

Understanding multidimensional tax systems

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Abstract Income tax systems are multidimensional, and ignoring their non-rate aspects can introduce bias into cross-country empirical estimation of the impact of taxation on economic outcomes. We analyze 10 non-rate tax system aspects, codified based on recent reports published by the Organisation for Co-operation and Development. We find that a single factor (which we call *Dispersed Responsibility*), related to the role of taxpayers and third parties in tax collection, can reasonably summarize the cross-country covariation, and offer it as a parsimonious measure of non-rate tax system dimensions for future empirical analysis. We also ascertain that a standard measure of trust in government is positively associated with greater administrator coverage and administrative assessment, as well as more serious sanctions for non-compliance. Ethnic heterogeneity, individualism, and a history of external conflict also can explain certain aspects of tax systems. We find that countries with greater trust in government score lower on *Dispersed Responsibility*. Finally, we find that adding a measure of the number of tax authority employees can eliminate the otherwise significant positive estimated coefficient of GDP per capita on the tax level, and attracts a significant positive correlation itself, suggesting that the extent of tax administration and enforcement is part of the story that explains the enduring statistical regularity between tax levels and per capita income.

Keywords Tax administration · Tax enforcement · Cross-country

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JEL Classification C72 · M41**1 Introduction and motivation**

Although cross-country empirical analyses of the impact of tax systems generally focus on measures of tax rates, a tax system encompasses much more than the rate structure, including the definition of the base as well as the administration and enforcement of the tax rules.¹ The failure to recognize the multidimensionality of tax systems can produce bias in empirical estimates of the effects of tax rates on economic outcomes, and precludes any investigation of the effect of non-rate, non-base aspects of tax systems on outcomes. Although some recent empirical work has recognized the joint importance of tax rates and tax administration, the dearth of empirical proxies for most aspects of tax systems has limited the ability of researchers to pursue these issues. Indeed, until recently there was no comparable cross-country information available about the non-rate, non-base aspects of tax systems.

Fortunately, this data vacuum has now been filled by the Organisation for Economic Co-operation and Development (OECD 2006; OECD 2008) publication of a careful cataloguing of scores of aspects of up to 47 countries' tax administration.² In this paper we highlight 10 measures constructed using a subset of the OECD-assembled information, which is sometimes qualitative, so that it can be readily used by other researchers. We feature five enforcement measures that generally apply to all taxpayers and all taxes the revenue body administers. In addition, we feature five procedural measures that apply largely to individual income tax systems, although administration of individual income tax systems surely impact businesses. We also use factor analysis to construct a single summary measure of tax systems. Our sample coverage across the 10 measures is made up of approximately two-thirds OECD countries and one-third non-OECD countries, while sample coverage for our summary measure reflects a lower proportion of non-OECD countries.

Our study is informative along three dimensions. First, the paper offers some stylized facts about non-rate, non-base aspects of tax systems and examines their relation to proxies for tax system aspects used in earlier literature. Importantly, we offer a parsimonious measure that captures an important aspect of cross-country variation in tax systems; the role of taxpayers and third parties in tax collection. Second, it presents a statistical analysis of the determinants of tax system variation across countries. This is a critical initial first step in future empirical analysis of the effect of (endogenously chosen) tax systems on economic outcomes. Finally, the paper looks at whether tax

¹By "tax system" we are referring to the rate and base structure as well as the procedures used to assess and collect tax liabilities and to monitor and enforce tax compliance.

²The information provided in the OECD data was obtained from a survey of national revenue bodies, revenue bodies' annual reports, third-party information sources (e.g., the International Bureau of Fiscal Documentation), and selected other OECD tax publications (e.g., *Revenue Statistics, Tax Co-operation*). Based upon our inspection of the data for the United States, the OECD data appear to be highly accurate. In instances where the content of the data tables was unclear or inconsistent, we engaged in direct conversations with OECD staff in charge of the study.

system variation can explain one of the most enduring and fascinating cross-country correlations: high-tax countries are richer.

The paper proceeds as follows. Section 2 describes the new data source and tax system measures and Sect. 3 compares our new tax system measures with proxies used in the prior literature. Section 4 examines determinants of our tax system measures. Section 5 examines the positive correlation between tax levels and per capita real income. Section 6 concludes.

2 New tax system measures

2.1 Data source

OECD (2006, 2008) provides internationally comparable data on aspects of tax systems in all 30 OECD countries and 17 selected non-OECD countries,³ with the aim of encouraging and facilitating cross-country dialogue between officials on tax administration matters. The information contained in these OECD reports was obtained from surveys of national revenue bodies, from revenue bodies' annual reports, and from several third-party sources obtained and validated by the relevant revenue bodies. The information is both qualitative and quantitative, and our coding of the qualitative data to some extent reflects our judgments, often made after consulting with OECD personnel.

We focus on a subset of the information contained in OECD (2006) and OECD (2008)⁴ labeled as *Self-assess*, *Withhold*, *Withhold Type*, *Report*, *Match*, *Collect*, *Bank*, *Verify*, *Penalty*, and *Coverage*.⁵ These tax system aspects for the most part pertain to individual income taxation. In what follows, we discuss these 10 tax system measures loosely categorized along two dimensions—procedural and enforcement. Table 1 defines our tax system measures in detail with reference to the underlying data, and the Appendix shows the values of the tax system measures for each country in the sample.

³The 47 countries featured in OECD (2006) and OECD (2008) are as follows: (i) the 30 OECD countries are Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, South Korea, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland, Turkey, United Kingdom, and the United States; (ii) the 17 non-OECD countries are Argentina, Bulgaria, Brazil, Chile, China, Cyprus, Estonia, India, Latvia, Lithuania, Malaysia, Malta, Romania, Russia, Singapore, Slovenia, and South Africa.

⁴With one exception: *Bank* was obtained from OECD (2007). We also note that Brazil, India, Lithuania, and Russia were not featured in OECD (2008); thus, OECD (2006) is the source of the tax system measures for those four non-OECD countries.

⁵We have coded and documented a total of 46 tax system measures including, for example, the existence of a large taxpayer division, the use of an advance ruling system, the extent of electronic filing, and the ratio of average administrator salaries to per capita income. Values and documentation of our procedures for measures not included in this study are available from the authors.

Table 1 Variable descriptions

Variable name	Definition	Source
<i>Tax system measures</i>		
<i>Self-assess</i>	Indicator variable that equals 1 if individual income tax liability is self-assessed.	Table 39, OECD
<i>Withhold</i>	Number of categories of income for which tax is withheld (out of a possible 10).	Table 37, OECD
<i>Withhold Type</i>	Nature of withholding on employee's tax liabilities: 0 = none, 1 = non-cumulative, 2 = cumulative.	Table 39, OECD
<i>Report</i>	Number of categories of income subject to information reporting (out of a possible 10).	Table 37, OECD
<i>Match</i>	Number of payment categories that use taxpayer identification numbers (out of a possible 6).	Table 36, OECD
<i>Collect</i>	Number of powers to enforce collection of tax debts (out of a possible 14).	Table 33, OECD
<i>Verify</i>	Number of powers to search and seize taxpayer records (out of a possible 9).	Table 28, OECD
<i>Penalty</i>	Maximum penalty for failure to correctly report tax liability.	Table 31, OECD
<i>Coverage</i>	Number of administrators per working-age persons (in thousands).	Table 14, OECD and US Census Bureau International Database
<i>Bank</i>	Indicator variable that equals 1 if tax authority has access to bank information in all tax matters.	Table B-2, OECD (2007)
<i>Dispersed Responsibility</i>	The principal factor retained from factor analysis of above 10 (standardized) tax system measures.	Computed by authors
<i>Tax GDP</i>	Ratio of tax revenue to GDP.	Table 16, OECD
<i>Tax Rate</i>	Income tax rate index, higher means lower tax rate (we reversed the published measure in our analysis).	Fraser Institute, Economic Freedom of the World Report
<i>Tax Mix</i>	Share of income tax revenue to total tax revenue.	Table 16, OECD

Table 1 (Continued)

Variable name	Definition	Source
<i>Tax system proxies</i>		
<i>GDPPC</i>	Gross domestic product per capita (PPP).	OECD (2008)
<i>Hours</i>	Measures the time to comply with taxes (in hours per year) which includes time to prepare, file and pay (or withhold) corporate income tax, value added/sales/labor taxes (including payroll and social security) for an 'average' hypothetical firm.	World Bank (Paying Taxes)
<i>Payments</i>	Measures tax payments made per year for all taxes to all government agencies for an 'average' hypothetical firm.	World Bank (Paying Taxes)
<i>Corruption</i>	An index from 1 to 10 where higher values imply less corruption (we reversed the published measure in our analysis).	Transparency International
<i>Bribery</i>	Survey question: "Firms make undocumented extra payments or bribes in connection with annual tax payments"; 1 = common, 7 = never (we reversed the published measure in our analysis).	World Economic Forum, Global Competitiveness Report
<i>Weak Law</i>	An index from 1 to 10 where higher values imply a stronger legal system (we reversed the published measure in our analysis).	Fraser Institute, Economic Freedom of the World Report
<i>Seigniorage</i>	Average percent change in the money base from 1977–2000.	International Financial Statistics
<i>Non-compliance</i>	Survey question: "Tax evasion in your country is minimal"; 1 = strongly disagree, 7 = strongly agree (we reversed the published measure in our analysis).	World Economic Forum, Global Competitiveness Report
<i>Burden</i>	Survey question: "Tax system in your country promotes competitiveness"; 1 = strongly disagree, 7 = strongly agree (we reversed the published measure in our analysis).	World Economic Forum, Global Competitiveness Report

Table 1 (Continued)

Variable name	Definition	Source
Tax system		
<i>Economic variables</i>		
Conflict	Indicator variable that equals 1 if a country was involved in an external conflict between 1800 (or date of independence if later) and 1975.	www.correlatesofwar.org
Agriculture GDP	Share of GDP from agriculture.	CIA Factbook
Landlock	Indicator variable that equals 1 for landlocked countries.	CIA Factbook
Latitude	The absolute value of the latitude of the country, scaled to take values between 0 and 1.	CIA Factbook
<i>Political Variables</i>		
Ethnic	Average of 5 indices and ranges between 0 and 1; high values imply more ethnic heterogeneity within a country.	La Porta et al. (1999)
Legal Origin	Indicator variables for each of English, French, German, Socialist and Scandinavian.	La Porta et al. (1999)
<i>Cultural Variables</i>		
Religion	Percent of population belonging to each of Catholic, Muslim, Protestant, and Other denomination.	La Porta et al. (1999)
Individualism	An index from 0 to 100 with higher values implying individualism (societies in which ties between individuals are loose; opposite of collectivism).	www.geert-hofstede.com
Trust	Survey question: "Public trust in the financial honesty of politicians is"; 1 = very low, 7 = very high.	World Economic Forum, Global Competitiveness Report

Reference to OECD as the source refers to OECD (2006) or OECD (2008) unless otherwise noted

2.2 Procedural measures

Procedural measures depict the filing, remittance, and assessment procedures in place. The five procedural measures of tax administration that we introduce characterize individual income tax systems: *Self-assess*, *Withhold*, *Withhold Type*, *Report*, and *Match*. However, these tax system features have implications for business taxpayers as well, as firms serve as intermediaries that facilitate withholding and reporting.

High values of these measures imply use (or greater use) of the particular policy instrument. Procedures that enable the government to compute or collect taxpayers' income outside the context of an audit facilitate compliance. For instance, income reported on an information return is much more likely to be declared by taxpayers. Therefore, information reporting, as well as withholding and matching systems increase the probability of detection, and thus, compliance. Additionally, it is possible that self-reported tax liabilities, as opposed to assessed tax liabilities, might involve greater sanctions for misreporting. That is, administrative procedures in place may influence the nature and extent of any enforcement.

Self-assess is an indicator variable that equals one where individual income tax liabilities are self-assessed (i.e., determined by the taxpayer rather than by the revenue body) and zero otherwise. *Withhold* measures the extent of withholding used in the tax system and is the total number of income categories (out of a possible 10) for which tax is withheld and remitted by the payer. *Withhold Type* is a variable that captures the nature of withholding on employees' tax liabilities and is equal to zero if there is no withholding, one if withholding is non-cumulative, and two if withholding is cumulative.⁶ *Report* measures the extent of third-party reporting in the tax system and is the total number of categories of income (out of a possible 10) that are subject to information reporting requirements. *Match* measures the extent to which taxpayer identification numbers (TINs) are used for information reporting and matching and is the total number of payment types that use TINs (out of a possible 6). Comprehensive systems of taxpayer registration support a number of tax administration processes, including detection of non-filers and the exchange of information between government agencies. Table 2 provides descriptive statistics for these five procedural measures.

2.3 Enforcement measures

Enforcement measures reflect the extent to which revenue bodies are empowered to fulfill their objective of accurately assessing tax liabilities and collecting revenue,

⁶An important feature of the personal tax system in many countries is the operation of tax withholding arrangements that are designed to free the majority of employee taxpayers from the requirement to file an annual tax return. The objective of the *cumulative* approach is to ensure that for the majority of employees the total amount of taxes withheld over the course of a fiscal year matches their full-year tax liability. To the extent this is achieved, employees are freed of the obligation to prepare and file an annual tax return. The alternate approach to withholding on employment income is described as *non-cumulative*. The objective of the non-cumulative approach is to ensure that the amount of taxes withheld over the course of the fiscal year by employers for their employees roughly approximates their tax liability on such income. This approach to withholding acknowledges that employees are generally expected to prepare and file an end-of-year tax return disclosing all of their income and entitlements in order to properly assess their full year tax liability and calculate whether additional tax remittance is required or a refund is due.

Table 2 Descriptive statistics

Variable	N	Mean	Median	Std. dev.	P25	P75	Min	Max
Tax system measures								
<i>Self-assess</i>	47	0.553	1.000	0.503	0.000	1.000	0.000	1.000
<i>Withhold</i>	47	4.617	5.000	2.541	3.000	7.000	0.000	10.000
<i>Withhold Type</i>	47	1.553	2.000	0.619	1.000	2.000	0.000	2.000
<i>Report</i>	43	5.837	6.000	2.609	4.000	8.000	1.000	10.000
<i>Match</i>	46	4.478	5.000	1.810	4.000	6.000	0.000	6.000
<i>Collect</i>	45	9.800	9.000	1.817	9.000	11.000	5.000	13.000
<i>Verify</i>	45	6.523	6.000	1.522	5.524	8.000	3.000	9.000
<i>Penalty</i>	37	1.236	1.000	1.057	4.000	2.000	0.090	5.000
<i>Coverage</i>	46	1.501	1.588	0.822	0.797	2.036	0.110	3.163
<i>Bank</i>	38	0.789	1.000	0.413	1.000	1.000	0.000	1.000
<i>Dispersed Responsibility</i>	33	0.000	-0.215	0.884	-0.643	0.754	-1.399	1.885
<i>Tax GDP</i>	47	0.327	0.337	0.087	0.280	0.371	0.115	0.491
<i>Tax Rate</i>	47	3.929	4.000	2.137	2.000	5.000	0.000	8.333
<i>Tax Mix</i>	45	0.223	0.199	0.101	0.154	0.296	0.039	0.499
Tax system proxies								
<i>GDPPC</i>	47	25.802	25.610	13.805	13.550	34.902	2.492	76.870
<i>Hours</i>	46	263.130	233.500	191.389	132.000	328.000	58.500	900.000
<i>Payments</i>	46	18.152	14.500	16.614	9.000	22.000	2.000	104.500
<i>Corruption</i>	47	3.698	3.533	2.282	1.433	5.667	0.367	7.433
<i>Bribery</i>	47	1.195	1.100	0.746	0.500	1.900	0.033	2.600
<i>Weak Law</i>	47	2.049	1.667	1.637	0.394	3.333	0.000	6.066
<i>Seigniorage</i>	47	0.149	0.114	0.126	0.072	0.168	0.023	0.597
<i>Non-compliance</i>	45	3.345	3.583	1.079	2.587	4.237	0.867	4.950
<i>Burden</i>	47	3.526	3.667	1.010	2.867	4.300	1.367	5.367
Tax system determinants								
<i>Conflict</i>	47	0.723	1.000	0.452	0.000	1.000	0.000	1.000
<i>Agriculture GDP</i>	47	0.041	0.034	0.033	0.019	0.052	0.000	0.158
<i>Landlock</i>	47	0.170	0.000	0.380	0.000	0.000	0.000	1.000
<i>Latitude</i>	47	0.477	0.511	0.165	0.394	0.589	0.014	0.722
<i>Ethnic</i>	46	0.202	0.134	0.194	0.065	0.300	0.000	0.831
<i>Legal Origin</i>	47							
English		0.234	0.000	0.428	0.000	0.000	0.000	1.000
French		0.298	0.000	0.462	0.000	1.000	0.000	1.000
German		0.106	0.000	0.312	0.000	0.000	0.000	1.000
Scandinavian		0.106	0.000	0.312	0.000	0.000	0.000	1.000
Socialist		0.255	0.000	0.441	0.000	1.000	0.000	1.000
<i>Religion</i>	47							
Catholic		40.313	30.000	38.564	1.400	82.100	0.000	97.300
Muslim		5.022	0.100	16.248	0.000	1.400	0.000	99.200
Protestant		19.960	2.700	29.612	0.600	37.900	0.000	97.800
Other		34.712	18.900	33.061	5.500	67.690	0.700	98.500
<i>Individualism</i>	42	55.381	59.500	21.346	37.000	71.000	18.000	91.000
<i>Trust</i>	47	3.398	3.100	1.348	2.300	4.400	1.400	6.300

See Table 1 for variable definitions

as well as their capacity to do so in terms of personnel. The five enforcement measures that we examine generally apply to all taxpayers and all taxes the revenue body administers: *Collect*, *Bank*, *Verify*, *Penalty*, and *Coverage*.⁷

The ability to impose a penalty for detected evasion is, of course, an important enforcement power. However, the deterrent effect, as well as the legitimacy, of a given penalty rate rests upon whether the revenue body is granted powers that facilitate the burden of proof that accompany any sanction as well as the collection of any penalties imposed. The deterrent effect of a given penalty will be higher if the revenue body has, for example, extensive search and seizure powers, as well as powers to enforce debt collection. Administrative powers may also affect taxpayer perceptions of the probability of detection. For example, if the ability to access bank records facilitates the verification of tax liabilities, then taxpayers may view the probability of detection as greater.

Collect is the number of powers provided (out of a possible 14) for enforced payment of taxes and filing of tax returns, such as seizing or obtaining a lien on assets, restricting travel, or denying access to government services. *Bank* is an indicator variable that equals one when the tax authority has access to bank information in all tax matters (e.g., domestic, international, civil, criminal) and zero otherwise. *Verify* is the number of information access and search powers granted to tax officials (out of a possible 9) in order to verify or establish tax liabilities, such as the ability to request and serve a search warrant, obtain information from other government departments, or seize documents without the taxpayer's consent. *Penalty* is the maximum penalty rate that the tax system can impose for incorrectly reporting a tax liability. *Coverage* proxies for the resources available to the tax authority and is measured as the number of administrators the tax authority employs relative to the size of the country's working-age population (in thousands). All else equal, a higher ratio implies a higher probability of detection.⁸ The extent of resources devoted to tax administration and enforcement is likely to influence the effectiveness of such enforcement because the ultimate collection of tax debts and penalties requires resources (e.g., auditing, verification, appeal procedures, dispute resolution mechanisms, etc.). Moreover, the breadth and depth of an audit is likely a function of competing demands on tax administrators' time. Table 2 provides descriptive statistics for these five enforcement measures.

2.4 Correlation among tax system measures

In Table 3 Panel A we report the cross-country correlations among our ten tax system measures, as well as correlations between our measures and the ratio of tax collections to *GDPPC* (real GDP per capita), *Tax GDP* (total tax revenue as a share of

⁷*Penalty* is one exception to the general applicability, as different penalties sometimes apply for individual income tax, corporate tax, and value added tax. In instances where different penalties apply, we capture the penalty applicable to underreporting of individual income tax.

⁸We adjust the OECD measure of *Coverage* so that the number of tax administrators is relative to the working-age population rather than the labor force in order to correct for cross-country variation in the extent of informal labor (which is not included in the measure of the labor force).

Table 3 Correlations
Panel A—Tax system measures

	Self-assess	Withhold	Withhold Type	Report	Match	Collect	Verify	Penalty	Coverage	Bank	Dispersed Responsibility	GDP	Tax Rate	Tax Mix
<i>Self-assess</i>	1.000													
<i>Withhold</i>	0.221	1.000												
<i>Withhold Type</i>	0.393	0.400	1.000											
<i>Report</i>	0.216	0.446	0.069	1.000										
<i>Match</i>	0.087	0.056	0.170	0.118	1.000									
<i>Collect</i>	-0.020	0.273	0.181	0.138	0.179	1.000								
<i>Verify</i>	0.058	-0.053	-0.085	-0.144	-0.053	-0.027	1.000							
<i>Penalty</i>	-0.116	0.049	0.038	0.233	-0.029	0.158	0.246	1.000						
<i>Coverage</i>	- 0.282	-0.022	0.049	-0.077	-0.057	0.058	-0.081	-0.186	1.000					
<i>Bank</i>	0.157	0.281	0.303	0.444	0.191	0.378	0.108	-0.076	0.086	1.000				
<i>Dispersed Responsibility</i>	0.468	0.799	0.549	0.663	0.178	0.573	-0.124	0.236	- 0.311	0.574	1.000			
<i>GDP</i>	- 0.285	- 0.283	- 0.276	- 0.271	-0.051	- 0.221	-0.217	- 0.335	0.330	- 0.258	- 0.433	1.000		
<i>Tax GDP</i>	- 0.338	-0.058	-0.007	-0.087	0.148	0.096	-0.141	- 0.414	0.554	0.164	-0.182	0.451	1.000	
<i>Tax Rate</i>	- 0.314	0.079	-0.079	0.023	-0.011	0.077	0.160	0.104	0.398	0.188	-0.034	0.325	0.522	1.000
<i>Tax Mix</i>	-0.032	-0.219	-0.146	-0.040	-0.030	0.011	0.124	0.112	-0.043	0.081	-0.004	0.444	0.274	0.417

This table reports correlations among the tax system measures, per capita income, tax levels, tax rates, and tax mix. Significant correlations ($p < .10$) are in *bold*. See Table 1 for variable definitions

Table 3 (Continued)
Panel B—tax system proxies

	GDPPC	Hours	Payments	Corruption	Bribery	Weak Law	Seigniorage	Non-compliance	Burden
<i>GDPPC</i>	1.000								
<i>Hours</i>	-0.575	1.000							
<i>Payments</i>	-0.308	0.019	1.000						
<i>Corruption</i>	-0.777	0.644	0.404	1.000					
<i>Bribery</i>	-0.662	0.600	0.361	0.923	1.000				
<i>Weak Law</i>	-0.713	0.591	0.221	0.812	0.691	1.000			
<i>Seigniorage</i>	-0.508	0.258	0.369	0.557	0.389	0.360	1.000		
<i>Non-compliance</i>	-0.586	0.566	0.201	0.787	0.740	0.640	0.453	1.000	
<i>Burden</i>	-0.248	0.431	-0.036	0.251	0.206	0.204	0.150	0.462	1.000
<i>Self-assess</i>	-0.285	0.239	-0.135	0.304	0.222	0.260	0.139	0.034	-0.013
<i>Withhold</i>	-0.283	0.302	0.188	0.364	0.388	0.229	0.129	0.308	0.286
<i>Withhold Type</i>	-0.276	0.356	0.075	0.389	0.305	0.218	0.306	0.300	0.131
<i>Report</i>	-0.271	0.204	0.040	0.231	0.222	0.090	0.274	0.150	0.227
<i>Match</i>	-0.051	0.233	0.028	0.116	0.126	0.051	0.225	0.148	0.267
<i>Collect</i>	-0.221	0.282	-0.091	0.350	0.435	0.285	0.207	0.580	0.435
<i>Verify</i>	-0.217	0.078	-0.180	0.022	0.029	0.028	-0.091	-0.036	0.077
<i>Penalty</i>	-0.335	0.190	0.077	0.160	0.160	0.187	0.069	-0.018	-0.067
<i>Coverage</i>	0.330	-0.326	-0.078	-0.216	-0.171	-0.440	-0.106	-0.016	0.121
<i>Bank</i>	-0.258	0.365	-0.206	0.193	0.119	0.098	0.219	0.331	0.404
<i>Dispersed Responsibility</i>	-0.433	0.471	0.069	0.484	0.491	0.338	0.385	0.412	0.289
<i>Tax GDP</i>	0.451	-0.164	-0.239	-0.446	-0.415	-0.459	-0.211	0.018	0.406
<i>Tax Rate</i>	0.325	-0.222	-0.214	-0.439	-0.380	-0.431	-0.430	-0.145	0.393
<i>Tax Mix</i>	0.444	-0.448	-0.368	-0.681	-0.654	-0.476	-0.394	-0.512	-0.005

This table reports correlations between tax system measures and prior tax system proxies. Significant correlations ($p < .10$) are in bold. See Table 1 for variable definitions

GDP), *Tax Rate*, and *Tax Mix*. *Tax Rate* is an index capturing the top marginal income tax rates applied to individual taxable income; the index takes into account the income thresholds at which the rates become effective. *Tax Mix* is the share of total tax revenue a country receives from personal and corporate income taxes.⁹

One notable aspect of the correlation matrix is the absence of a lot of strong correlations. Across countries, our measures of tax system dimensions do not move in lockstep. Some of the significant correlations that appear are not particularly surprising. The extent of withholding by type of income is positively correlated with the basic type of income withholding as well as the extent of information reporting. The use of extensive systems of withholding for employees' tax liabilities in countries with self-assessment regimes is consistent with the objective of trying to free the majority of employee taxpayers from the requirement to file an annual tax return. Self-assessment requires taxpayers to perform certain functions that might otherwise be undertaken by the tax authority, which is consistent with the fact that we observe fewer administrators in countries with self-assessed liabilities. The extent of collection powers is correlated with the extent of withholding, as well. This may reflect the fact that effective withholding systems require assistance from third parties, thus facilitating collection powers which also require third-party cooperation. One of the most inter-connected tax system aspects, as measured by the number of significant correlations with other tax system dimensions, is whether the tax authority has access to bank records. Having this authority is positively correlated with the extent of withholding, the basic type of withholding, the extent of information reporting, and the extent of collection powers. This cluster of correlated tax system aspects account for a large portion of the principal factor discussed in the next section.

Finally, several interesting relationships emerge between traditional measures of the level of taxation—*Tax GDP* and *Tax Rate*—and non-rate aspects of tax systems. High-tax countries, by either measure, are less likely to feature self-assessment. Self-assessment requires taxpayers to interpret and apply the tax law in order to assess their tax liabilities. If high-tax countries also have more detailed and complex tax laws, then perhaps shifting the cost of acquiring the necessary expertise to the taxpayer is not efficient. High-tax countries by either measure also devote significantly more resources to tax administration, as measured by the ratio of administrators to the working-age population. As developed in Slemrod and Yitzhaki (1996) and Slemrod and Kopczuk (2002), this empirical pattern is consistent with a model in which countries that place a higher value on government expenditures both levy higher tax rates and expend the resources to collect them, in order to equalize the marginal efficiency cost of funds across these two alternative ways to raise revenue.

Also notable is the lack of any significant correlations between *Tax Mix* and our tax system measures. One might have expected *Tax Mix*—the share of total tax revenue from income taxes—to have some association with our tax system measures because many of them, particularly the procedural measures, directly measure (individual) income tax administration. It is, though, positively correlated with *GDPPC*, *Tax GDP* and *Tax Rate*.

⁹Statistics that separate individual income tax revenue from corporate income tax revenue are not consistent across countries, and thus we do not make use of them.

2.5 Factor analysis

With the release of the OECD data, the state of reliable cross-country information has gone from a near-vacuum to a situation approaching information overload; we have codified 46 variables, and this study concentrates on just 10 of those. Given the existence of numerous tax system dimensions, it would be useful for future empirical work to be able to capture cross-country variation in tax systems using summary measures of the procedural and enforcement policies in place. To do so, we employ factor analysis to our ten tax system measures. Aggregating individual characteristics in this way allows researchers to incorporate multiple tax system aspects into empirical analyses in a comprehensive yet parsimonious way.

When we do so, a single factor emerges that appears to capture a distinct and important feature of a tax system: the extent to which the tax collection system disperses responsibility and the direct compliance burden away from the tax authority to the taxpayer and third parties such as employer withholders. We refer to this factor as *Dispersed Responsibility*. As signaled by the within-group correlations discussed in the previous section, this summary measure depicts a tax system with extensive withholding and information reporting, self-assessment principles, high collection facility (e.g., more power to enforce collection of tax debts and collection of information through, for example, bank access), and a smaller administrative workforce.¹⁰ The [Appendix](#) shows the values of the principal factor for each country in the sample. [Figure 1](#) provides the values of *Dispersed Responsibility* by country.

3 Relation to existing proxies

Some past empirical research has recognized the potential consequences of non-base, non-rate aspects of tax systems and employed various proxies to help explain cross-country variation in various outcome measures. In what follows, we discuss the justification for each of these proxies, the context in which it was used, and how these measures correlate with our tax system measures. [Table 1](#) provides a summary of definitions and sources for these proxies, [Table 2](#) provides descriptive statistics, and [Table 3 Panel B](#) reports correlations of these proxies with our direct tax system measures.

3.1 Per capita income

In an examination of the effect of tax rates on the size of the informal economy, [Friedman et al. \(2000\)](#) find that the negative association between individual tax rates and the size of the informal economy ceases to be significant when per capita income is included in the regression. In interpreting their findings, the authors suggest this

¹⁰The factor analysis of the individual tax system variables results in one principal factor with an eigenvalue greater than one. The factor loadings are .706 (*Withhold*), .586 (*Report*), .507 (*Bank*), .507 (*Collect*), .485 (*Withhold Type*), .414 (*Self-assess*), .209 (*Penalty*), .158 (*Match*), -.109 (*Verify*), -.275 (*Coverage*). Factor loadings represent the correlation of each individual variable with the principal factor. Only the tax system aspects mentioned in the text are associated significantly with the principal factor.

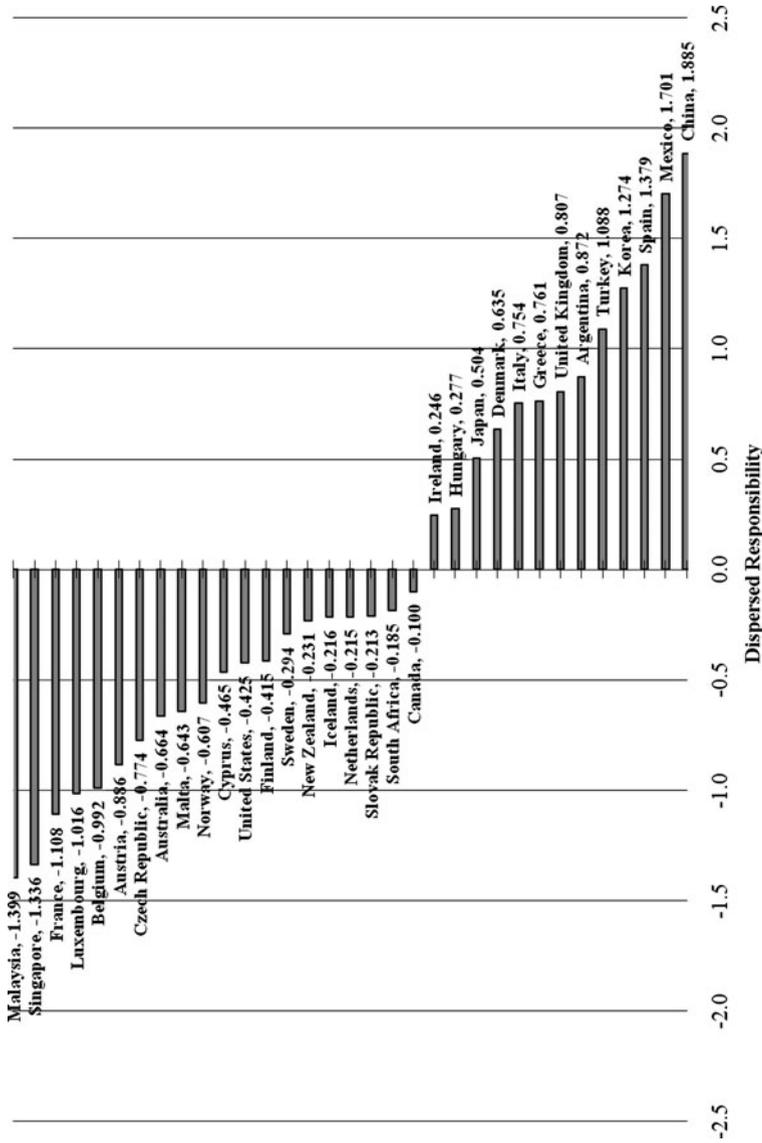


Fig. 1 This figure depicts our summary tax system measure by country. *Dispersed Responsibility* is the principal factor retained from factor analysis of the 10 tax system measures. See Table 1 for definitions of individual tax system measures

may indicate that “richer countries have better-run administrations *and* higher tax rates” (p. 460), which implies that per capita income is a sufficient statistic to capture a country’s administrative capacity to tax its citizens. In other words, the negative simple correlation between the extent of the informal economy and tax rates reflects a spurious correlation between the former and a “left-out” measure of the efficacy of tax administration. Of course, per capita income is used ubiquitously in the cross-country literature as a measure of the level of development and, unavoidably, of all the country attributes that are generally associated with the level of development.

Table 3 Panel B reports that eight of the ten tax system measures are significantly correlated with per capita income. In higher-income countries, the revenue body uses withholding and reporting on fewer types of income, is granted fewer powers to facilitate debt collection, imposes lower penalties for the under-reporting of tax liabilities, and is less likely to use self-assessment principles. Higher-income countries also employ more tax administrators as a fraction of the working-age population.

Of note is the fact that the sign pattern of the correlation of *GDPPC* with prior tax system proxies is the same as the sign pattern of the correlation of our direct tax system measures with these proxies. For example, the sign of the correlation of *Withhold* with *GDPPC* is negative, while the sign of correlation of *Coverage* with *GDPPC* is positive; the significant correlations of *Withhold* and *Coverage* with the tax system proxies follow a pattern that is the opposite sign to that of *GDPPC*. This suggests that there is an underlying characteristic of countries that is correlated with per capita income that these other measures are picking up.

3.2 Number of tax payments and hours spent on tax compliance

In their study of the effect of corporate tax rates on investment and entrepreneurship, Djankov et al. (2010) include as explanatory variables “measures of the burden of tax administration” (p. 10) to evaluate the robustness of their finding that corporate tax rates have a significant negative impact on these outcome variables. The first measure is the number of tax payments made per year (*Payments*) and the second measure is the number of hours per year needed to comply with tax regulations (*Hours*), both for a hypothetical business taxpayer.¹¹ In OLS regressions of their outcome variables on measures of corporate tax rates and either the number of annual tax payments or the number of hours spent on tax compliance, both administration measures have a significant negative association with entrepreneurship, but no significant association with investment; the partial effect of corporate tax rates survives inclusion of the administration measures.

Table 3 Panel B reveals that *Payments* is not associated with any tax system measure. In countries where more time is spent complying with tax regulations, the revenue body uses more extensive withholding procedures. Here it is important to highlight that the tax administration variables used in Djankov et al. (2010) reflect administrative burdens of a hypothetical *business*. Thus, this correlation highlights that

¹¹To construct these measures, accountants and tax lawyers in 87 countries were surveyed regarding the tax filing and payment obligations of a hypothetical standardized business under the tax system effective in fiscal 2004. The measures were then computed using a standardized case study of a hypothetical business taxpayer and are published in World Bank Group and PricewaterhouseCoopers (2007).

the administration of individual income tax systems impacts businesses; i.e., the positive correlation between our measures of withholding and *Hours* is picking up the compliance burden of withholding agents. Strikingly, *Hours* are high when there are less tax administrators, as measured by the *Coverage* variable. One interpretation of this empirical relation is that compliance costs are relatively high (when measured by hours spent) precisely when the government's administrative capacity is constrained, thus shifting the compliance burden from the government to taxpayers and other third parties.

3.3 Corruption and bribery

Torrini (2005) uses a corruption index, published by Transparency International, to proxy for tax enforcement in a cross-country study of the effects of taxation on self-employment. He argues that this corruption index “should pick up the effect of the degree of toleration for tax and social contributions evasion” and that it proxies for countries' attitudes toward rules and tax evasion because empirical evidence exists linking the corruption of tax inspectors and levels of tax evasion (p. 672).¹²

Table 3 Panel B shows that, in countries with more *Corruption* and *Bribery*,¹³ revenue bodies are more likely to use self-assessment, more likely to use withholding, and are given more powers to enforce tax debt collections.¹⁴ These correlations are especially interesting in light of the analysis in Richardson (2006) that suggests that fiscal corruption may be reduced if the interaction between the taxpayer and the corrupt official is limited. Our results are consistent with that story in that more corrupt countries tend to make use of tax systems where the administration is “procedural” (i.e., through mechanisms such as withholding and information reporting, rather than administrator coverage), arguably in order to avoid administration that is more “personal” in nature so as to limit the interaction between taxpayers and corrupt tax officials.

3.4 Law and order

Friedman et al. (2000) develop a model where tax revenues are used to produce law and order, and weak legal institutions undermine the tax base because it difficult to raise revenue when the benefit of public goods does not outweigh the private costs of taxation. The authors test their predictions by introducing a measure of the legal environment, denoted “rule of law,” into a regression of the size of the informal economy

¹²Ihrig and Moe (2001) also assert that an executive survey measure of bribery from the World Economic Forum's *Global Competitiveness Report* is a proxy for tax enforcement.

¹³The corruption and bribery indexes are highly correlated ($r = .923$), and so the association of one with other measures is approximately the same as the other.

¹⁴Another commonly used measure of corruption, although not used specifically in prior literature to proxy for tax systems, is the World Governance Indicator termed Control of Corruption, published by The World Bank (see Kaufmann et al. 2009). The correlations between this alternate measure of corruption and our tax system measures are very similar to those we report in Table 3 Panel B.

on tax rates.¹⁵ They find that tax variables, which otherwise have a positive association with the informal economy, become insignificant in a regression that includes a rule of law measure. Ihrig and Moe (2001, 2004) also suggest that aspects of tax enforcement may be picked up by indices that measure the quality of a country's legal environment.

Table 3 Panel B shows that, in countries with *Weak Law*, revenue bodies are more likely to use self-assessment, are given more powers to enforce tax debt collections, and employ fewer administrators.¹⁶ The correlations for countries with weak law and order are similar to those for countries with low corruption, and the same explanations apply. This analysis raises the question of whether, if countries with similar institutional features make similar tax policy choices, it is the institutional features themselves that have consequences for outcomes of interest such as economic performance, or whether it is the tax policy parameters, which may be determined or shaped by the institutional features.

3.5 Seigniorage

Cukierman et al. (1992) examine seigniorage across countries and conclude that countries with more inefficient tax systems rely more heavily on seigniorage. The underlying theory is that, for institutional or technological reasons, less developed countries are unable to have efficient tax systems and thus rely more heavily on inflation to finance government expenditure. Both Cukierman et al. (1992) and Click (1998) find that measures of per capita income are negatively associated with seigniorage, supporting this explanation for cross-country differences in fiscal and monetary discipline. Ihrig and Moe (2001, 2004) follow this line of research and proxy for the effectiveness of tax enforcement with the rate of seigniorage in a cross-country analysis of the ability of tax systems to explain levels of informal employment, and find that small changes in the tax rate cause measurable changes in the size of the informal economy, while modest changes in enforcement have negligible effects.

In Table 3 Panel B we show that *Seigniorage* is significantly positively correlated with the type of withholding and, in contrast to very other tax system proxy we discuss here, with the extent of income reporting across sources.

3.6 Survey measure of tax compliance

Several recent papers in finance and accounting have used an executive survey measure of tax compliance from the World Economic Forum's *Global Competitiveness*

¹⁵This measure is based on the *International Country Risk Guide's* Political Risk Component I for Law and Order: "Two measures comprising one risk component. Each sub-component equals half of the total. The 'law' sub-component assesses that strength and impartiality of the legal system, and the 'order' subcomponent assesses popular observance of the law." Source PRS Group, *International Country Risk Guide*, <http://www.prsgroup.com/ICRG.aspx>.

¹⁶Another commonly used measure of law and order, although not used specifically in prior literature to proxy for tax systems, is the World Governance Indicator termed 'Rule of Law', published by The World Bank (see Kaufmann et al. 2009). The correlations between this alternate measure of 'law and order' and our tax system measures are very similar to those we report in Table 3 Panel B.

Survey as a proxy for tax enforcement. The measure is based on the responses of corporate executives to the survey question “Tax evasion in your country is minimal.”

Dyck and Zingales (2004) examine the prospect that governments can act as monitors for minority shareholders via strong tax enforcement. The authors state explicitly that in order to test their prediction they need a measure of tax enforcement and not tax rates because higher tax rates subsidize the siphoning out activity of controlling shareholders, whereas tax enforcement should minimize rent extraction. In a regression of the block premia as a percent of firm equity on the survey measure of tax compliance, controlling for other factors that affect control premia, they obtain a statistically significant negative coefficient on tax compliance, suggesting that countries with a higher degree of tax compliance have lower private benefits of control.¹⁷ To validate the survey measure as a proxy for tax enforcement rather than tax morale, they include in the same multivariate analysis described above an individual survey measure of the “willingness to cheat on taxes” (from the World Values Survey).¹⁸ They find that the individual survey measure has an insignificant partial association, while the executive survey measure remains significant, which they interpret as evidence that the executive survey measure reflects “tax enforcement and not differences in moral values across countries (p. 587).”¹⁹

This executive survey measure of tax compliance also features in the accounting literature that attempts to explain cross-country differences in earnings management. Haw et al. (2004) find that insider income management is higher in countries with low levels of tax compliance, although Wysocki (2004) questions the interpretation of the findings in both Haw et al. (2004) and Dyck and Zingales (2004), claiming that it is unclear whether the executive survey measure captures enforcement by tax authorities or if it simply reflects firms’ endogenous tax compliance decisions when faced with other incentives and institutional factors.

Table 3 Panel B shows that countries with high levels of *Non-compliance* make more extensive use of withholding. This corroborates the view held by many tax experts that withholding and information reporting²⁰ are key elements of a tax system to combat non-compliance. Also of note is that countries with lower levels of tax compliance grant greater collection powers and bank access to their revenue bodies.

3.7 Survey measure of tax burden

A final proxy used in prior literature is a survey measure of the tax burden. The measure is based on the response of corporate executives to the survey question “Tax system in your country promotes competitiveness.” Johnson et al. (1998) claim that this measure captures “not just tax rates, but also the way the tax system is administered” (p. 389) and show that, in a cross-country regression of the size of the informal

¹⁷The block premia estimates the private benefits of a controlling shareholder by measuring the price difference between two classes of stock with different voting rights.

¹⁸The measure is based on the response to the survey question “Is it justifiable to cheat on taxes?” where 1 = never justifiable and 10 = always justifiable. The survey participants were individuals.

¹⁹This executive survey measure was used also in Desai et al. (2007), which examines the relation between corporate tax rates and corporate tax revenues.

²⁰*Non-compliance* is also positively correlated with *Report*, but not significantly.

economy, a lower tax burden is associated with a smaller informal economy, while lower tax rates are associated with a larger informal economy.

Table 3 Panel B shows that this measure of *Burden* is higher when the revenue body has greater withholding, powers to collect tax debts, matching, and access to bank records to verify tax liabilities.

4 Determinants of tax system variation

In this section, we investigate empirically why countries' non-rate tax system aspects differ. This exercise is of interest for three reasons. First, it complements the large existing literature on why countries differ in the level of taxation, the mix of taxes used and other readily measured features of tax systems such as the top marginal rates applied to individual and corporate taxpayers.²¹ Second, knowing the arguably exogenous determinants of tax systems is a critical requirement of empirical analysis of the effect of (endogenously chosen) tax systems on outcomes such as labor supply, saving and investment, the extent of the informal economy, and income growth rates. Finally, the ability to model international differences in tax systems raises interesting questions about possibilities for tax reform. For instance, if cultural theories explain non-rate, non-base aspects of tax systems, then rate and base policy choices may be constrained by the non-rate, non-base aspects of tax systems that are not readily altered. It may be that tax rates are more flexible than the methods of assessing, collecting, and enforcing tax liabilities, as the latter may be more rooted in what is economically, politically, and culturally acceptable.

The choice of the explanatory variables we examine is motivated by theories of the determinants of government institutions more generally, which fall into three broad categories (La Porta et al. 1999). Economic theories hold that institutions are created when the social benefits of building the institutions exceed the transaction costs of doing so, and so economic theories focus on efficiency. In contrast, political theories hold that institutions are shaped by those in power who wish to transfer resources to themselves, and so political theories focus on redistribution. Finally, cultural theories hold that some societies have beliefs such as intolerance or distrust that shape collective action and government.

Following La Porta et al. (1999), we examine political theories using measures of ethnic heterogeneity and the origin of a country's legal system. Ethnic heterogeneity can be viewed as a measure of redistributive tendencies (Alesina et al. 1999), while legal systems are indicators of the relative power of the State (La Porta et al. 1999). To examine cultural theories, we look at religious affiliations of the population (Landes 1998), a measure of individualism, and a measure of trust in government (Slemrod 2003). Finally, our strategy for examining economic theories is to look at prior incidence of war (Besley and Persson 2009), an indicator for landlocked countries, a measure of the share of gross domestic product generated from agricultural output, and latitude. As argued by La Porta et al. (1999), many of these variables capture

²¹ See, for example, Volkerink and de Haan (1999), Kenny and Winer (2006), Tosun and Abizadeh (2005).

characteristics of a country that may be instrumental in shaping government institutions.²² Descriptive statistics are reported in Table 2.

Of these variables, four of them have a significant partial association with several of the tax system aspects, and with the summary measure *Dispersed Responsibility*.²³ We report these results in Table 4. Our measure of trust in the government is the most consistent determinant of tax systems. Specifically, we find that countries with greater trust in government exhibit administrative assessment rather than self-assessment, less use of withholding, and harsher penalties for non-compliance.²⁴ Overall, *Trust* is negatively associated with *Dispersed Responsibility*. Thus the data are consistent with a story that countries where people place more trust in government are more likely to have authoritative tax systems under which the government retains much of the tax compliance responsibility.²⁵ Additionally, tax policy instruments such as withholding may be relatively more superfluous in an environment where taxpayers are more willing to pay taxes (because they trust how the government will spend the tax revenue). Also, we surmise that harsher penalties may be more effective when the public trusts that the sanctions will be imposed fairly.

We also find that ethnic heterogeneity is a determinant of some aspects of tax systems. Specifically, we find that greater ethnic heterogeneity is associated with less use of withholding and more limited bank access in tax matters. Ethnic heterogeneity is also negatively associated with *Dispersed Responsibility*. The pattern of partial associations is similar to that of *Trust*, except that *Ethnic* does not have the positive partial association with the use of penalties to deter tax evasion. It may be that, in ethnically heterogeneous societies, disagreement over policy objectives makes it more difficult to build support for withholding systems and bank transparency necessary to promote tax compliance. However, unlike the case for societies that place trust in government,

²²Upon the suggestion of Dhammika Dharmapala, we also considered measures of financial development constructed by Beck and Demirgüç-Kunt (2009) on the grounds that more developed financial systems may facilitate the development of tax systems. The only measure that was significantly associated with any of our tax system measures was the ratio of stock market value traded to bank credit. This variable is negatively associated with *Coverage* ($p < .0001$), suggesting that less market-based economies make greater use of tax administrators. We conjecture that technology may facilitate enforcement of the tax system especially in a market-based economy.

²³In presenting our summary statistics in Table 4, we do not show results with explanatory variables that were rarely significant when all of the determinants were examined simultaneously. A full set of summary statistics are available from the authors.

²⁴After removing potential outliers based on studentized residuals greater than 2.0 or less than -2.0 , our results regarding *Trust* are robust and generally increase in significance (i.e., *Withhold* ($p = .0122$), *Withhold Type* ($p = .0283$), *Penalty* ($p = .0553$), and *Dispersed Responsibility* ($p = .0075$)). Additionally, *Trust* becomes significant in explaining *Match* ($p = .0460$) and marginally significant in explaining *Report* ($p = .0973$). Some specific results are not robust to using other methods of examining outliers, but the qualitative findings generally survive these other methods; the details of our outlier analyses are available from the authors.

²⁵We note that of the explanatory variables we examine, trust in government is one where the assumption of exogeneity is tenuous. It is certainly possible that citizens' views about the trustworthiness of politicians might be influenced by the nature of the tax system in place. However, arguably it is not the tax system per se that would influence citizens' view of politicians, but rather how well the tax system functions. We are not directly measuring the latter.

Table 4 Determinants of tax systems

Independent variables	Dependent variables = Tax system measures										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	<i>Self-assess</i>	<i>Withhold</i>	<i>Withhold</i>	<i>Report</i>	<i>Match</i>	<i>Collect</i>	<i>Verify</i>	<i>Penalty</i>	<i>Coverage</i>	<i>Bank</i>	<i>Dispersed</i>
	<i>Type</i>										
<i>Conflict</i>	-0.4845 (0.9573)	0.6295 (0.9814)	0.1556 (0.2577)	2.3043* (0.9585)	-0.0179 (0.7660)	0.8252 (0.7961)	0.2712 (0.6804)	0.8241† (0.4227)	-0.2608 (0.3163)	3.0275* (1.6432)	0.7944** (0.2913)
<i>Agriculture</i>	10.0655 (13.9300)	5.7807 (13.9209)	2.1093 (3.6560)	-10.9538 (15.5222)	3.0570 (12.4067)	12.6584 (12.8843)	4.3770 (11.0119)	8.8896 (6.1547)	2.2006 (5.1221)	111.3000 (83.1101)	8.4860† (5.0427)
<i>Individualism</i>	0.0178 (0.0205)	0.0220 (0.0198)	0.0002 (0.0052)	-0.0491* (0.0196)	0.0058 (0.0157)	0.0055 (0.0163)	0.0057 (0.0139)	-0.0170* (0.0083)	0.0198** (0.0065)	0.1216 (0.0917)	-0.0099 (0.0061)
<i>Trust</i>	-0.7247* (0.3361)	-0.5737† (0.3143)	-0.1552† (0.0825)	-0.3760 (0.3178)	-0.3299 (0.2455)	-0.1613 (0.2582)	-0.0242 (0.2207)	0.2387† (0.1378)	0.0301 (0.1014)	-1.6563 (1.1890)	-0.2575** (0.0943)
<i>Ethnic</i>	-2.7254 (2.1796)	-5.2583* (2.1374)	-0.6602 (0.5613)	-2.8760 (2.2293)	-1.0860 (1.7680)	-0.4557 (1.8403)	0.6921 (1.5729)	1.0165 (0.9340)	-1.0787 (0.7299)	-8.5576† (4.5659)	-1.6395* (0.6701)
<i>Constant</i>	2.1571 (1.8367)	8.0008*** (1.9141)	1.9797*** (0.5027)	9.0346*** (2.0647)	5.4891*** (1.6133)	9.1297*** (1.6886)	5.7985*** (1.4432)	0.2874 (0.8401)	0.5860 (0.6661)	-2.7395 (4.3183)	0.9704 (0.6149)
Adjusted <i>R</i> -sq	0.1774	0.2497	0.0983	0.3163	-0.0570	-0.0054	-0.1273	0.2831	0.1981	0.4243	0.5423
<i>N</i>	41	41	41	38	40	39	39	32	40	35	30

This table reports summary statistics of OLS regressions of tax system measures on economic, political, and cultural determinants of tax systems. Columns (1) and (10) report summary statistics from logistic regressions. **, *, † denote significance at the 1, 5, 10 percent level (two-tailed), respectively. Standard errors are in parentheses. See Table 1 for variable definitions

ethnically diverse societies do not support more punitive regimes for dealing with tax evasion.²⁶

Perhaps not surprisingly, more individualistic societies are less likely to feature high penalties for tax evasion and greater support for alternative methods of deterrence, specifically greater administrator coverage.²⁷ Notably, though, *Individualism* is negatively associated with use of information reporting. Information reporting systems require that individuals accept giving up some privacy, which is less likely to happen in societies characterized by individualism.

Finally, a measure of external conflict, motivated by the Besley and Persson (2009) finding that a history of external conflict can explain variations in tax levels, is positively associated with several tax system measures that support enforcement, such as the use of penalties to deter evasion, as well as the use of extensive information reporting and bank access.²⁸ *Conflict* is also positively associated with *Dispersed Responsibility*. This highlights a fascinating chicken-and-egg issue. Does a history of external conflict shape relatively positive attitudes toward punitive treatment of what might be construed as anti-social behavior (i.e., tax evasion) or the acceptance of more transparency in tax enforcement, which in turn facilitates the collection of higher levels of tax? Or is it the other way around: a history of external conflict leads to higher taxes, through the mechanism that Besley and Persson (2009) highlight, which then requires greater use of deterrence to ensure collection of those taxes? One suspects that the answer is more complex than choosing one story over the other; to be sure, learning the answer would require analysis of a long time-series analysis rather than the cross-sectional analysis we have undertaken here.

5 Can tax system variation shed light on the correlation between tax levels and real per capita income?

One of the most striking statistical regularities in the study of taxation is the strong positive cross-country correlation between real per capita income and tax level: richer countries levy more taxes, as a fraction of income, than do poor countries, both across countries and within a country over time.²⁹ Although the existence of this relationship is not controversial, its interpretation is. One explanation, dubbed Wagner's Law,

²⁶After removing potential outliers based on studentized residuals greater than 2.0 or less than -2.0, our results regarding *Ethnic* are robust and generally increase in significance (i.e., *Withhold* ($p = .0036$) and *Dispersed Responsibility* ($p = .0261$)). Additionally, *Ethnic* becomes marginally significant in explaining *Report* ($p = .1029$) and *Penalty* ($p = .0891$).

²⁷After removing potential outliers based on studentized residuals greater than 2.0 or less than -2.0, our results regarding *Individualism* are robust and generally increase in significance (i.e., *Report* ($p = .0041$), *Penalty* ($p = .0948$), and *Coverage* ($p = .0002$)). Additionally, *Individualism* becomes significant in explaining *Withhold* ($p = .0598$) and *Dispersed Responsibility* ($p = .0329$).

²⁸After removing potential outliers based on studentized residuals greater than 2.0 or less than -2.0, our results regarding *Conflict* are robust and generally increase in significance (i.e., *Report* ($p = .0047$), *Penalty* ($p = .0470$), and *Dispersed Responsibility* ($p = .0261$)). Additionally, *Conflict* becomes significant in explaining *Collect* ($p = .0497$).

²⁹This is true in our data. Table 3 shows the correlation between *GDPPC* and *Tax GDP* is .451, and between *GDPPC* and *Tax Rate* is .325.

is that it reflects a demand phenomenon: more affluent citizens value, demand, and obtain through the political process a greater fraction of their income in government services; Wagner (1911) associated these services with urbanization. Another, not mutually exclusive, possibility is that in richer countries the cost of raising revenue is lower, so that other things equal it is appropriate for government to provide more of the relatively cheaper services. Finally, one might imagine the causation running in the other direction: higher taxes cause more prosperity and higher real incomes. Given that taxes are presumed to dampen incentives to produce income and to generate deadweight losses, this is unlikely. However, it is certainly possible that some of what the government provides with the tax money it collects, such as education, healthcare, and infrastructure, is indeed conducive to prosperity, and so it is plausible that the positive correlation between tax level and income could in part be picking up the causal effect of (certain) government activities on prosperity.

Sorting out these explanations with only cross-sectional data is difficult, if not impossible, given the identification issues that arise.³⁰ This is not for lack of trying. Goode (1968) examined cross-country variation in tax levels and suggested that, rather than income being the driving factor, this association may result from the positive correlation between per capita income and other social and economic conditions that make direct taxes acceptable and effective, such as a high level of literacy, wide use of standard accounting methods, effective public administration, and political stability. Tanzi (1992) studied the determinants of the tax ratio in 83 developing countries from 1978 to 1988. Although, by itself, the log of per capita income is positively associated with the tax ratio, the share of agricultural output to GDP explains more of the variation in tax shares than does per capita income (with a negative sign), and when both variables are included as explanatory variables, per capita income no longer has a statistically significant positive effect, although the negative effect of the agricultural share survives.

Given the systematic relationship between per capita income and non-rate aspects of tax systems discussed in Sect. 3.1, a natural and intriguing question to ask is whether the simple correlation between tax levels and per capita income survives as a partial relationship when one holds constant tax system measures. We report these results in Table 5. Without any tax system measures as explanatory variables in column (1), regressing $TaxGDP$ on $GDPPC$ yields a coefficient of 0.285 with a t-statistic 3.39. Adding the 10 tax system measures as explanatory variables in columns (2) through (11), one at a time, does not eliminate the significant partial coefficient on $GDPPC$. However, as column (10) in Table 5 reports, when *Coverage* (the ratio of tax authority employees to the working-age population) is added as an explanatory variable, the estimated coefficient on $GDPPC$ falls to 0.158 and attracts a t-statistic of 1.96. This result suggests that variations in administrative effort affect tax levels, and these variations are correlated with a country's level of development.³¹

³⁰These issues are discussed in more detail in Slemrod (1995).

³¹This set of results is sensitive to the sample for which the regression is run. For example, when the sample comprises only OECD countries, the coefficient on $GDPPC$ becomes completely insignificant when *Coverage* is included, and also when either *Self-assess* or *Dispersed Responsibility* is included. In part this is due to the lower variation in tax levels among OECD countries. These results are not sensitive to using $GDPPC$ or the natural log of $GDPPC$.

Table 5 Relation between tax levels and per capita income

Independent variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
<i>Self-assess</i>		-3.9620 [†] (2.3691)											-7.0004* [*] (3.2202)
<i>Withhold</i>			0.2589 (0.4812)										-0.1640 (0.6758)
<i>Withhold Type</i>				1.7919 (0.0330)									2.4446 (2.9096)
<i>Report</i>					0.1075 (0.4942)								0.5711 (0.7371)
<i>Match</i>						0.7907 (0.6405)							0.8628 (0.8232)
<i>Collect</i>							0.9314 (0.0330)						-0.1142 (0.9826)
<i>Verify</i>								-0.2971 (0.8055)					-0.0340 (1.0034)
<i>Penalty</i>									-2.5048 [†] (1.3724)				-2.8168 [†] (1.5871)
<i>Coverage</i>										4.8447** (1.3270)			5.5645** (1.9295)
<i>Bank</i>											6.1874 [†] (3.3092)		2.5683 (4.0666)
<i>Dispersed Responsibility</i>												0.1120 (1.9714)	

Table 5 (Continued)

Independent variables	Dependent variable = <i>Tax GDP</i>												
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
<i>GDPPC</i>	0.2854** (0.0843)	0.2443** (0.0862)	0.2989** (0.0886)	0.3076** (0.0879)	0.2860** (0.0959)	0.2609** (0.0858)	0.2923** (0.0889)	0.2574** (0.0907)	0.2922** (0.1015)	0.1582 [†] (0.0807)	0.3143** (0.1014)	0.3070* (0.1261)	0.0374 (0.1302)
<i>Constant</i>	25.3039** (2.4607)	28.5575** (3.0996)	23.7609** (3.7915)	21.9491** (4.4202)	24.6032** (4.5547)	22.6333** (3.9106)	16.0870* (7.4598)	28.0805** (6.3504)	27.4925** (3.9619)	21.6036** (2.5928)	19.6645** (4.5776)	24.4847** (4.0264)	20.4616 (14.2043)
Adjusted <i>R</i> -sq	0.1854	0.2166	0.1723	0.1824	0.1475	0.1574	0.1746	0.1384	0.2947	0.3340	0.1927	0.1386	0.4226
<i>N</i>	47	47	47	47	43	46	45	45	37	46	38	33	33

This table reports summary statistics of OLS regressions of tax levels on tax system measures and per capita income. **, *, [†] denote significance at the 1, 5, 10 percent level (two-tailed), respectively. Standard errors are in parentheses. See Table 1 for variable definitions

We also note that in a regression with *all* of the tax system measures along with *GDPPC* as explanatory variables, the estimated coefficient on *GDPPC*, reported in column (13) of Table 5, is 0.037, with a t-statistic of just 0.29, while *Self-assess*, *Penalty*, and *Coverage* all attract coefficients that are significantly different from zero. To be sure, definitively pinning down the causal arrows among these variables will have to wait for further research on this issue. But we can report tentative evidence that the famous relationship between tax levels and GDP per capita is picking up the fact that administrative procedures, and in particular administrative effort, happen to vary by the level of development, so that high-income countries are more successful at raising taxes than other countries.

6 Conclusion

Income tax systems are multidimensional and not adequately summarized by the tax level and rate structure applied to the income tax base. Ignoring non-rate, non-base aspects of income tax systems can introduce bias into empirical estimation of the impact of taxation. Although this concern has been noted, lack of comprehensive, comparable cross-country data on tax systems has until recently precluded a systematic analysis of the importance of this issue.

Our analyses of 10 tax system aspects, codified based on OECD (2006, 2008), suggests that no pair of tax system aspects moves in lockstep across countries, but a factor analysis of the tax system measures indicates that a single factor can summarize the covariation, which we conceptualize with respect to whether collection responsibility is dispersed, or centralized in the tax authority. We call this factor *Dispersed Responsibility* and offer it as a parsimonious measure that may be used in future empirical research. Empirical work examining the impact of tax systems on economic behavior can recognize the joint importance of tax rates and non-rate aspects of tax systems by incorporating our summary measure, or a subset of the separate measures, into the analysis. Non-rate tax system features may have a direct effect on taxpayer behavior, and may also intermediate the effect on behavior of tax rates. For example, statutory tax rates may matter more when an array of enforcement instruments is brought to bear.

Proxies for non-rate, non-level aspects of tax systems are, with one exception, significantly correlated with one or more of the tax system aspects, with the extent of withholding and tax collection powers by far the most likely correlate. The pattern of sign correlations is almost identical across the proxies, both with respect to the tax system aspects and with respect to per capita income. This is true even though the proxies used in the past literature vary widely in what they intend to measure. For example, some are intended to measure features of a country's institutions, such as *Weak Law*, while others purport to measure an outcome affected by many institutions, such as *Non-compliance*.

Our investigation of what determines variation in tax systems reveals that a standard measure of trust in government is positively associated, holding other determinants constant, with administrative assessment, as well as more serious sanctions for non-compliance. Ethnic heterogeneity, individualism, and a history of external conflict also can explain certain aspects of tax systems in reasonable directions. Using

the factor that emerges from our factor analysis as a summary tax system measure, we find that countries with greater trust in government are more likely to have a tax compliance atmosphere that views the government as primarily responsible for accurate income tax reporting.

Finally, we investigate whether the new measures of tax system dimensions can shed light on the well-known cross-country empirical regularity that rich countries on average collect higher taxes or, depending on one's causal interpretation of the correlation, that high-tax countries are more prosperous. No smoking gun emerges from this exercise; although a measure of resources devoted to tax collection—the ratio of tax authority employees to the working-age population—does reduce the significant positive estimated coefficient of GDP per capita on the tax ratio, and attracts a significant positive correlation itself. This is only suggestive evidence that the extent of tax administration and enforcement is part of the story that explains this enduring statistical regularity.

This set of exploratory data analyses raises more questions than it provides definitive answers concerning the origin and consequences of non-rate tax system dimensions. In our view, though, it does establish that serious cross-country empirical analysis (and, in a few years, panel data analyses) of taxation should not, and need not, ignore the multidimensionality of tax systems.

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Appendix

Country	Self-assess	Withhold	Withhold Type	Report	Match	Collect	Verify	Penalty	Coverage	Bank	Dispersed Responsibility
<i>OECD countries</i>											
Australia	1	1	1	3	5	10	8	0.90	1.55	1	-0.664
Austria	0	3	2	2	2	10	8	2.00	1.44	0	-0.886
Belgium	0	5	1	4	4	9	6	2.00	2.54	0	-0.992
Canada	1	2	1	8	6	9	8	0.50	1.69	1	-0.100
Czech Republic	0	3	2	1	6	9	9	0.20	2.17	1	-0.774
Denmark	0	5	2	7	5	13	6	2.00	2.47	1	0.635
Finland	0	5	1	5	6	9	6	0.30	1.70	1	-0.415
France	0	0	0	9	1	9	6	0.80	3.12	1	-1.108
Germany	0	4	2	3	2	12	7	-	2.04	1	-
Greece	0	9	1	9	3	12	9	2.00	1.94	1	0.761
Hungary	1	6	1	5	6	12	8	0.50	1.96	1	0.277
Iceland	0	5	1	7	5	8	8	0.25	0.50	1	-0.216
Ireland	1	5	2	6	4	9	8	1.00	2.43	1	0.246
Italy	1	5	2	7	6	10	7	2.00	0.85	1	0.754
Japan	1	7	2	9	0	6	6	0.40	0.67	1	0.504
Luxembourg	0	4	2	2	5	9	3	0.40	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	2.00	2.81	1	-0.215
New Zealand	1	3	2	3	5	9	8	1.50	2.20	1	-0.231
Norway	0	1	1	5	6	11	5	0.60	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 Republic	1	4	2	4	1	8	4	0.15	1.50	1	-0.213
South Korea	1	7	2	8	6	12	5	0.40	0.49	1	1.274
Spain	1	8	2	10	6	10	6	1.50	0.99	1	1.379
Sweden	0	3	1	6	5	11	4	0.20	1.68	1	-0.294

(Continued)

Country	Self-assess	Withhold	Withhold Type	Report	Match	Collect	Verify	Penalty	Coverage	Bank	Dispersed Responsibility
<i>OECD countries</i>											
Switzerland	0	3	0	1	0	9	6	-	0.18	0	-
Turkey	1	6	2	7	4	13	7	1.00	0.91	1	1.088
United Kingdom	1	9	2	8	4	8	6	1.00	2.21	1	0.807
United States	1	1	1	5	5	9	5	0.75	0.46	1	-0.425
<i>Non-OECD countries</i>											
Argentina	1	10	2	3	6	11	6	1.00	0.84	1	0.871
Brazil	1	5	2	6	6	13	7	-	0.11	-	-
Bulgaria	1	2	2	8	6	9	5	-	1.39	-	-
Chile	1	4	2	8	4	5	8	3.00	0.36	-	-
China	1	8	2	10	5	13	6	5.00	0.80	1	1.885
Cyprus	1	3	2	5	6	8	5	0.10	1.53	0	-0.465
Estonia	1	3	2	4	5	10	5	-	2.23	-	-
India	0	3	1	-	-	-	-	3.00	-	-	-
Latvia	1	7	2	9	1	12	6	1.00	3.16	-	-
Lithuania	1	5	2	-	6	10	9	1.00	1.24	-	-
Malaysia	1	2	1	1	1	8	9	1.45	0.40	0	-1.399
Malta	1	5	1	5	6	8	6	0.09	1.47	0	-0.643
Romania	0	8	2	8	6	9	4	-	1.68	-	-
Russia	0	3	2	-	6	-	-	-	1.63	1	-
Singapore	0	0	0	7	6	8	7	3.00	0.48	0	-1.336
Slovenia	0	7	1	7	4	9	7	-	1.80	-	-
South Africa	0	1	2	4	4	11	7	2.00	0.51	1	-0.185

This data appendix shows tax system measures by country, and the principal component score obtained from a factor analysis of the ten measures, called *Dispersed Responsibility*

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