NEXUS BETWEEN TAX EFFECTIVENESS, TAXATION POLICY, AND DOUBLE TAXATION CONVENTIONS. A PANEL DATA MODEL APPROACH

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ABSTRACT: Taxation represents one of the most important issues nowadays in the field of economics, *lato sensu,* and in the field of finance, *stricto sensu.* In this study, we address the complex issue of taxation policy in the context of tax effectiveness, with the backdrop of double taxation conventions aimed at creating fiscal space. In this regard, Dumiter's (2023) index is used to evaluate and assess the impact of fiscal policy on the economy and to assess the tax effectiveness criteria of tax authorities. The research methodology encompasses panel data modeling techniques for a sample of 38 OECD countries with a long-run financial database. The conclusions of the study reveal that tax compliance and tax culture are very important features for reducing tax evasion, and a stable tax law framework is needed for the long-term efficiency of the fiscal policy.

Keywords: Double Taxation Conventions, Taxpayer, Dumiter index, Taxation, tax compliance, tax policy, tax evasion, panel data.

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1. Introduction

Over time, international economic and legal double taxation has raised several issues such as double non–taxation, *treaty shopping* practices, *anti-abuse* clauses in tax treaties, use of arbitration in tax disputes, and international litigation in tax matters. Thus, international double taxation should be seen in the *panacea or placebo* dichotomy of international tax policy, *lato sensu*, and direct taxation, *stricto sensu*.

In addition, the inhibition of economic development due to double taxation is eliminated through the signing of international tax treaties (Lefter & Chirică, 2010; Covrig, 2012; Rus et al., 2013; Dumiter et al., 2014). The application of the provisions of these treaties is a priority over national regulations (Pohl & Keller, 2012), so divergences often arise, the solution of which is dependent on the interpretation of international tax law (Caster, 2011; Kirsch, 2009; Riza, 2014). Few studies also draw attention to redefining some concepts of tax treaties to correspond to reality (Taylor, 2010; Keefe, 2010).

Therefore, the importance of our study lies in the necessity of a direct convergence between the legal and financial aspects regarding the direct taxation problems, especially in EU countries. Literature suggests it is crucial to investigate the judicial and economic point of view of the double taxation convention and its impact on direct taxation.

Hence, the objective of our study is to establish the connection between the entire process of double taxation conventions and their impact on direct taxation within the framework of fiscal policy.

The scope of the research was to use the Dumiter (2023) index for measuring the soundness of the double taxation conventions in order to analyze the complex relationship that manifests in practice between double taxation conventions, taxation policy within several stages and paths, and the multifaced structure of tax effectiveness in different types of states which promote different styles of fiscal policy. Moreover, tax compliance is a very important feature that is analyzed through the effectiveness of tax policy and tax agenda.

This study reveals the positive relationship that manifests between the economic and legal aspects of double taxation conventions, which are interrelated with the tax policy and taxation mechanism in order to have a complex mechanism for taxation at the international level. Although at the European Union level, the tax policy agenda has been improved lately, in the matter of direct taxation, there can be seen more *room to maneuver* in order to create the desired fiscal space.

In this paper, it is provided qualitative and quantitative analysis is provided regarding the complex mechanism of tax effectiveness at different stages of a country, tax compliance, and the connections with tax culture and tax policy. The economic, financial, judicial, and social aspects of taxation are highlighted in order to offer some interesting insights regarding the optimum policy mix between tax policy, tax compliance, tax effectiveness, tax behavior, and the legal aspects of taxation.

The structure of the article is the following: in the first part there are provided the current state of the art regarding tax effectiveness, taxation policy, and double taxation conventions is provided through the identification of the research gaps and limitations; the second part of the article consists in constructing the research hypothesis, research methodology and models and the presentation of the empirical data used; the third section highlights the empirical results obtained with the econometrical tools and provided the quantitative overview of the fiscal policy and its implications upon tax effectiveness and fiscal strategy; the last section draws the final

considerations of the paper, give insights for policy outcomes, identifies the measure that tax authorities need to adhere in the future and presents the research limitations.

2. Literature review

Over the past two decades, tax effectiveness, taxation policy, and double taxation conventions have been widely researched. Tax policy plays a pivotal role in enhancing tax effectiveness by structuring incentives, ensuring compliance, and aligning economic goals with fiscal measures. Li (2016) and Martínez et al. (2022) highlight that fiscal decentralization and tax incentives increase tax revenue collection and tax competition. Fonseca-Díaz, Fernández-Rodriguez & Martínez-Arias (2014) advocate that institutional quality and development level influence tax effectiveness. Rumasukun & Noch (2023) consider that institutional frameworks, technological advancement, and economic structures determine tax system performance. Loretz (2007) identified country size as a proxy for tax effectiveness, and Genschel & Seelkopf (2016) observed that taxation trends are closely associated with socioeconomic changes (GDP per capita) and structural factors (country size).

The study of Andrejovská & Puliková (2019) found that macroeconomic factors are crucial in determining tax effectiveness, especially the employment rate, which manifests the strongest correlation to tax revenues. Baiardi et al. (2019) and Moyo, Samour & Tursoy (2021) observed a significant relationship between tax revenues and economic growth. Kotlán & Machová (2014) emphasized the influence of corporate taxation on economic growth. The research of Barrios et al. (2018) suggested that labor tax is a significant factor in tax effectiveness. Stoilova & Patonov's (2012) results support that a tax structure based on direct taxes is more efficient for supporting economic growth in EU countries. At the same time, the increasing tax burden leads to financial stability in the EU (Skarzauskas, 2021).

Research by Djankov et al. (2009) highlights that corporate tax rates are negatively correlated with aggregate investment, foreign direct investment (FDI), and entrepreneurial activity, but positively correlated with the size of the informal economy. Sani et al. (2024) linked tax avoidance to debt capital. Ajaz & Ahmad (2010) emphasized that governance and corruption are identified as primary determinants of tax revenue. Additionally, political stability affects tax collection effectiveness (Gupta, 2007). Slemrod & Robinson (2010) observed that trust in government is positively associated with greater tax administration coverage and stricter compliance measures, and Besley & Persson (2014) noted that economic, political, and sociological/cultural factors contribute to low tax revenue in developing countries. Improving institutions and reducing the shadow economy are seen as key factors in boosting tax performance (Grigorian & Davoodi, 2007). Casi, Spengel & Stage (2020) confirm that the Common Reporting Standard effectively reduces tax evasion in traditional tax havens.

A study by Hines Jr. (1996) evidences that taxpayers are very responsive to the worldwide tax rate. For multinational companies, locating subsidiaries depends on multiple tax factors, including tax rates and double tax treaty networks (Chennells & Griffith, 1997; Huizinga & Voget, 2009; Keller & Schanz, 2013; Sztajerowska, 2021). Morisset & Pirnia (1999) observed that taxes influence investment decisions, but sustainable strategies for infrastructure and policy improvements attract long-term investments. Additionally, both corporate and income tax rates in host and home countries significantly affect foreign direct investment flows (Cassou, 1997).

Several studies found a positive association between double taxation treaties and FDI and international trade (Barthel, Busse, and Neumayer, 2009; Azémar & Dharmapala, 2018; Petkova, Stasio & Zagler, 2019; Pham, Pham & Cuong Ly, 2019). Kudła, Kopczewska & Stachowiak-Kudła, (2023) noted that expanding bilateral trade intensity can increase the tax treaty network. Dagan (2003) considered that tax treaties may not be necessary to prevent double taxation and can redistribute tax revenues from poorer to richer countries. Klemm & Van Parys (2009), Xu & Wu (2021) found a negative association between corporate income tax and FDI inflows, suggesting that corporate income tax is a key factor in international tax competition. Also, Bretschger & Hettich (2005) advocate for tax competition theory that supports the theory that globalization harms capital taxes and, therefore, tax effectiveness. Linseis (2023) supports harmonizing tax treaties and unilateral provisions.

Gordon & Hines Jr. (2002) highlight that integrating global capital markets influences tax policy design, considering that tax avoidance is pervasive, leading to fiscal externalities, and international agreements could improve tax system efficiency. Multinational corporations use treaty shopping and transfer pricing mechanisms to optimize tax liabilities (Beer & Loeprick, 2018; Kinda & Tagem, 2023), and raise ethical concerns (Benhabib, Benali & Tkiouat, 2024). Keen (2018) observed that competition, coordination, and avoidance are interconnected aspects of international taxation; therefore, coordination among nations is essential to combat tax abuse and harmonize tax policies (Hretsa, 2023). De Mooij, Klemm & Perry (2021) argue that the current international tax architecture is no longer fit for purpose due to globalization and digitalization, and Diller, Ehm & Lorenz (2024) consider that there is a need for a dynamic and flexible regulatory framework to address the challenges posed by digital economies.

Dumiter, Jimon & Bene (2019) support the idea that there is a need for new multilateral tax conventions at the EU level to address treaty shopping practices. The OECD Model Tax Convention is crucial in developing the current international bilateral treaties network (Fishbien & Lempert, 2023). The Multilateral Convention to Implement Tax Treaty-Related Measures to Prevent Base Erosion and Profit Shifting is a significant development in international tax law, addressing issues like hybrid mismatches and treaty abuse (Popovic & Ilic-Popov, 2017). On the contrary, Lammers & Magalhães (2023) argue that double taxation must be avoided, and in their research, they propose a simplified tax treaty model that allows for a limited overlap between home and host state taxes.

Double taxation conventions are vital in shaping economic relations, influencing compliance, and addressing legal and regulatory challenges. However, challenges regarding international tax treaties can be identified. Tavares (2016) distinguishes incoherent or ineffective legislation in key aspects, such as recognizing permanent establishments and profit attribution. Lang & Owens (2014) noted weak domestic tax legislation for effectively utilizing double tax treaties to achieve development goals like the Millennium Development Goals. Avi-Yonah & Lempert (2023) acknowledge the difficulty in achieving a multilateral tax convention due to the fundamental divergence of interests among countries, mainly because of the monetary stakes involved.

The following table presents some relevant studies on tax effectiveness, taxation policy, and double taxation conventions.

Table 1. Previous studies regarding tax effectiveness, taxation policy, and double taxation conventions

	Author	Research methods	Findings	Research limitation

1.	Xu & Wu, 2021	Generalized Method of Moments (GMM)	The negative association between corporate income tax and foreign direct investment inflows, suggests that CIT is a key factor in international tax competition.	Insufficient investigation into the impact of preferential tax regimes, state aid, or subsidies on FDI.
2.	Petkova, Stasio & Zagler, 2019	Poisson Pseudo Maximum Likelihood (PPML) estimation and the gravity model	Double tax treaties increase foreign direct investment and offer a financial advantage over domestic law	Limited understanding of the complex network of Double tax treaties and their unforeseen consequences
3.	Bretschger & Hettich, 2005	Quantitative panel data analysis using regression techniques	Globalization harms capital taxes, consistent with tax competition theory. The study supports the "efficiency hypothesis" of globalization, suggesting it is efficient for governments to decrease taxes on mobile factors.	Need for a more nuanced understanding of how globalization affects capital tax rates.
4.	De Mooij, Klemm & Perry (Ed.), 2021	Theoretical review with analytical synthesis	The current international tax architecture is no longer fit for purpose due to globalization and digitalization.	Lack of international cooperation and the risk of unilateral reforms causing economic spillovers. Complexity and uncertainty in domestic tax systems due to anti-avoidance rules indicate a need for simplification.
5.	Klemm & Van Parys, 2009	Ordinary least squares (OLS); maximum likelihood, spatial lag model (MLSL); Maximum likelihood, spatial error model (MLSE); Generalized Method of Moments (GMM)	Lower corporate income tax rates and more extended tax holidays attract FDI but do not boost private investment or growth.	Limited empirical evidence on tax incentives in developing countries
6.	Kudła, Kopczewska &	ANOVA, Hierarchical Linear Model, and Ordered	Bilateral trade intensity is the most critical factor in reducing asymmetry in tax	Need for a more comprehensive analysis of tax

	Stachowiak-Kudła, 2023	Logistic Regression with spatial lags	treaties. Tax competition has a limited impact on asymmetry.	competition mechanisms.
7.	Stoilova & Patonov, 2012	Ordinary least squares (OLS)	A tax structure based on direct taxes is more efficient for supporting economic growth in EU countries.	Refinement in research methodology or data collection for more definitive conclusions
8.	Barthel, Busse & Neumayer, 2009	Dyadic fixed-effects estimation; Generalized Method of Moments (GMM)	Treaties (DTTs) are positively associated with higher Foreign Direct Investment (FDI) stocks	Need for a more comprehensive analysis of the costs and benefits of DTTs from a policy perspective
9.	Pham, Pham & Cuong Ly, 2019	Generalized Least Squares (GLS)	Double taxation treaties significantly contribute to Vietnam's trade with ASEAN and EU countries, especially in terms of imports.	The potential effect of double taxation treaties on bilateral trade activities has not been studied to the same extent as their impact on FDI flows in Vietnam.
10.	Moyo, Samour & Tursoy, 2021	Autoregressive Distributed Lag Model (ARDL), Bayer-Hanck combined co-integration test, and Granger causality testing	The study finds a positive and significant relationship between government expenditure and economic growth in the short and long run. Tax revenue also has a significant positive relationship with economic growth.	Insufficient consideration of other tax revenues such as taxes on imports, exports, international trade, and non-payment or late payment.
11.	Skarzauskas, 2021	Multiple linear regression and hierarchical clustering (Ward method)	The increase in tax burden strengthens state financial stability in three EU country groups (High Tax Burden/Low Financial Stability, Low Tax Burden/High Financial Stability, Low Tax Burden/Low Financial Stability) but decreases it in the High Tax Burden/High Financial Stability Group	Complexity in international tax burden comparisons and their impact on financial stability. There is a need for further empirical studies to clarify the impact of tax burden on financial stability.
12.	Riera-Crichton,	Quantitative analysis	Tax rates are a more accurate tax policy measure	Challenges in measuring and

	Vegh & Vuletin, 2017		than revenue-based measures like cyclically adjusted revenues. Developing countries follow a procyclical fiscal policy, affecting tax multiplier estimation.	identifying exogenous tax shocks Complexity of tax policy involving multiple rates and thresholds
13.	Avi-Yonah & Lempert, 2023	Theoretical review with comparative analysis	The primary finding is that the difficulty in achieving a multilateral tax convention (MTC) is due to the fundamental divergence of interests among countries, mainly because of the monetary stakes involved.	Further investigation into the monetary stakes and interest alignment in multilateral tax conventions compared to investment and trade law.
14.	Linseis, 2023	Theoretical review with legal and economic analysis	Harmonizing tax treaties and unilateral provisions is recommended to ensure equal treatment of comparable cross-border inheritance cases.	There is a need for further research to address inconsistencies in the avoidance of double taxation.
15.	Kinda & Tagem, 2023	Generalized Method of Moments (GMM) and entropy balancing method	Double taxation treaties have a negative impact on resource revenue mobilization in resource-rich countries due to reduced withholding tax rates and treaty shopping by multinational corporations	Need for further exploration of tax treaty networks and their impact on revenue mobilization
16.	Casi, Spengel & Stage, 2020	Difference-in-difference design	The Common Reporting Standard effectively reduces tax evasion in traditional tax havens; relocation to other jurisdictions remains a viable option for tax evaders.	Exclusion of alternative channels for tax evasion, such as equity or bond portfolios, and real estate.
17.	Beer & Loeprick, 2018	Difference-in-Difference framework	Double tax treaties with investment hubs do not increase foreign direct investment in Sub-Saharan Africa but lead to significant revenue losses due to treaty shopping, contradicting the	Assess the large magnitudes of treaty-related base erosion and profit shifting in Sub-Saharan Africa.

			assumption that these treaties attract investment.	
18	Azémar & Dharmapala, 2018	Poisson pseudo-maximum likelihood (PPML) fixed effects estimator and instrumental variables (IV) strategy	Tax-sparing agreements are associated with a 97% increase in FDI, with a causal effect concentrated in the year following implementation.	Lack of studies on the impact of tax sparing for multinational corporations from countries with different tax systems
19	Sztajerowska, 2021	Difference-difference empirical strategy and linear probability model (LPM)	The study finds a statistically significant positive effect of International Investment Agreements (IIAs) combined with Double-Taxation Treaties (DTTs) on the probability of multinational enterprises.	Limited understanding of the effects of IIAs on different margins of multinational enterprises' activity
20	Sani et al., 2024	Generalized Method of Moments (GMM)	Corporate tax avoidance shows a negative association with debt policy, indicating that tax avoidance is likely to increase debt capital in Nigeria, supporting the trade-off theory of capital structure.	Limited understanding of the relationship between tax avoidance and capital structure.

Studies reflect a complex connection between government structures, economic conditions, and the design of tax systems in influencing tax effectiveness. Researchers have examined tax effectiveness, taxation policy, and double taxation conventions from different perspectives, employing diverse research methodologies and econometric techniques. The literature highlights the complex implications of double taxation conventions for tax legislation and policy effectiveness, international trade and economic cooperation, tax compliance and anti-evasion efforts, and key principles such as transparency, certainty, predictability, and the clarity of tax jurisdiction and competencies—all of which contribute to the facilitation of cross-border transactions and foreign direct investments. The main challenges in exploring the complex framework of tax effectiveness, tax policy, and double taxation treaties rely on data availability, limited cross-regional studies and research on cross-cultural perspectives and values determining tax compliance, heterogeneity of tax policy, divergence in legislation, and lack of policy and juridical coordination between countries.

3. Research methodology, hypothesis, models, and data

3.1. Research hypothesis

The *panacea* of international taxation represents the directions in which double taxation conventions influence both economic and judicial the overall taxation policy. This is important for creating the fiscal space in order to create a complete mix of tax effectiveness, taxation policy, and tax compliance.
Further, we propose the following assumptions:
Hypothesis I.1.: The increase or decrease in the level of taxation rates is influenced by the conclusion of a double taxation convention.
Hypothesis I.2.: Strengthening and favoring of cross–border trade with a direct increase in GDP per capita is based on a fair system of direct taxation that is influenced by the conclusion of double taxation conventions.
Hypothesis I.3.: Global cross-border investments depend on a complex and complete set of double taxation conventions for fairer direct taxation at the national and international levels.
Hypothesis I.4.: The framework of the direct taxation system at the national and international levels, through equitable taxation of personal income and fair international tax competition, is improved by increasing the fiscal impact of double taxation conventions.
Hypothesis I.5.: The legal system is strengthened through the efficiency and effectiveness of direct taxation established at a cross-border level, especially through a high level of government effectiveness, based on a complex network of double taxation conventions.

3.2.Data

The data used in this research is presented in Table 2 and Table 3. In Table 2 the independent variables are: tax revenue (TXR), Tax on personal income (TPI), GDP per capita (GDPcap), Foreign Direct Investments-inward (FDIin), Foreign Direct Investments-outward (FDIout), Government effectiveness (GovEf), International Tax Competitiveness Index (IntTAXcompetitiveness), Tax Complexity Index (TAXcomplexity). The range of the empirical data starts from the 1960s and it is spread until 2023.

Table 2 The names of the variables selected from data set I.

Variable		Description	Data source	
Tax revenue	TXR	Tax revenue encompasses income and profits taxes, social security contributions, taxes on goods and services, payroll taxes, property ownership and transfer taxes, and various other levies, constituting the total income generated from taxation.	OECD	https://data-explorer.oecd.org/
Tax on personal income	TPI	Personal income tax refers to taxes imposed on an individual's net income (gross	OECD	https://data-explorer.oecd.org/

		income minus permitted deductions) and capital gains.		
GDP per capita	GDPcap	Gross Domestic Product (GDP) measures the total value added from goods and services produced within a country over a specific period.	OECD	https://data-explorer.oecd.org/
Foreign direct investments - inward	FDIin	Inward FDI flows by partner countries represent the annual value of direct investment received from each source country.	OECD	https://data-explorer.oecd.org/
Foreign direct investments - outward	FDIout	Outward FDI is the value of investments made by a country's residents in foreign businesses to establish lasting control or influence.	OECD	https://data-explorer.oecd.org/
Government effectiveness	GovEf	Government effectiveness measures the quality of public services, policy implementation, and the competence of civil institutions.	World Bank	https://data.worldbank.org/
International Tax Competitiveness Index	IntTAXcompetiveness	The International Tax Competitiveness Index evaluates how well a country's tax system supports growth and investment through efficiency and neutrality.	Tax Foundation	https://taxfoundation.org/research/all/global/2024-international-tax-competitiveness-index/
Tax complexity index	TAXcomplexity	The Tax Complexity Index assesses the regulatory and procedural complexity of corporate taxation in different countries.	Global MNC Tax Complexity Project	https://www.taxcomplexity.org/

According to Table 3, for the double taxation conventions variable, it is chosen the Dumiter (2023) index in order to quantify the qualitative variable of double taxation conventions, which are based on three pillars: Pillar 1 – double taxation conventions' temporal aspects and elements; Pillar 2 – the double taxation conventions agreements analyzed through geographic aspects and their worldwide distribution; Pillar 3 – double taxation conventions analyzed through the types of agreements concluded by the states.

The aggregated index is built on these three pillars, with a score ranging from 0 points (minimum value) to 1 point (maximum value). Each of these pillars comprises three variables that

take values from 0 to 1, and the average score of each pillar is the arithmetic mean of the variables. The total value of the index is the arithmetic mean of the aggregate value of these three pillars of the index.

Table 3 The names of the variables selected from data set II

Variable		Description	Data source
Pillar I	TADTC	Temporal aspects of conclusion of double taxation conventions.	Own processing.
Pillar II	GADTC	Geographic aspects of the conclusion of international double taxation conventions.	Own Processing.
Pillar III	SADTC	Aspects regarding the types of double taxation conventions.	Own Processing.
Overall score	AIQFII	Aggregated index – total score – median value of the three pillars.	Own Processing.

In this study, 38 OECD countries were selected for the empirical and statistical modeling, namely: Australia, Austria, Belgium, Canada, Chile, Colombia, Costa Rica, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Latvia, Lithuania, Luxembourg, Mexico, Netherlands, New Zeeland, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkiye, United Kingdom, United States of America.

3.3. The Model

The arrangement of the entries reveals a panel structure of the data, having two index column entries, namely *countries* and *years*. One of the variables, namely the target variable DTC, which is represented by the Dumiter (2023) aggregated index, has the following structure: Pillar I TADTC, Pillar II GADTC, Pillar III SADTC, and Overall score AIQFII. The independent variables are explained by the remaining variables TXR, TPI, GDPcap, FDIin, FDIout, GOVef, IntTAXcomp, and TAXcomplex.

To test the relationship between double taxation conventions represented by the Dumiter (2023) index with three pillars and the overall score and tax effectiveness and taxation policy agenda in the 38 OECD countries we use *R-package software with Linear quantile mixture panel regression (lqmix) and Bayesian dynamic panel models based on the multi-disciplinary probabilistic programming realized in STAN*.

Thus, the regression equation is the following:

$$DTC_{it} = \alpha + \beta_1 xGDPPC_{it} + \beta_2 xFDI_{it} + \beta_3 xCTR_{it} + \beta_4 xTPI + \beta_5 xIMP_{it} + \beta_6 xEXP_{it} + \beta_7 xBAL_{it} + \varepsilon_{it} \quad (1)$$

Where:
DTC the fiscal impact of international double taxation conventions through the Dumiter (2023) aggregate index.

α is the free coefficient.
$\beta_{1,2,3,4,5,6,7,8}$ are predictor coefficients.
TXR is tax revenue.
TPI is the Tax on personal income.
GDPcap denotes Gross Domestic Product per capita, current prices.
FDIin denotes Foreign Direct Investment: Inward flows and stock.
FDIout denotes Foreign Direct Investment: outward flows and stock.
GovEf denotes Government effectiveness.
IntTAXcomp denotes the International Tax Competitiveness Index.
TAXcomplex denotes the Tax Complexity Index.
Finally, ε presents the regression error.

4. Empirical results

4.1. Data analysis

Two data sets refer to different aspects of a list of $N_c = 38$ countries, mostly the economically developed ones. The first data set contains yearly entries from 1960 to 2023, out of which we select 8 variables (features), which are listed in Table 2. Hence data set I contain $N_c x 65 = 2432$, row entries. Data set II lists four variables (features) without time resolution for all countries, the names of which are listed in Table 3.

The goal of the present work is to find a statistical model for the first variable from data set I. In general, the data sets are expected to contain missing values or so-called NAs. This is indeed the case, for many of the variables of dataset I, especially so for the "older" data entries. The data set II does not contain NAs. The first step in the data inspection and data analysis is to describe basic statistical properties, at first, country-wise for all eight variables, respectively (38 tables). Thereafter, the summary statistics include NA counts for dataset I, see Tables 4 –11 "Countries by variables over time period 1960-2023", a selection of the most important country results.

Table 4 Summary of the variables from dataset I, Country: **Australia**

Variable	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	NA's
TXR	19.8	25.4	27.2	26.5	28.6	30.4	7
TPI	7.07	10.6	11.5	10.9	11.9	13.3	7
GDPcap	2.38e+03	7.17e+03	1.82e+04	2.36e+04	3.88e+04	7.19e+04	1
FDIin	-3.25	2.73	3.58	3.03	4.07	4.53	46
FDIout	-4.23	0.381	0.64	0.983	1.5	6.8	46
GovEf	1.33	1.49	1.61	1.65	1.81	1.93	39
IntTAXcomp.	71.3	73	76.2	75.6	78.3	78.9	54
TAX complex.	0.356	0.365	0.377	0.375	0.387	0.391	60

Table 5 Summary of the variables from dataset I, Country: **France**

Variable	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	NA's

TXR	33.2	38.5	42.2	40.9	43.5	46.1	6
TPI	3.24	4.31	5.03	5.96	7.59	9.95	6
GDPcap	1.81e+03	6.2e+03	1.83e+04	2.07e+04	3.33e+04	5.72e+04	1
FDIin	0.0935	0.682	1.1	1.08	1.3	2.39	46
FDIout	0.724	1.53	1.81	2.26	3.26	4.16	46
GovEf	1.14	1.34	1.42	1.43	1.54	1.76	39
IntTAXcomp.	38.9	42.8	43.5	44.7	47.9	50.7	54
TAXcomplex.	0.385	0.386	0.391	0.393	0.398	0.405	60

Table 6 Summary of the variables from dataset I, Country: **Germany**

Variable	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	NA's
TXR	31.6	34.9	35.8	35.6	36.4	39.3	6
TPI	7.78	8.87	9.7	9.64	10.4	11.4	6
GDPcap	4.04e+03	1.28e+04	2.42e+04	2.7e+04	3.84e+04	6.66e+04	11
FDIin	-0.0121	0.617	1.2	1.12	1.77	2.34	46
FDIout	1.06	2.02	2.38	2.68	3.64	4.94	46
GovEf	1.19	1.5	1.52	1.54	1.66	1.81	39
IntTAXcomp.	62.7	66.6	67.1	67	67.8	70.2	54
TAXcomplex.	0.369	0.37	0.378	0.378	0.385	0.386	60

Table 7 Summary of the variables from dataset I, Country: **Netherlands**

Variable	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	NA's
TXR	30.5	35.6	37.2	37.3	39.3	42.1	6
TPI	5.56	6.92	8.31	8.22	9.56	10.9	6
GDPcap	4.09e+03	1.23e+04	2.4e+04	2.86e+04	4.49e+04	7.45e+04	10
FDIin	-8.95	0.891	2.95	3.61	5.79	23	46
FDIout	-19.1	3.11	6.31	6.57	8.74	30.9	46
GovEf	1.58	1.77	1.81	1.82	1.93	2.07	39
IntTAXcomp.	65.5	70.8	74.5	74.4	77.5	82	54
TAXcomplex.	0.324	0.343	0.352	0.348	0.356	0.364	60

Table 8 Summary of the variables from dataset I, Country: **Slovak Republic**

Variable	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	NA's
TXR	27.9	30.6	32.8	32.8	34.8	39.5	36
TPI	2.6	2.95	3.26	3.34	3.74	4.26	36
GDPcap	7.18e+03	1.1e+04	2.11e+04	2.08e+04	2.94e+04	4.06e+04	33
FDIin	-2.25	0.313	2.04	2.42	3.89	10.2	46
FDIout	-0.316	0.0581	0.35	0.438	0.798	1.38	46
GovEf	0.23	0.541	0.691	0.664	0.793	0.877	39
IntTAXcomp.	69.3	70.3	74.1	72.8	74.3	76	54
TAXcomplex.	0.337	0.355	0.386	0.381	0.412	0.416	60

Table 9 Summary of the variables from dataset I, Country: **Switzerland**

Variable	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	NA's
TXR	16	23	24.2	23.9	26.2	28.5	6
TPI	5.35	8.01	8.35	8.14	8.75	9.57	6
GDPcap	7360	19100	31200	36600	53500	90700	11
FDIin	-13.9	-11	1.41	0.04	9.37	18.4	55
FDIout	-8.93	-5.41	0.1	1.63	8.97	14.3	55
GovEf	1.75	1.88	1.97	1.96	2.03	2.16	39
IntTAXcomp.	77	78.6	82.6	81.6	84.7	85.2	54
TAXcomplex.	0.22	0.23	0.24	0.25	0.26	0.31	60

Table 10 Summary of the variables from dataset I. Country: **United Kingdom**

Variable	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	NA's
TXR	29.1	31.6	32.5	32.5	33.4	36.7	6
TPI	7.65	8.92	9.42	9.69	10.1	13.7	6
GDPcap	2.19e+03	5.7e+03	1.74e+04	2.08e+04	3.49e+04	5.68e+04	1
FDIin	-2.28	1.65	2.24	2.98	3.68	9.58	46
FDIout	-4.94	0.499	2.32	2	3.39	10.9	46
GovEf	1.16	1.45	1.62	1.58	1.75	1.88	39
IntTAXcomp.	56.1	61.7	62.5	64	68	71.5	54
TAXcomplex.	0.351	0.354	0.357	0.364	0.368	0.392	60

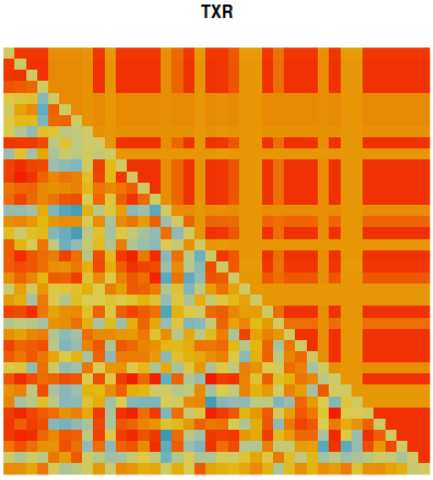
Table 11 Summary of the variables from dataset I, Country: **United States**

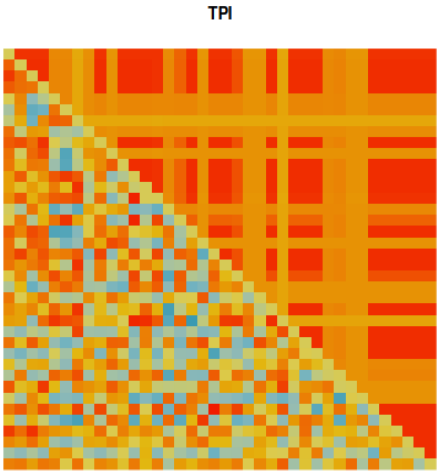
Variable	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	NA's
TXR	22.9	24.6	25.6	25.5	26.2	28.3	6
TPI	7.46	8.97	9.49	9.6	10.2	12.5	6
GDPcap	5.23e+03	1.55e+04	2.99e+04	3.27e+04	4.85e+04	7.63e+04	11
FDIin	0.537	1.2	1.41	1.51	1.74	2.66	46
FDIout	-0.628	1.38	1.75	1.57	2.06	2.8	46
GovEf	1.22	1.45	1.52	1.51	1.58	1.74	39
IntTAXcomp.	44.3	54.1	62	58.8	63.5	66.8	54
TAXcomplex.	0.369	0.39	0.402	0.404	0.416	0.446	60

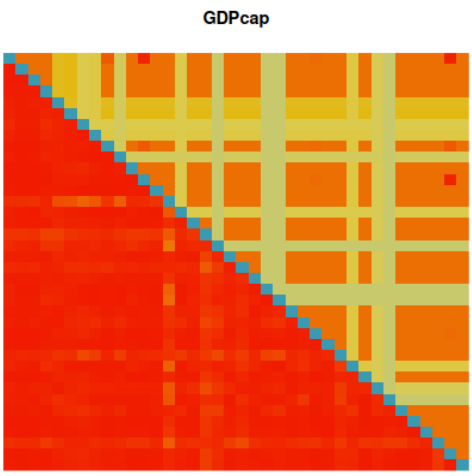
In this series of sub-tables, the countries are listed in alphabetical order. The next table (Tx.4) refers to the statistical summary of the four variables from data set II.

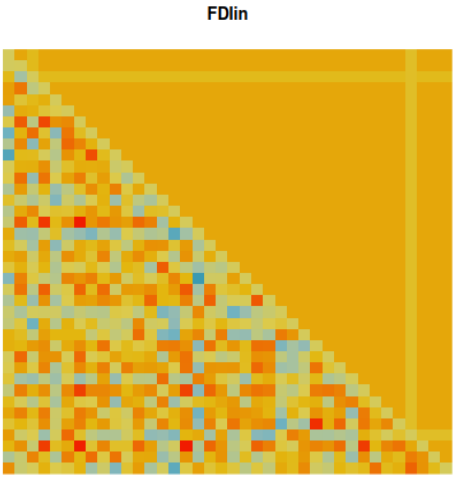
Table 12. The statistical summary of the variables from the second data set: Pillars I – III and Overall score.

Variable	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
Pillar. I...TADTC	0.42	0.69	0.92	0.811	0.92	1
Pillar.II...GADTC	0.08	0.83	0.92	0.878	1	1
Pillar.III...SADTC	0.5	0.83	0.83	0.837	0.92	1
Overall. Score...AIQFII.	0.44	0.803	0.89	0.841	0.92	1









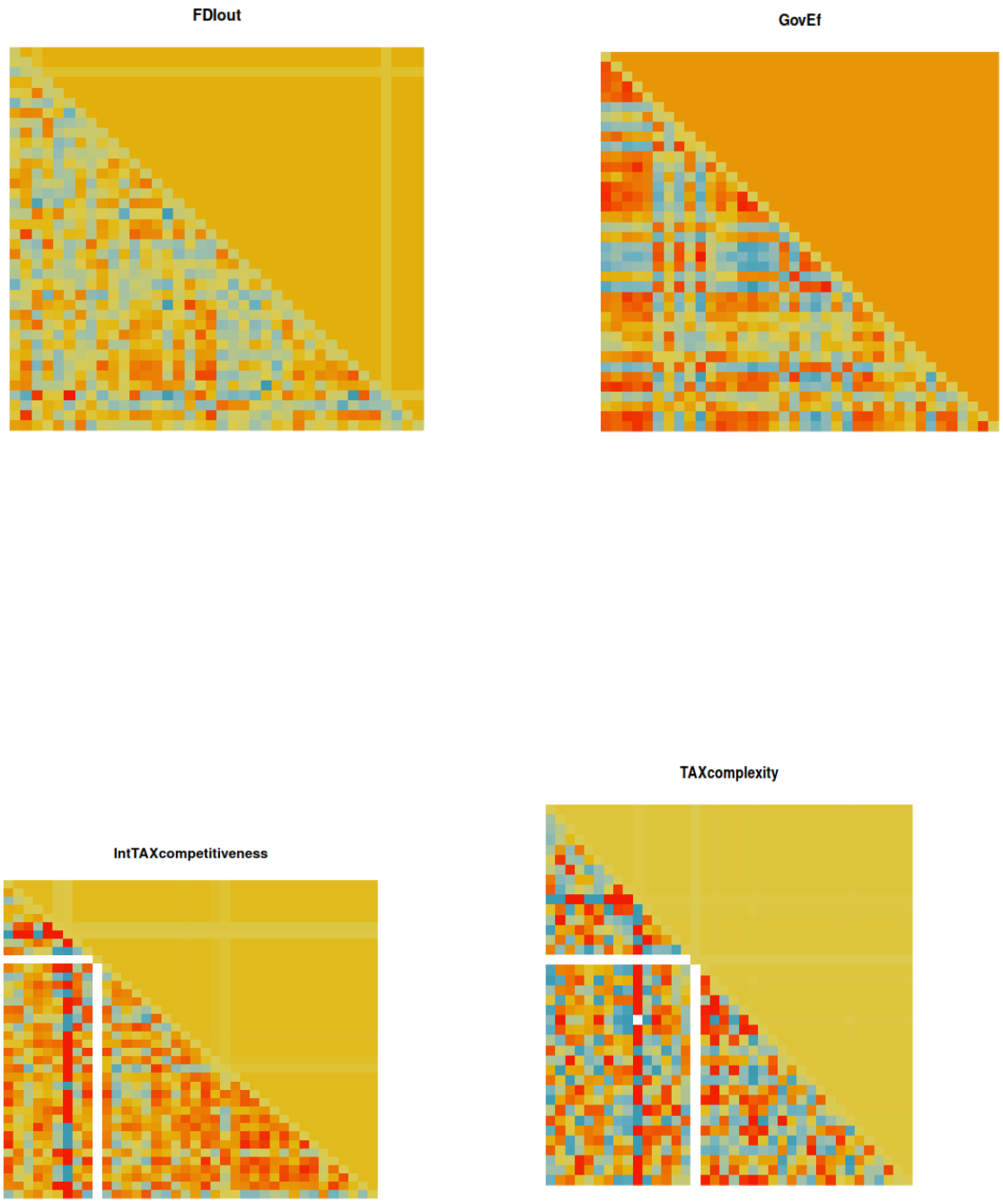


Figure 1 Matrices with lower triangle elements being correlations between country pair time series and upper triangle entries being the share of numerical (non-NA) time series entries out of all such entries.

Figure 1 shows that the only almost homogeneous high positive correlation between country pairs appears for GDPcap, which is not particularly surprising if measured in nominal currency and given the quite long time period.

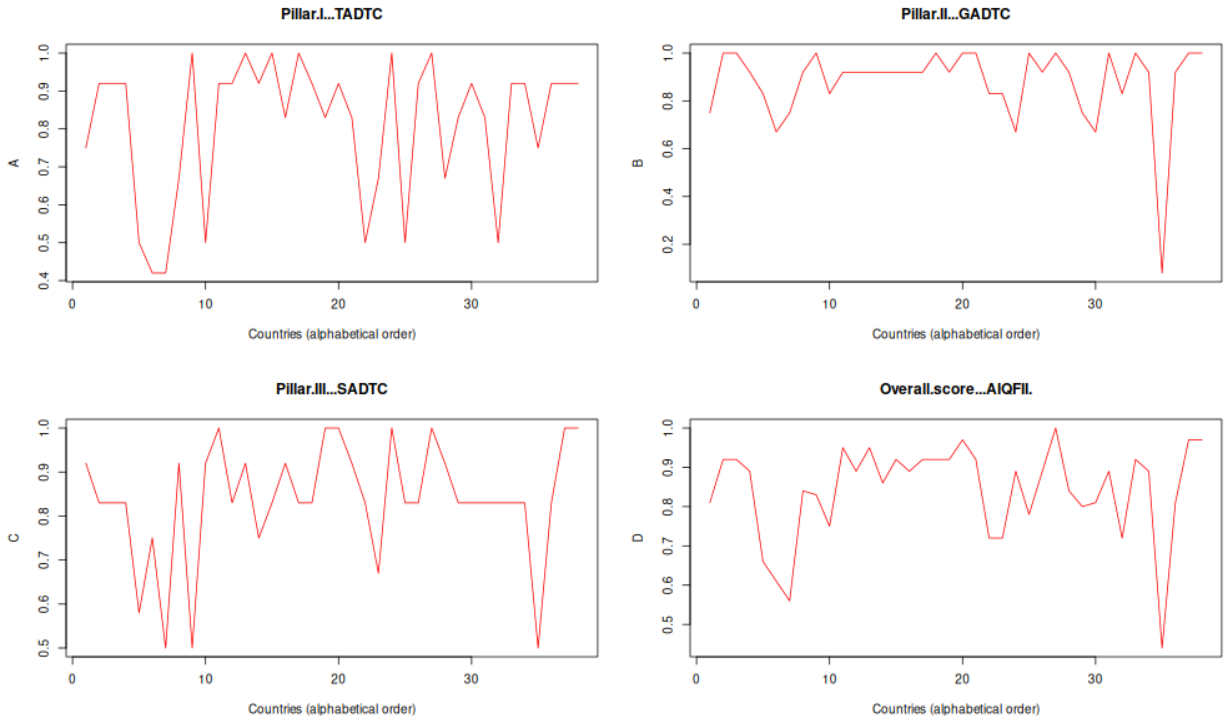


Figure 2 Variables from the data set II over countries plotted in alphabetical order

Figure 2 shows the plotted variables of the Dumiter (2023) index for the 38 OECD countries. As can be seen from Figure 2, the plotted Dumiter (2023) index for the 38 countries shows that there are several similarities between countries regarding the structure of the double taxation conventions, but also some disparities and differences between several types of countries regarding the double taxation conventions network.

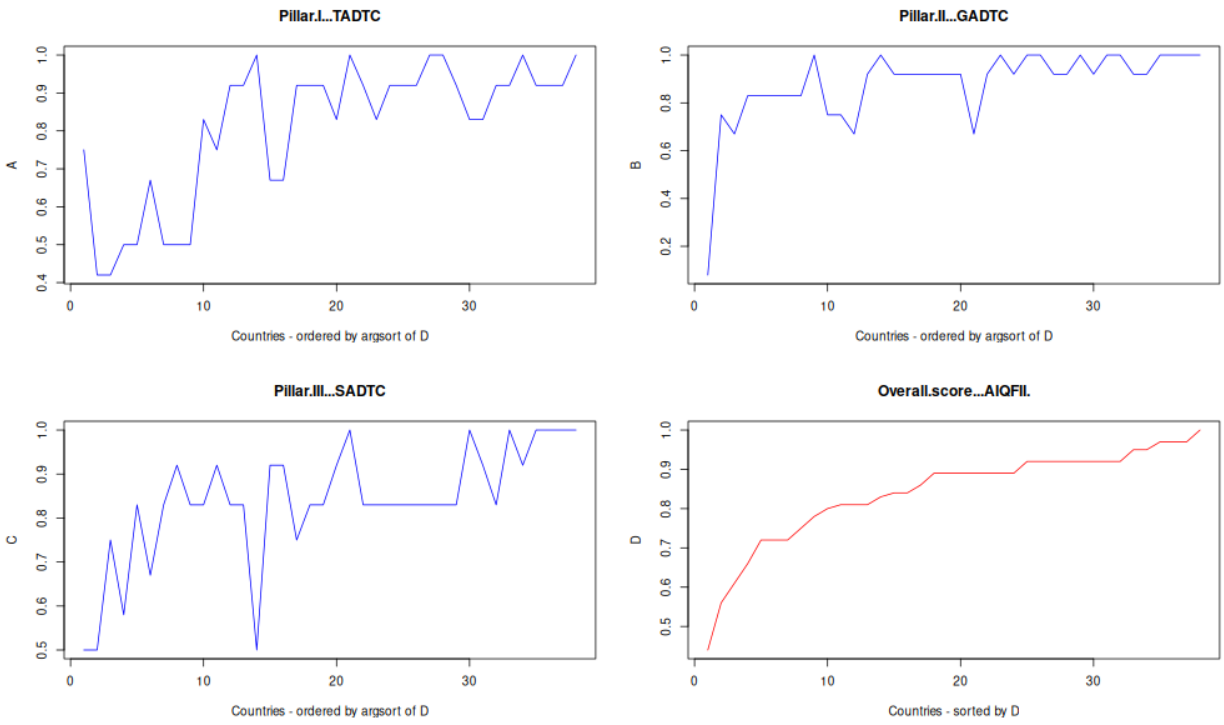


Figure 3 Same subplots as in Figure 2 over countries plotted in arg-sort order (sorted by values of D)

Figure 3 shows a different type of plot of the Dumiter (2023) index for the 38 OECD countries. As can be seen from Figure 3, in this case, it manifests several similarities between countries but also significant differences. The overall score plot is the most interesting one because the overall score of the index is the aggregation of the three pillars, and this shows that there are different types of patterns in some countries regarding the structure and network of double taxation conventions.

4.2. Qualitative data analysis

The following (Figure 4) is an image of the qualitative dependence of variable TXR on TPI. From Figure 5, we identify qualitative dependencies that do indicate a significant positive dependence (Australia, Austria) and (Germany, Japan), and a much lesser dependence (USA) or no or extremely faint dependence (Belgium). Furthermore, country value pairs tend to cluster with different variance and concentration (the most concentrated being that of the USA, having the least "outliers"). In general, there is high cluster overlap (Figure 4), which precludes "reconstructing" country data from all non-NA pairs (TXR, TPI).

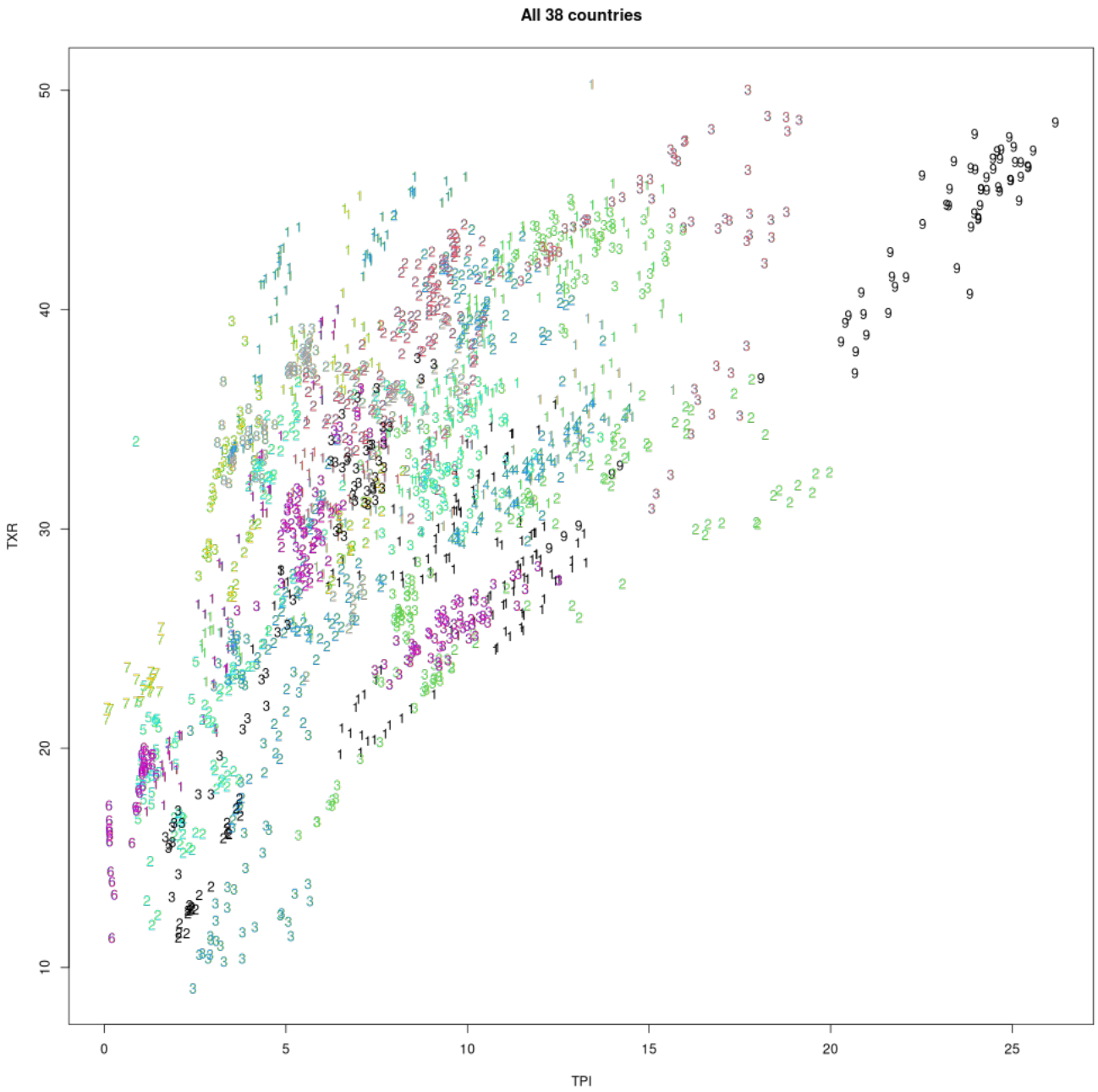


Figure 4. The overall dependence of TPI on TXR over all 38 countries (indicated by numbers and colors leads one to expect a significant (overall) positive fixed coefficient model. For better visibility, countries 1,11,12, …,19 have label 1, those with label 2,20,21,…,29 have label 2, and those with 3,30,31,…,38 have label 3, but one can distinguish them by different colors. Countries with labels 4,5,…, and 9 keep their original label. The "extreme" countries with labels 6 and 9 refer to Colombia (6) and Denmark (9), respectively.

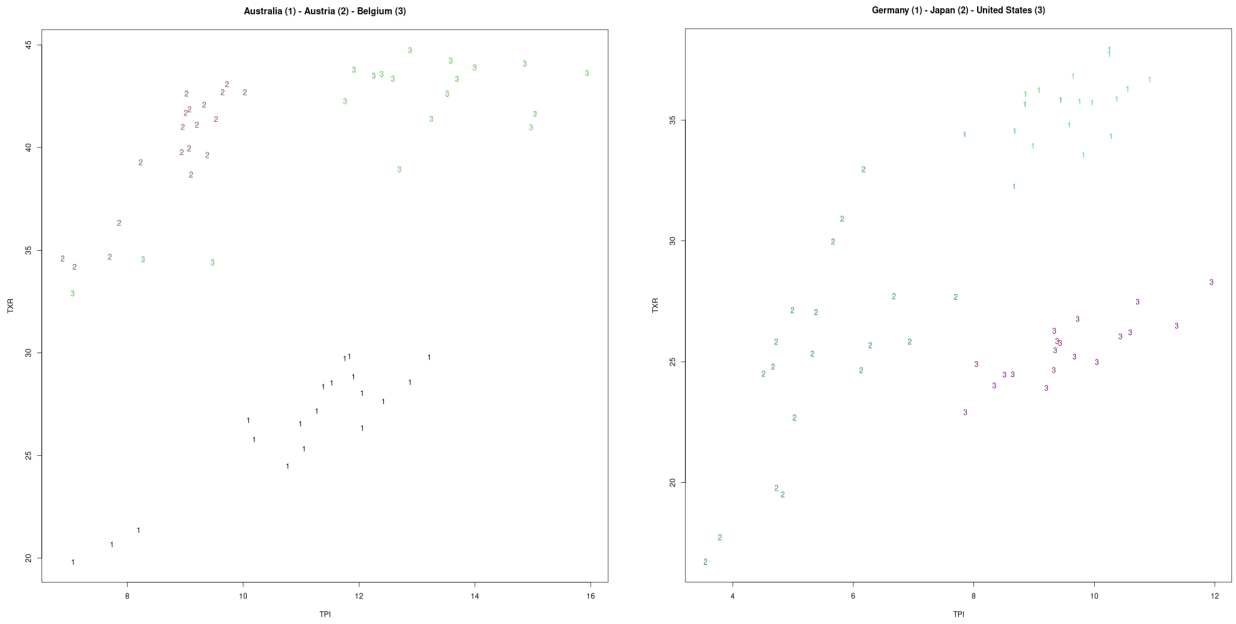


Figure 5. The dependence of TPI on TXR for Australia-Austria-Belgium (left panel) and German-Japan-USA.

4.3. Linear quantile mixture panel regression

The *lqmix* regression implemented in ***R*** (Marino et al. 2025; Alfò et al. 2023) has the option of searching for an optimal combination of time constant random coefficients (randomTC) and time-varying random coefficients (randomTV) on top of the overall fixed coefficients, which are the coefficients of a linear model. In case of skewed data, the approach of using quantile regression may help; otherwise, it should not be detrimental.

Informed by the qualitative inspection of Figure 4, the first model to consider is to use *lqmix* panel regression for quantitatively characterizing the dependence of TXR on TPI. This may also include a TPI: time interaction for completeness. This choice also facilitates the largest number of non-missing value time entries, namely 1773, compared to all cases including more independent variables, which have different and sometimes more missing value entries. The result of this *lqmix*-run is listed in Table 13. As it may be read from this statistical summary table, the TPI contribution to TXR is highly significant, confirming the intuition gained from Figure 4, while the interaction of time and TPI does not matter as far as the overall fixed coefficients are concerned. Furthermore, one time-constant random coefficient is significant, and so are both time-varying random coefficients.

Table 13. The statistical summary of the *lqmix*-run sTCTV1

```
sTCTV1 = search_lqmix(formula = TXR ~ TPI + TPI:time, randomTC = ~ time,
                      randomTV = ~ 1, nran = 2, group = "group_c",
                      time = "time", mv = 1:2, Gv = 1:2,
                      data = mX1, seed = 11078, parallel=TRUE)

---- Observed process ----

Fixed Coefficients:                                  Time-Constant Random Coefficients:                  Time-Varying Random Coefficients:
      Estimate St.Error z.value P(>|z|)              Estimate St.Error z.value  P(>|z|)                  Estimate St.Error z.value   P(>|z|)
```

```
TPI        1.0951   0.1454  7.5312  < 2e-16 ***    t_C1  -0.0603   0.0392 -1.5367  0.1219                  Icpt_S1  15.5107   1.9539  7.9383   < 2.2e-16 ***
TPI.time   0.0053   0.0046  1.1512  0.2447         t_C2   0.1477   0.0401  3.6859  0.0002 ***              Icpt_S2  20.9195   1.9386 10.7910   < 2.2e-16 ***

---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1          Abbreviations: t_C1 := time component 1,  Icpt_S1 := Intercept state 1

Residual scale parameter: 0.9439 - Residual standard deviation: 2.6698

---- Latent process ----

Mixture probabilities:                          Initial probabilities:                          Transition probabilities:
     Estimate St.Error                               Estimate St.Error                               Estimate St.Error
Comp1   0.3947   0.0852        S1     0.5641   0.11                          S1 -> S1   0.9854   0.0044
Comp2   0.6053   0.0852        S2     0.4359   0.11                          S1 -> S2   0.0146   0.0044
                                                                                S2 -> S1   0.0101   0.0040
                                                                                S2 -> S2   0.9899   0.0040
Log-likelihood at convergence: -4251.187
Number of observations: 1773 - Number of subjects: 38
```

By using the potentially explanatory variables TPI, GDPCap (scaled), FDIin, and FDIout, we also reduce the number from 1773 to 665 as determined by those time entries that belong to non-missing values in all of these variables, including the target TXR. The result of the *lqmix*-run is listed in Table 14.

Table 14. The statistical summary of the *lqmix*-run sTCTV2

```
> sTCTV2 = search_lqmix(formula = TXR ~ TPI + GDPcap + FDIin + FDIout,
                        randomTC = ~ time,
                        randomTV = ~ 1, nran = 2, group = "group_c",
                        time = "time", mv = 1:2, Gv = 1:2,
                        data = mX1, seed = 11078, parallel = TRUE)

---- Observed process ----

Fixed Coefficients:                                    Time-Constant Random Coefficients:                    Time-Varying Random Coefficients:
     Estimate St.Error z.value P(>|z|)                 Estimate  St.Error  z.value   P(>|z|)                 Estimate St.Error  z.value   P(>|z|)
TPI      1.0968   0.0593 18.4884  <2e-16 ***          t_C1   -0.1179   0.0117  -10.0437  < 2.2e-16 ***     Icpt_S1  18.8285  0.5298   35.539  < 2.2e-16 ***
GDPcap   0.0198   0.0093  2.1343  0.0322 *            t_C2    0.0795   0.0139    5.7363  < 2.2e-16 ***     Icpt_S2  24.0419  0.2402  100.094  < 2.2e-16 ***
FDIin    0.0079   0.0270  0.2922  0.7547
FDIout  -0.0043   0.0292 -0.1470  0.8654

---
Signif. Codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1          Abbreviations: t_C1 := time component 1,  Icpt_S1 := Intercept state 1
Residual scale parameter: 0.7441 - Residual standard deviation: 2.1047

---- Latent process ----

Mixture probabilities:                          Initial probabilities:                          Transition probabilities:
     Estimate St.Error                               Estimate St.Error                               Estimate St.Error
Comp1   0.3421   0.0797        S1     0.3556   0.0765                        S1 -> S1     1.0000   0.0046
Comp2   0.6579   0.0797        S2     0.6444   0.0765                        S1 -> S2     0.0000   0.0046
                                                                                S2 -> S1     0.0084   0.0057
                                                                                S2 -> S2     0.9916   0.0057
Log-likelihood at convergence: -1453.728
Number of observations: 665 - Number of subjects: 38
```

This was obtained on the reduced data, here for ease of comparison, exemplified by the remaining TRX ~ TPI data points. According to the significance levels obtained, the reduced usable data set trades in a limited influence of GDPcap on TRX. Both time-constant random coefficients and both time-varying random coefficients are significant, sharing the sign and relative magnitude order of the run depicted in Table 13. However, the absolute magnitude of the time-varying random effect (intercept) increases substantially, while the standard error thereof decreases.

In order to test the effect of eliminating TPI as an explicator of TXR, we re-run the experiment displayed in Table 14 without this variable. The result (in Table 15) is that GDPcap is now taking over the role of the significant fixed coefficient explicator, while the remaining variables remain insignificant. Note that the number of effective (non-missing value) time entries differs just by one compared to that from Table 14. The adjustment is made by changing the sign of the constant time

random effect coefficient, and by again increasing the magnitude of the time-varying random intercept, with decreasing standard error.

Table 15. The statistical summary of the *lqmix*-run sTCTV3

```
sTCTV3 = search_lqmix(formula = TXR ~ GDPcap + FDIin + FDIout,
                      randomTC = ~ time,
                      randomTV = ~ 1, nran = 2, group = "group_c",
                      time = "time", mv = 1:2, Gv = 1:2,
                      data = mX1, seed = 11078, parallel = TRUE)

---- Observed process ----

Fixed Coefficients:                                    Time-Const ant Random Coefficients:                    Time-Varying Random Coefficients:
      Estimate St.Error z.value P(>|z|)                      Estimate St.Error  z.value  P(>|z|)                Estimate  St.Error  z.value    P(>|z|)
GDPcap   0.0827   0.0075 11.0210  <2e-16 ***      t_C1  -0.2214   0.0149 -14.8847   < 2e-16 ***          Icpt_S1  30.1835   0.2794   108.037  < 2.2e-16 ***
FDIin   -0.0016   0.0560 -0.0290  0.9573          t_C2  -0.0374   0.0101  -3.6962   < 2e-04 ***          Icpt_S2  37.2352   0.4213    88.389  < 2.2e-16 ***
FDIout   0.0070   0.0506  0.1378  0.8726

---
Signif. Codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1                    Abbreviations: t_C1 := time component 1,  Icpt_S1 := Intercept state 1

Residual scale parameter: 0.8936 - Residual standard deviation: 2.5274

---- Latent process ----

Mixture probabilities:                    Initial probabilities:                    Transition probabilities:
     Estimate St.Error                         Estimate St.Error                                 Estimate St.Error
Comp1   0.4739   0.0855       S1   0.5787   0.0739                    S1 -> S1   0.9914   0.0055
Comp2   0.5261   0.0855       S2   0.4213   0.0739                    S1 -> S2   0.0086   0.0055
                                                                      S2 -> S1   0.0133   0.0088
                                                                      S2 -> S2   0.9867   0.0088

Log-likelihood at convergence: -1589.415
Number of observations: 666 - Number of subjects: 38
```

4.4. Bayesian dynamic panel models

Based on multi-disciplinary probabilistic programming realized in STAN (Carpenter et al. 2017; Stan Development Team 2024), which is a very powerful and general approach to multi-group and multi-level statistical modeling, a useful R-interface named *dynamite* (and *dynamic* for data with missing values) was made available recently (Tikka et al. 2025). The underlying STAN is very flexible about model structures and model classes (it does not restrict functional form), requiring basically a prior distribution over models – possibly reflecting domain knowledge – and produces posterior distributions over the more adequate and informative models, given the data. In this sense, it is - at least in theory - the “last word” of statistical modeling. In practice, however, the priors used may be inadequate and misleading, and convergence may be too slow; hence, the other (non-Bayesian, simpler) approaches are well justified, reporting or maybe just sufficient.
Next, we list the results of a Bayesian *dynamite* model on the data used for the *lqmix* model of Table T.x2. We clearly see that the constant coefficient associated with variable TPI dominates the influence on TXR, followed by a much weaker positive influence of GDPcap. This is effectively the same result obtained as in the case of the *lqmix* model. The statistical measures, Mean, Standard Deviation, etc., reported in the table result from the fact that the Bayesian approach produces model distributions. We suppress more technical information resulting from the long Bayesian MCMC simulations, which are not relevant to our context.

Table 16. TXR beta-response for the years 1960-2023

```
m1_formula <- obs( # the formula which will be used by a call to dynamite(.) - not shown here
    TXR ~ TPI + GDPcap + FDIin + FDIout,
    family = "gaussian"
) + splines(df = 10)
```

	beta_TXR_TPI	beta_TXR_GDPcap	beta_TXR_FDIin	beta_TXR_FDIouTHis t
Mean	1.0981	0.0256	-0.0107	0.0093
StdDev	0.0573	0.0069	0.0165	0.0157
Q5	1.0046	0.0142	-0.0378	-0.0165
Q95	1.1925	0.0366	0.0166	0.0347

The STAN-based ***R*** package *dynamite* allows for time-lag structures. Such lagged dependencies are important general probabilistic processes and can be valuable explanations in econometrics too. In Table 17, we update our model as displayed in Table 16 by allowing for variable lags of the target variable TXR. Hence, we ask if an auto-regressive term has explanatory power.

Table 17. TXR beta-response and autoregressive response for the years 1960-2023

```
m2_formula <- obs(   # same meaning as in companion table above ...
     TXR ~ TPI + GDPcap + FDIin + FDIout + varying(~lag(TXR)),
   family = "gaussian"
  ) + splines(df = 10)
```

	beta_TXR_TPI	beta_TXR_GPcap	beta_TXR_FDIin	beta_TXR_FDIout
Mean	0.01580	-0.0009	-0.0045	0.0023
StdDev	0.01584	0.0018	0.0038	0.0037
Q5	-0.0101	-0.0039	-0.0108	-0.0036
Q95	0.0425	0.0019	0.0017	0.0084

Introducing the variant of adding a time-lagged TXR changes the reduced statistical summary a lot. TPI is comparatively but not absolutely the dominant influence, standard deviations become larger compared to the means, and an uncertainty corridor appears with sign-uncertainty in all four independent variables. As will be seen in Figure 6, this is compensated by the influence of time-lagged TXR. As the number of missing values diminishes over the historical time period, the uncertainty corridors narrow down and the time lag tends to stabilize (in the mean) to a value of one (left plot inset of Figure 6). Figure 7 is a schematic qualitative representation of the effective dependence structure, without taking their strengths into account. Cyclical structures may also be considered.

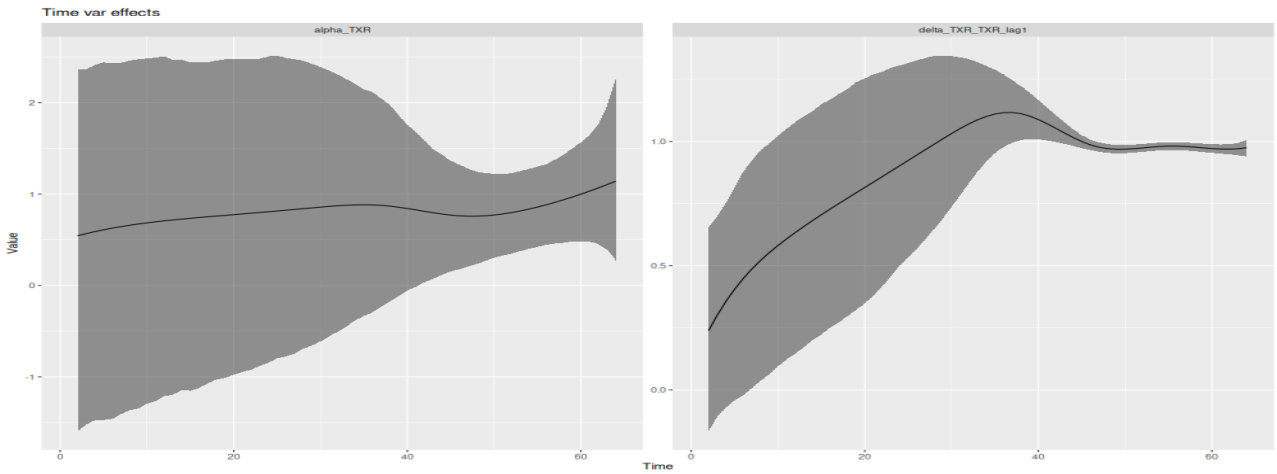


Figure 6. TXR(t) time-varying effects (left inset) and the same for TXR(t-1) for the years 1960-2023

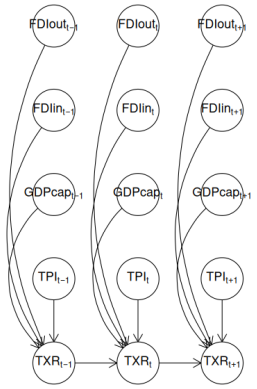


Figure 7. Dependence of TXR(t) over time on TXR(t-1) and the other four variables

The Evolution of the time-invariant coefficients (Figure 8) depends on the stipulated family of distributions in the model formulation (see Tables above), which is our model set to "Gaussian". This is a robust assumption, but it can also express the lack of, or the inaccessibility of, deeper domain knowledge, which oftentimes requires reasonable cooperation between practitioners and the statistical modelers. Note that the resulting distributions (densities) are, in general, not symmetric, and they may not even be unimodal. Hence, in general, the Gaussianity assumption may be sub-optimal, especially when modeling (economic, etc.) activities in networks with link restrictions.

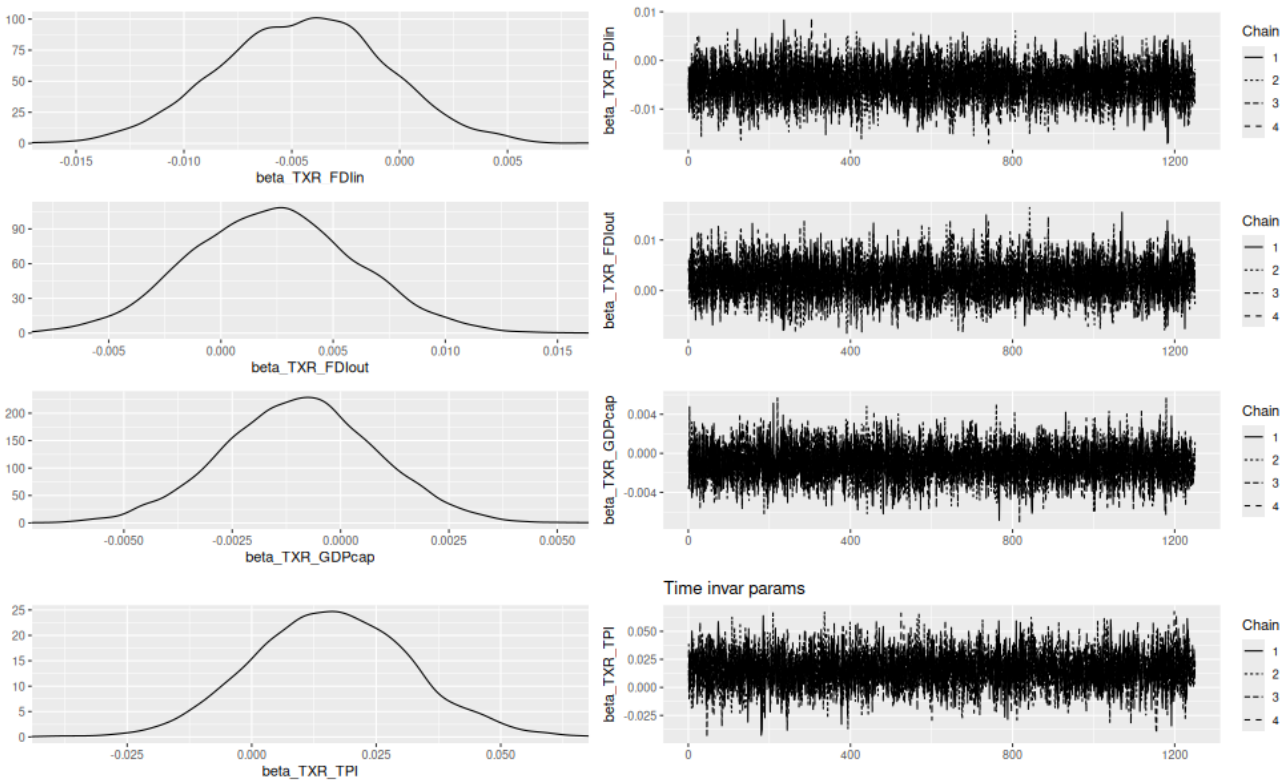


Figure 8. Evolution of the time-invariant coefficient distributions (left-hand column of insets) after an extended four-channel MCMC simulation (right-hand column of insets)

5. Conclusions, recommendations, and policy outcomes

The empirical results of this study are in line with the results of other empirical studies. First, it is necessary to improve the automatic exchange of information under the global standards between tax authorities in the sense that Bhatia et al. (2018) emphasize a more comprehensive circulation of fiscal information. Second, this study is also focused on enhancing the tax transparency revealed by Goulder (2020) with a high degree of public disclosure of tax information. Third, tax authorities must take into account and improve the fiscal space with the new regime of tax information emphasized by Jackson and Brown (2021). Fourth, the strengthening of the taxpayers' protection in the international environment, in the sense that Liotti (2022) reveals the proper administration of tax rights.

Regarding the research hypotheses, the following can be concluded:

Hypothesis I.1. is confirmed. The consolidation of the double taxation agreements, both through quantity and quality, influences the level of corporate taxes.

Hypothesis I.2. is confirmed. A proper direct taxation system is a *quid pro quo* for strengthening cross-border trading. This fact also relies on the complexity and comprehensibility of double taxation convention schemes with a direct impact on cross-border trade sustainability.

Hypothesis I.3. is partially confirmed. Constructing, consolidating, and strengthening the fiscal space on European and international levels could enhance cross-border investments. However, this is not the only feature for cross-border investment enhancements, but it is an important one.
Hypothesis I.4. is confirmed. Strengthening the national legislation tax codes and tax procedures codes at the national level is the fundamental feature in consolidating the network of double taxation conventions and can lead to an optimal fiscal space.
Hypothesis I.5. is confirmed. The complex network of double taxation conventions can enhance the soundness of the legal systems in the direct tax domain and could improve the manifestation of cross-border trade levels.
The statistical results enriched in the econometric models come to sustain the complex relationship that manifests in theory between taxation policy, tax compliance, tax effectiveness, and tax agenda. This is also connected with the judicial and legal aspects of taxation, which are enriched in the national, European, and international taxation legislation. In our opinion, the creation of a fiscal space in the European Union has started, but the economic, financial, and judicial problems of direct taxation still remain. From the practitioner's point of view, the complex aspects of the nexus between taxation policy, double taxation conventions, and tax effectiveness in an ongoing process, due to the fact that, especially at the European country levels, there are several taxation changes made by the tax authorities overnight, which are difficult to implement and applied by the small and medium-size enterprises at regional and international level.
Therefore, empirical results of the relationship between double taxation conventions, tax effectiveness, and taxation policy in the proposed OECD sample show the following: (i) significant statistical relationship between direct taxes and the temporal aspects of the conclusion of double taxation conventions, which means that an adequate fiscal framework at the level of double taxation conventions generates beneficial effects on direct taxes; (ii) the change in the legislation established by double taxation conventions depends on the amount of direct taxes; (iii) there is a significant connection between double taxation conventions, through their structure and construction, and the level of direct taxation.
In light of the somewhat limited information gained by using linear panel regression, some other directions may be further pursued, namely:
a) Testing for the possibility of time-dependent relations by using variants of the models that allow for autoregressive model features (sub-models with time-lags).
(b) Allowing for generalizations of the functional models by using more general non-linear approaches, both for panel-based and quantile-based model variants.
(c) Using other kinds of pre-regression data groupings (strongly dependent on empirical data insight).

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