (red); and non-EU member country mean (gray) is presented as small circle. Size of the bubble represents tax burden (tax revenues as percentage of GDP); x-axis measures income tax reliance (tax revenues from income taxes as percentage of total revenues); y-axis measure fiscal decentralization (tax revenues collected at non-federal, i.e., local and state levels as percentage of total tax revenues).

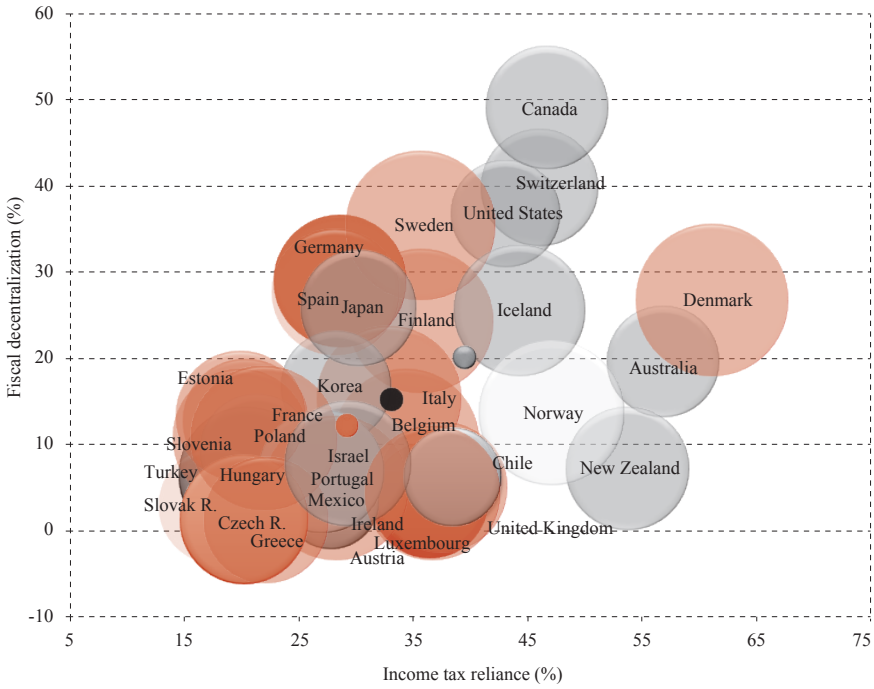
Figures 1 and 2 illustrate which countries are similar and different with regard to the three tax-rate factors for the years 1975 and 2010.[5] According to these graphs, EU countries do tend to cluster together – with Denmark and Germany being outliers or exceptions.

Of course, in addition to EU and eurozone membership, other factors also impact tax burden, tax composition, and fiscal decentralization. For example, prior research has shown that tax systems are significantly different in common law than in code law countries (Pippin et al., 2010). Similarly, Kenny and Winer (2006) suggest that the countries' tax systems are affected by different political regimes, such as capitalist versus socialist or democratic versus non-democratic. We therefore expect that countries that were members of the former Eastern bloc will

[5] Note that in 1975 the entire sample consisted of fewer non-EU and EU member countries. In the 1990s several countries joined the OECD increasing the total number of countries from 24 in 1965 to 34 in 1995. Some (but not all) of these countries eventually also joined the EU and the euro-zone.

FIGURE 2

Tax burden, income tax reliance, and fiscal decentralization for EU, eurozone, and non-EU countries in the year 2010



Notes: EU member countries are red; eurozone countries are dark red; non-EU member countries are gray; overall mean (black), EU member country mean (red); and non-EU member country mean (gray) is presented as small circle. Size of the bubble represents tax burden (tax revenues as percentage of GDP); x-axis measures income tax reliance (tax revenues from income taxes as percentage of total revenues); y-axis measure fiscal decentralization (tax revenues collected at non-federal, i.e., local and state levels as percentage of total tax revenues).

exhibit significant differences due their history during the Cold War as well as the economic challenges these new democracies were faced with in the 1990s and are still facing today. In order to control for these effects, we test the tax system differences using simple OLS regression models:

$$VAR_{it} = \beta_0 + \beta_1 EU_{it} + \beta_2 EURO_{it} + \beta_3 ANGLO_i + \beta_4 EAST_i + \beta_5 POP_{it} + \beta_6 GDP_{it} + \beta_7 YOUNG_{it} + \beta_8 OLD_{it} + \tau_t + \varepsilon_{it} \quad (1)$$

The dependent variable, $VAR_{i,t}$, is one of the three tax collection metrics, total tax revenues as percentage of GDP, income tax revenues as percentage of total tax revenues, or state and local tax revenues as percentage of total tax revenues, for each country *i* and year *t* in the sample. *EU*, *EURO*, *ANGLO*, and *EAST* are dummy variables equaling one for EU or eurozone membership, common law country, or former Eastern bloc countries respectively and zero otherwise. We control for demographic, economic and time effects. Total population of a country can be seen as

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a scale variable. For example, countries that have large populations tend to have more decentralized fiscal systems. Thus, we include *POP*, which is the natural log of the country's population. A country's gross domestic product per capita controls for the development level of the country. While European countries are relatively higher-income, there is still some variation, especially between East and West. In our model *GDP* measures GDP per capita (also logged). Further, we include *YOUNG* (*OLD*), which measures the percentage of the population under 15 (over 64). These demographic variables are used to control for the potential impact of demography, particularly the working age population and elderly population, on tax burden, tax composition and the level of decentralized public service delivery. Last, we include indicator variables, one for each year of data used in the sample (τ_t) to control for time effects. ε_{it} is the error term and is i.i.d.

As stated above, visual analysis and t-test results suggest significant differences between EU and non-EU members. However, a visual comparison of 1975 with 2010 does not imply that the tax systems of the EU countries have converged over time. In order to test whether tax systems have become more similar (or different) in each of the three tax rate dimensions (burden, income tax reliance, and decentralization), nine additional metrics were created using the following formula:

$$DIFF\_MEAN_{it} = (VAR_{it} - MEAN_t) / MEAN_t \quad (2)$$

$MEAN_t$ is the mean value for the respective variable for all countries, for EU member countries only, and for eurozone countries only for each year t in the sample. That is, for each of the three tax collection variables, "tax burden", "income tax reliance", and "fiscal decentralization", we compute three different averages: "overall mean", "mean of EU member countries", and "mean of eurozone countries." Then, for each metric (tax burden, income tax reliance, fiscal decentralization), for each country, and for each year in the sample, we compare the individual country value to the overall mean, the EU mean, and the eurozone mean for the respective year. The difference is scaled by the respective mean and taken as an absolute term. Summary statistics of the difference to means measures for all countries as well as the subgroups "EU members only" and "eurozone only" are presented in table 5.

A comparison of the measures in Panel A (all countries) with Panel B (EU member countries) and Panel C (eurozone countries) suggests that, on average, the differences to the mean for the tax burden and income tax reliance variables tend to be smaller when only considering EU member (eurozone) countries. However, in the case of fiscal decentralization, EU member (eurozone) countries are more different from the mean than the entire country group. This is true for all countries as well as the subgroup summary statistics, thus providing some support for the premise that the tax systems within the groups are more similar.

Table 5

Summary statistics for differences to mean variables

Panel A. All countries

Scaled absolute difference of…		Mean	Min.	Max.	Std. dev.
…tax burden to	overall mean	0.201	0.000	0.670	0.145
	mean of EU member countries	0.197	0.001	0.719	0.146
	mean of eurozone countries	0.177	0.000	0.599	0.128
…income tax reliance to	overall mean	0.267	0.000	0.990	0.188
	mean of EU member countries	0.298	0.000	1.480	0.232
	mean of eurozone countries	0.294	0.000	1.154	0.250
…fiscal decentralization to	overall mean	0.428	0.002	0.979	0.307
	mean of EU member countries	0.436	0.002	0.979	0.305
	mean of eurozone countries	0.494	0.028	0.933	0.313

Panel B. EU member countries

Scaled absolute difference of…		Mean	Min.	Max.	Std. dev.
…tax burden to	overall mean	0.180	0.001	0.476	0.125
	mean of EU member countries	0.134	0.001	0.391	0.084
	mean of eurozone countries	0.130	0.000	0.339	0.081
…income tax reliance to	overall mean	0.229	0.000	0.814	0.191
	mean of EU member countries	0.246	0.002	1.010	0.204
	mean of eurozone countries	0.232	0.001	1.154	0.206
…fiscal decentralization to	overall mean	0.515	0.044	0.882	0.288
	mean of EU member countries	0.532	0.033	0.890	0.282
	mean of eurozone countries	0.590	0.099	0.898	0.264

Panel C. Eurozone countries

Scaled absolute difference of…		Mean	Min.	Max.	Std. dev.
…tax burden to	overall mean	0.157	0.001	0.343	0.093
	mean of EU member countries	0.120	0.001	0.292	0.071
	mean of eurozone countries	0.121	0.000	0.272	0.070
…income tax reliance to	overall mean	0.180	0.000	0.477	0.123
	mean of EU member countries	0.169	0.002	0.476	0.108
	mean of eurozone countries	0.161	0.001	0.453	0.102
…fiscal decentralization to	overall mean	0.535	0.044	0.882	0.299
	mean of EU member countries	0.569	0.033	0.890	0.279
	mean of eurozone countries	0.590	0.099	0.898	0.264

Notes: Tax burden is measured as total tax revenues as percentage of GDP; income tax reliance is measured as revenues from income taxes as percentage of total tax revenues; and fiscal decentralization is measured as revenues collected at state or local government levels as percentage of total tax revenues. For each year in the sample, each country's value is compared to the mean value for the respective year. The difference is scaled by the mean and taken as an absolute term.

If countries' tax systems become more similar over time, the difference to the mean will decline over time. Nontabulated summary statistics of the difference to mean metrics for each country and each year individually suggest no significant difference across time with the exception of the year 1995 when several countries joined the OECD and the EU. In order to test across-time variation further, we

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employ regression analysis with a time benchmark dummy and interaction variables. First, we test how the country-specific, demographic, and economic factors affect the difference to the mean for each tax system variable:

$$DIFF\_MEAN_{it} = \beta_0 + \beta_1 EU_{it} + \beta_2 EURO_{it} + \beta_3 ANGLO_i + \beta_4 EAST_i + \beta_5 POP_{it} + \beta_6 GDP_{it} + \beta_7 YOUNG_{it} + \beta_8 OLD_{it} + \tau_t + \varepsilon_{it} \quad (3)$$

Next, we use simple t-tests to determine whether the difference to mean metrics are significantly different before and after certain time "benchmark" events, namely the period before/after 1992 and the period before/after 2004. One important event for EU countries was the ratification of the Maastricht Treaty in 1992. Among other things it led to the creation of the common currency (euro) and established the three pillars of the European Union, "European Community", "Common Foreign and Security Policy", and "Justice and Home Affairs." It also included a clause mandating all member countries to keep "sound fiscal policies" with countries' debt limited to 60% of GDP and annual deficits no greater than 3% of GDP. While we cannot assume that the European Union's requirement of "sound fiscal policy" directly changed member countries' tax systems, we believe that over time it could have led to a more harmonized system of collecting revenues. Thus, we separate the sample into the time period before and including the year of 1992 and the time period after 1992.

The single largest expansion of the European Union, in terms of territory, number of countries, and population took place in 2004 with Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, and Slovenia joining the community. These new member countries brought many challenges – some due to the fact that they were part of the former Eastern bloc. Member states anticipated and dealt with significant difficulties. Nonetheless, according to the European Commission the enlargement was a success (Vucheva, 2009). The new dynamic in the European Parliament and among member countries undoubtedly impacted each members' fiscal strategy. We therefore also compare the years before and after 2004.

$$\begin{aligned} DIFF\_MEAN_{it} = {} & \beta_0 + \beta_1 EU_{it} + \beta_2 EURO_{it} + \beta_3 ANGLO_i + \beta_4 EAST_i + \beta_5 POP_{it} \\ & + \beta_6 GDP_{it} + \beta_7 YOUNG_{it} + \beta_8 OLD_{it} + \beta_9 PERIOD1992 \\ & + \beta_{10} PERIOD2004 + \beta_{11} EU * PERIOD1992 \\ & + \beta_{12} EU * PERIOD2004 + \beta_{13} EURO * PERIOD2004 + \varepsilon_{it} \end{aligned} \quad (4)$$

PERIOD1992 (PERIOD2004) is an indicator variable for the time period before 1992 (2004) equaling 1 for the years after 1992 (2004) and zero otherwise. Note that the interaction of eurozone countries is only possible for the 2004 time dummy.

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4 RESULTS

The regression results are presented in tables 6, 7, and 9. Table 8 shows the t-tests examining whether the difference to the mean variables is significantly distinct before or after 1992 and before and after 2004. The results for the tax system dependent variables (table 6, Panel A) confirm a significant difference of tax system variables for EU member countries as well as eurozone countries. Specifically, the tax burden is higher but income tax reliance and fiscal decentralization are lower for EU member countries. For eurozone countries, the signs are opposite for tax burden and fiscal decentralization – but not for income tax reliance (after controlling for EU membership). Common law countries, such as the UK and Australia, have higher income tax reliance and lower fiscal decentralization. For the countries from the former Eastern bloc it is the opposite. The size of the country (measured by the natural log of the population) and the percentage of younger people (under 15) are negatively related to tax burden but economic output per capita as well as the older (over 64) population are positively correlated.

For the non-rate tax system variables – the measures related to administration and enforcement (Robinson and Slemrod, 2011) – simple OLS regression analysis, shown in table 6 below, does not imply a significant difference between EU member (eurozone) countries and others. More important seems to be whether a country has a common law system or is a former Eastern bloc country. For example, according to the regression results, common law countries are more likely to employ a tax system of self-assessment & self-reporting of certain taxes, and allow tax officials more access to taxpayer information than non-Anglo countries. Former Eastern bloc countries, on the other hand, have lower dispersed responsibility and lower penalty rates. Also significant is GDP per capita which is negatively correlated with most non-rate tax system measures implying that richer countries have fewer administrative and enforcement tools – such as withholding of different types of taxes, penalties for non-compliance, or access to bank information – than countries with a lower average of GDP per capita. Although regression results do not suggest a relationship, Pearson correlation coefficients (nontabulated) are significant for the correlation between the EU (eurozone) dummy variable and the self-assessment indicator (negative) as well as the "coverage of enforcement" measure (positive). This implies that EU and eurozone countries might be less likely to allow taxpayers to self-assess their tax due and have more enforcement possibilities. It is important to note that due to a very limited sample size for non-rate tax system metrics (a set of 34 countries and no time-series information) any failure to find significant results could also be a problem of statistical power.

The results for regression model (3) are listed in table 7. The dependent variable in each model is the scaled absolute difference of the tax system variable to the respective group means (overall mean, EU country mean, and eurozone country mean).

The regression results suggest that EU membership and eurozone membership are generally significantly related to the difference to mean numbers even after controlling for code law/common law countries, former Eastern bloc countries as well

as demographic and economic variables. Note that this applies to all three difference-to-mean metrics: difference to mean of all countries, difference to mean of EU countries only, and difference to mean of eurozone countries only. For example, we find that EU members' tax burdens are more similar to the mean tax burden of all countries but also more similar to the mean tax burden of EU countries and the mean tax burden of eurozone countries.

The impact of time effects was introduced with the two benchmark years, 1992 and 2004, to test if tax system harmonization occurred overall, within EU countries, and/or within eurozone countries after the Maastricht Treaty of 1992 and/or the biggest EU expansion in 2004. We used t-tests as well as regression model (4) to evaluate the difference to means before/after 1992 and before/after 2004. Table 8 (Panel A) illustrates that tax systems seem to converge with regard to the tax burden variable but that there is much less harmonization for income tax reliance and no convergence for fiscal decentralization. More specifically, the tax burdens converge for all countries as well as for the EU countries. Income tax reliance converges for all countries but not for the sub-sample of EU countries, and countries' fiscal decentralization does not become more similar over time. Note that for the subsample of eurozone countries there are no data before 1999.

Table 6

Panel A: OLS regression results for tax rate tax system variables

	Tax burden	Income tax reliance	Fiscal decentralization
Intercept	-73.921***	-1.457***	-2.428***
	(6.988)	(0.129)	(0.414)
EU membership	7.482***	-0.036***	-0.138***
	(0.434)	(0.008)	(0.020)
Eurozone membership	-3.217***	-0.065***	0.108***
	(0.670)	(0.011)	(0.026)
Common law (Anglo) country	-0.323	0.067***	-0.136***
	(0.505)	(0.008)	(0.019)
Former East bloc country	2.914***	0.038***	-0.066**
	(0.651)	(0.011)	(0.029)
Population (natural log)	-0.900***	-0.005**	0.042***
	(0.147)	(0.002)	(0.005)
GDP per capita (natural log)	10.807***	0.175***	0.302***
	(0.544)	(0.010)	(0.039)
Percentage of population under 15	-0.147**	0.428***	-2.799***
	(0.069)	(0.124)	(0.294)
Percentage of population over 64	0.366***	0.020	-4.306***
	(0.109)	(0.185)	(0.604)
Adjusted R-square	0.511	0.359	0.641
Overall F	22.750	12.870	13.27

*Notes: Tax burden is measured as total tax revenues as percentage of GDP; income tax reliance is measured as revenues from income taxes as percentage of total tax revenues; and fiscal decentralization is measured as revenues collected at state and local government levels as percentage of total tax revenues. All regression models include year dummies (not tabulated). Standard errors in parentheses; *, **, and *** indicate significance at the .1; .05; and .01 level respectively.*

TABLE 6

Panel B: OLS regression results for non-rate tax system variables

Dependent variables: tax administration factors of tax systems

	Adj. R^2	Intercept	EU member-ship	Eurozone member-ship	Common law (Anglo) country	Former East bloc country	Population (natural log)	GDP per capita (natural log)	Percentage of population under 25	Percentage of population over 64	Overall F
Tax administration (combined factor)	0.11	112.182**	3.640	-0.688	0.459	-6.981	0.165	-7.922**	-0.434	-0.540	1.47
		(46.379)	(3.127)	(2.842)	(2.637)	(4.384)	(0.710)	(3.497)	(0.629)	(0.595)	
Self-/3rd party assessment of tax liability	0.51	5.969*	-0.103	-0.106	0.597***	0.108	0.081	-0.508*	-0.029	-0.031	5.11
		(3.344)	(0.225)	(0.205)	(0.190)	(0.316)	(0.051)	(0.252)	(0.045)	(0.043)	
Withholding (for # of income categories)	0.08	51.178**	1.546	0.098	-0.538	-3.068	-0.075	-3.746**	-0.252	-0.190	1.35
		(21.506)	(1.450)	(1.318)	(1.223)	(2.033)	(0.329)	(1.621)	(0.292)	(0.276)	
Withholding type (zero, non-, and cumulative)	-0.08	6.482	0.644	-0.298	0.008	-0.426	0.034	-0.328	-0.046	-0.087	0.69
		(6.042)	(0.407)	(0.370)	(0.344)	(0.571)	(0.093)	(0.456)	(0.082)	(0.077)	
Reporting (for # of categories) by 3rd parties	0.12	39.795*	0.475	0.111	-0.205	-3.093	0.246	-3.425*	-0.029	-0.002	1.55
		(22.625)	(1.526)	(1.386)	(1.287)	(2.139)	(0.346)	(1.706)	(0.307)	(0.290)	
Matching of info (by use of taxpayer ID)	-0.15	8.759	1.078	-0.493	0.597	-0.502	-0.120	0.086	-0.077	-0.229	0.49
		(17.802)	(1.200)	(1.091)	(1.012)	(1.683)	(0.273)	(1.342)	(0.241)	(0.228)	

Table 6
Panel B: Continued

Dependent variables: enforcement factors of tax systems plus overall factor "dispersed responsibility"

	Adj. R^2	Intercept	EU member-ship	Eurozone member-ship	Common law (Anglo) country	Former East bloc country	Population (natural log)	GDP per capita (natural log)	Percentage of population under 25	Percentage of population over 64	Overall F
Enforcement (combined factor)	-0.07	80.090**	1.379	0.690	1.828	-2.623	-0.623	-5.542**	0.021	0.137	0.79
		(33.307)	(2.154)	(2.059)	(1.673)	(3.477)	(0.499)	(2.548)	(0.413)	(0.400)	
Collection (power to enforce)	-0.14	1.179	1.546	-0.828	-1.217	-0.486	0.241	0.450	0.102	-0.038	0.50
		(17.954)	(1.211)	(1.100)	(1.021)	(1.697)	(0.275)	(1.354)	(0.243)	(0.230)	
Verification (info access of tax officials)	0.18	44.520***	-0.949	1.192	1.893**	-0.520	-0.279	-3.118***	-0.187	0.017	1.90
		(13.065)	(0.881)	(0.801)	(0.743)	(1.235)	(0.200)	(0.985)	(0.177)	(0.168)	
Penalty(maximum penalty rate)	0.18	15.843**	0.306	0.398	0.254	-1.466*	-0.090	-1.346**	-0.025	0.022	1.72
		(7.018)	(0.501)	(0.479)	(0.389)	(0.781)	(0.113)	(0.542)	(0.095)	(0.092)	
Coverage of enforcement	0.50	-9.513*	1.125***	0.054	0.520	0.677	-0.060	0.662	0.145*	0.090	4.94
		(5.371)	(0.362)	(0.329)	(0.305)	(0.508)	(0.082)	(0.405)	(0.073)	(0.069)	
Access to bank information of taxpayers	0.02	4.232	0.144	-0.198	0.204	-0.112	0.029	-0.373	0.004	0.009	1.09
		(3.509)	(0.240)	(0.230)	(0.186)	(0.380)	(0.054)	(0.266)	(0.046)	(0.045)	
Dispersed responsibility	0.41	19.802**	0.619	-0.667	-0.272	-2.114***	0.081	-1.500**	-0.146	-0.141	3.13
		(6.904)	(0.446)	(0.427)	(0.347)	(0.721)	(0.103)	(0.528)	(0.086)	(0.083)	

*Notes: The dependent variables are the individual tax administration and enforcement variables (Robinson and Slemrod, 2011); dispersed responsibility is the combined variable from Robinson and Slemrod (2011); the administration and enforcement measures are calculated by summing the first set of five metrics (tax administration) and the second set of five variables (enforcement). Standard errors in parentheses; *, **, and *** indicate significance at the .1; .05; and .01 level respectively.*

TABLE 7

OLS regression results for difference to overall mean, EU mean, and eurozone mean variables

	Absolute difference of countries' tax burden to tax burden…			Absolute difference of countries' income tax reliance to income tax reliance…			Absolute difference of countries' fiscal decentralization to fiscal decentralization…		
	Overall mean	EU countries mean	Eurozone countries mean	Overall mean	EU countries mean	Eurozone countries mean	Overall mean	EU countries mean	Eurozone countries mean
Intercept	-0.516***	0.278**	0.040	1.685***	0.784***	-1.611***	0.295	-2.479*	7.043*
	(0.164)	(0.139)	(0.165)	(0.242)	(0.285)	(0.345)	(0.738)	(1.285)	(3.569)
EU membership	-0.024**	-0.078***	-0.029**	-0.025*	-0.035**	0.031	0.137**	-0.470***	
	(0.010)	(0.008)	(0.015)	(0.014)	(0.017)	(0.031)	(0.054)	(0.094)	
Eurozone membership	0.007***	0.016	-0.015	-0.094***	-0.137***	-0.281***	0.061	0.280**	-0.518
	(0.013)	(0.011)	(0.013)	(0.020)	(0.023)	(0.028)	(0.069)	(0.120)	(0.209)
Common law (Anglo) country	-0.130	-0.068***	-0.009	0.042***	0.107***	-0.009	-0.124***	-0.208***	-0.005
	(0.010)	(0.008)	(0.014)	(0.014)	(0.017)	(0.028)	(0.043)	(0.076)	(0.147)
Former East bloc country	-0.106***	-0.094***	-0.037***	0.090***	0.115***	0.163***	-0.208**	-0.326**	-0.308**
	(0.014)	(0.011)	(0.012)	(0.020)	(0.024)	(0.026)	(0.081)	(0.140)	(0.147)
Population (natural log)	0.025***	0.026***	0.030***	-0.017***	-0.022***	-0.026***	-0.095***	0.009	0.005
	(0.003)	(0.002)	(0.003)	(0.004)	(0.005)	(0.007)	(0.013)	(0.023)	(0.035)
GDP per capita (natural log)	-0.002	-0.052***	-0.034***	-0.075***	0.027	0.239***	0.267***	0.370***	-0.358
	(0.013)	(0.011)	(0.014)	(0.019)	(0.022)	(0.029)	(0.069)	(0.119)	(0.350)
Percentage of population under 25	1.435***	0.985***	0.661***	-0.798***	-0.914***	0.275	0.841	-0.113	-8.017**
	(0.157)	(0.132)	(0.216)	(0.231)	(0.272)	(0.452)	(0.823)	(1.432)	(3.548)
Percentage of population over 64	0.774***	-0.476**	-0.704**	-1.129***	-1.485***	-0.626	-7.166***	-3.443	-5.281
	(0.235)	(0.198)	(0.272)	(0.345)	(0.406)	(0.569)	(1.560)	(2.714)	(6.217)
Adjusted R-square	0.285	0.485	0.419	0.113	0.188	0.356	0.311	0.285	0.120
Overall F	9.48	21.01	17.07	3.69	5.92	13.32	4.16	3.79	1.82

*Notes: Tax burden is measured as total tax revenues as percentage of GDP; income tax reliance is measured as revenues from income taxes as percentage of total tax revenues; and fiscal decentralization is measured as revenues collected at state and local government levels as percentage of total tax revenues. All regression models include year dummies (not tabulated). Standard errors in parentheses; *, **, and *** indicate significance at the .1; .05; and .01 level respectively.*

The results from the t-tests further suggest that the 2004 expansion did not impact tax system harmonization much. The tax burden variable (tax revenues in percent of GDP) converges for all countries in the sample and for the EU member countries. There appears to be no harmonization with regard to fiscal decentralization.

Table 8

Difference to mean measures

Panel A. Before and after 1992 (Maastricht Treaty)

		All countries	EU countries
Absolute difference of tax burden to tax burden mean	before 1992	0.230	0.206
	after 1992	0.182	0.167
	P-value	<.0001	0.001
Absolute difference of income tax reliance to income tax reliance mean	before 1992	0.278	0.226
	after 1992	0.257	0.227
	P-value	0.073	0.936
Absolute difference of fiscal decentralization to fiscal decentralization mean	before 1992	0.460	0.331
	after 1992	0.540	0.483
	P-value	0.013	0.003

Panel B. Before and after 2004 (largest expansion)

		All countries	EU countries	Eurozone countries
Absolute difference of tax burden to tax burden mean	before 2004	0.210	0.194	0.162
	after 2004	0.175	0.151	0.153
	P-value	0.000	0.000	0.538
Absolute difference of income tax reliance to income tax reliance mean	before 2004	0.266	0.221	0.186
	after 2004	0.265	0.239	0.176
	P-value	0.970	0.306	0.595
Absolute difference of fiscal decentralization to fiscal decentralization mean	before 2004	0.503	0.428	0.482
	after 2004	0.495	0.468	0.468
	P-value	0.850	0.447	0.841

Notes: Tax burden is measured as total tax revenues as percentage of GDP; income tax reliance is measured as revenues from income taxes as percentage of total tax revenues; and fiscal decentralization is measured as revenues collected at state and local government levels as percentage of total tax revenues. Fiscal decentralization data is not available for years 1972 and earlier. Euro-countries cannot be assessed for the time period before 1992.

The t-tests only examined whether some harmonization is taking place but not whether there is more cooperation within the EU (eurozone) than among other OECD countries in our sample. This is tested in regression model 4 with the results presented in table 9. The results confirm that the difference of country tax variable to the mean tax variable is lower for EU countries in the case of the tax burden and income tax reliance but not in the case of fiscal decentralization. The significantly negative correlation of the "later than 1992" dummy variable with the tax burden and with income tax reliance indicates that after the year 1992, on average, the difference between the country variable and the overall mean was less than before 1992. Again, this correlation was not significant for fiscal decen-

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tralization. After the year 2004, the absolute difference to the mean increased again for the burden and income tax reliance measures but decreased for fiscal decentralization. The coefficient estimates for interactions between the 1992 year and 2004 year and the EU dummy variables provide a mixed image of tax harmonization. For the tax burden measure and for the income tax reliance variable, the interaction of EU country and later than 1992 (later than 2004) time measure is positive (negative) which would indicate that at first, the difference to the mean decreases less for EU countries than for the entire country set as a whole but then, after 2004, this trend reverses. For the fiscal decentralization measure, the results are mostly not significant suggesting that tax system cooperation within the EU or eurozone is not significantly different (stronger *or* weaker).

Table 9

Tests for tax harmonization within EU and eurozone (OLS regression results)

	Dependent variable is the absolute difference of the countries...					
	...tax burden to overall tax burden mean		**...income tax reliance to overall income tax reliance mean**		**...fiscal decentralization to overall fiscal decentralization mean**	
	Parameter estimate	**Standard error**	**Parameter estimate**	**Standard error**	**Parameter estimate**	**Standard error**
Intercept	-0.585	0.133***	1.367	0.198***	0.375	0.634
EU membership	-0.038	0.012***	-0.078	0.018***	0.118	0.056**
Eurozone membership	-0.009	0.018	-0.050	0.027*	0.013	0.070
Common law (Anglo) country	-0.132	0.009***	0.040	0.014***	-0.119	0.037***
Former East bloc country	-0.100	0.013***	0.104	0.020***	-0.197	0.073***
Population (natural log)	0.025	0.003***	-0.014	0.004***	-0.093	0.013***
GDP per capita (natural log)	0.005	0.010	-0.058	0.015***	0.249	0.049***
Percentage of population under 25	1.387	0.154***	-0.689	0.228***	0.866	0.777
Percentage of population over 64	0.661	0.224***	-1.088	0.332***	-6.922	1.337***
Later than 1992	-0.024	0.013*	-0.034	0.019*	0.043	0.049
Later than 2004	0.030	0.016*	0.065	0.024**	-0.095	0.055*
Interaction of 1992 with EU	0.049	0.018***	0.076	0.027***	0.010	0.076
Interaction of 2004 with EU	-0.046	0.025***	0.042	0.037		
Interaction of 2004 with eurozone	0.016	0.027	-0.103	0.039***	0.122	0.082
Adjusted R-square	0.31		0.13		0.38	
Overall F	38.83		13.74		17.29	

*Notes: Tax burden is measured as total tax revenues as percentage of GDP; income tax reliance is measured as revenues from income taxes as percentage of total tax revenues; and fiscal decentralization is measured as revenues collected at state and local government levels as percentage of total tax revenues. *, **, and *** indicate significance at the .1; .05; and .01 level respectively.*

Nontabulated results using dependent variables with the absolute difference to the EU mean and the absolute difference to the eurozone mean also imply not much difference in cooperation within the EU (eurozone) than otherwise.

5 CONCLUSION

Tax systems can be assessed using a plethora of rate and non-rate variables. This study focuses on three rate variables measuring different aspects of tax collection as well as several non-rate measures related to administration and enforcement. The descriptive analysis, graphical representation, as well as t-tests indicate that tax systems within the EU and within the eurozone (even when controlling for EU membership) are significantly different from other countries' tax systems with regard to tax burden, income tax reliance, and fiscal decentralization. As one might expect, the tax burden in EU countries is significantly higher than in other OECD countries. Interestingly, countries in the eurozone have, on average, lower tax burdens than other EU countries that have not adopted the euro. Income tax reliance, which has sometimes been used as proxy of a tax system's general rate structure and progressivity (Robinson and Slemrod, 2011; Richardson, 2007), is lower in EU countries and even lower in eurozone countries. Similarly, there is less fiscal decentralization in the EU; again, the difference is not quite as high for countries in the eurozone as in countries that have joined the EU but have not adopted the euro. With regard to non-rate dimensions of tax systems, i.e., metrics related to tax administration and enforcement, the differences between EU countries and non-EU countries are not significant.

When analyzing the change of the tax system variables over time, one might expect some coordination of certain tax variables – especially within country groups that have a common currency system. Indeed, t-test results confirm overall tax system harmonization with regard to tax burden by comparing the difference to the means for each tax system variable using the benchmark years of 1992 (Maastricht Treaty) and 2004 (largest expansion of the European Union). For other variables not much cooperation can be detected. Moreover, tax system harmonization does not appear to be different (stronger or weaker) for EU member (eurozone) countries. This is noteworthy especially in the current political climate where many politicians are asking for more tax cooperation among EU (eurozone) member countries. The next task might therefore be to identify possible reasons for the lack of cooperation. One answer may lay in the analysis of non-rate factors related to administration and enforcement (Robinson and Slemrod, 2011). These variables measure how countries administer and enforce tax collection, with higher numbers generally implying more/better means to combat non-compliance or tax evasion. Unfortunately, for the non-rate tax system dimensions no time-series analysis is possible at this point. Of course, it would be interesting to compare and correlate changes in tax administration and enforcement with changes of other tax system variables. Future research may investigate whether a country's tax structure changes together with the administration of tax reporting and collection. Furthermore, a tax system index that combines non-rate and rate information might help with future analysis and comparisons. We therefore hope that this research will be extended to develop a more comprehensive tax system index that comprises the different aspects of taxes into one measure.

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