MAASTRICHT UNIVERSITY | SCHOOL OF BUSINESS AND ECONOMICS

United Nations University Maastricht Economic and Social Research Institute on Innovation and Technology (UNU-MERIT)

UNIVERSITE CLERMONT-AUVERGNE | ECOLE DOCTORALE DES SCIENCES ECONOMIQUES, JURIDIQUES, POLITIQUES ET DE GESTION

Centre d'Etudes et de Recherche sur le Développement International (CERDI-CNRS)

Essays in Public Economics: Multi-Layer Tax Structure and Implications

Thèse présentée et soutenue publiquement le 17 Décembre 2020 pour l'obtention du titre de Docteur en Sciences Économiques par

Rose Camille Vincent

Sous la direction de Arno Riedl, Grégoire Rota-Graziosi et Kaj Thomssom

Membres du Jury

Prof. Franziska Gassman	Maastricht University | UNU-MERIT	Président, Rapporteur
Prof. Thierry Madiès	University of Fribourg	Rapporteur
Prof. Simone Bertoli	Université Clermont-Auvergne	Suffragant
Dr. Pui-Hang Wong	Maastricht University | UNU-MERIT	Suffragant
Dr. Stephan Dietrich	Maastricht University | UNU-MERIT	Suffragant
Dr. Bob Rijkers	The World Bank Group	Suffragant
Prof. Arno Riedl	Maastricht University	Directeur
Prof. Grégoire Rota-Graziosi	Université Clermont-Auvergne	Directeur
Dr. Kaj Thomsson	Maastricht University	Superviseur

Essays in Public Economics

Multi-Layer Tax Structure and Implications

Rose Camille Vincent

ISBN 978-94-6423-070-3

Cover design: Ron Zijlmans and ProefschriftMaken
Publisher: ProefschriftMaken, Maastricht, The Netherlands

Essays in Public Economics

Multi-Layer Tax Structure and Implications

Dissertation

to obtain the degree of Doctor at Maastricht University
on the authority of the Rector Magnificus Prof. Dr. Rianne M. Letschert
in accordance with the decision of the Board of Deans
and
Docteur en Sciences Économiques at Université Clermont-Auvergne
on the authority of University President Prof. Dr. Mathias Bernard
in accordance with the decision of the Board of Deans

to be defended in public on Thursday, 17 December 2020 at 14:00 hours.

by
Rose Camille Vincent

Supervisors:
Prof. Dr. Arno Riedl
Prof. Dr. Grégoire Rota-Graziosi (Université Clermont-Auvergne)

Co-Supervisor:
Dr. Kaj Thomsson

Assessment Committee:
Prof. Dr. Franziska Gassman (Chair)
Prof. Dr. Simone Bertoli (Université Clermont-Auvergne)
Prof. Dr. Thierry Madiès (University of Fribourg)
Dr. Bob Rijkers (The World Bank Group)
Dr. Pui-Hang Wong

SUMMARY

The dissertation is written under the premises that the structure of the tax system across tiers of governments sets the basis upon which all stakeholders in the economy (such as government authorities, residents and firms) interact. As such, the design of inter-governmental tax institutions and arrangements matter to various extents for policy-targeted socio-economic and behavioural outcomes. The dissertation thus aims at providing a better understanding of the assignment of taxing responsibilities across different tiers of government and across countries, and bringing solid cross-country empirical evidence into the ramifications of multi-layer tax arrangements. It combines four empirical essays written through the lens of a comparative cross-country approach and connects existing theoretical frameworks in Public, Behavioural and Institutional Economics.

The dissertation begins with the study of the legal and administrative structure of tax institutions across tiers of governments through content analysis of laws and regulations that define the governance of the tax system. In **Chapter 2**, it proposes a conceptual approach into capturing the discretionary power of all government tiers over the tax system, principal tax instruments – such as income, consumption and property taxes, and different decision dimensions – such as the setting of tax rates or tax administration. The gathered information is aggregated into a new dataset on the multi-layer tax structure in more than one hundred countries. Core findings from the dataset convey the complexity and the granularity of the tax system across countries, tiers of government, and the assignment of tax-related decisions regarding different instruments.

The dissertation continues with empirical enquiries into the linkages between the hierarchical structure of tax institutions and socio-economic and behavioural outcomes. Indicators on sub-national governments' taxing rights, derived from the new dataset, are linked to economic performance in **Chapter 2**. The results point to an inverted U-shaped relationship between the discretionary power of lower-tier authorities over the tax system and per capita GDP growth in *non*-OECD member states. The findings also suggest that there might be an economic dividend to granting sub-central governments some discretionary power over the setting of tax rates in *non*-OECD countries, although an extensive form of discretion might be detrimental.

Chapter 3 and **Chapter 4** bring evidence into the ramifications of intergovernmental

tax arrangements for firms' business operations and individual tax compliance. They thereby show how macro-level characteristics of multi-layer tax institutions are linked to micro-patterns of firms' and individuals' behaviours and perceptions. Both chapters also contribute to the scholarly discussion on how complex tax structure can affect the tax bases and revenue mobilization in developing and emerging economies.

The findings from **Chapter 3** indicate that firms in countries with a higher sub-national discretionary power over the tax system tend to report a higher burden of tax rates and tax administration on their business operations. The empirical results also indicate that lower-tier authorities' legal ability to set tax rates is particularly harmful to the private sector. Exploring other constraints faced by private enterprises, the chapter reveals that the probability of being audited, the likelihood of tax officials requesting bribe during tax audits, and the average time that managers spend dealing with government regulations significantly increase with the level of taxing rights granted to sub-national authorities, more broadly, and their level of discretion over tax administration.

Chapter 4 confirms the overarching hypothesis that the multi-layer structure of tax institutions matters for the understanding of individual behaviours towards tax payments. In particular, results from the chapter indicate that tax compliance is lower in countries with a higher level of sub-national taxing rights and a higher discretion of lower-tier authorities over tax administration. They also indicate that the scarcity of tax knowledge exacerbates the harmful effects of sub-national taxing rights or discretion over tax administration on tax compliance.

Chapter 5 takes on a more comprehensive approach into investigating the deep-rooted economic, cultural, and historical origins of cross-country variations in intergovernmental tax arrangements observed in the dataset. It provides evidence that countries' historical trajectories play a significant role in shaping their multi-layer tax institutions. Countries with a higher level of pre-colonial state centralization tend to have more decentralized tax institutions in modern times. The path out of colonization also matters: countries which have experienced a violent independence movement tend to have a more centralized tax structure.

Together, the essays of the dissertation create new avenues for empirical enquiries into the various forms of taxing rights granted to different government tiers, and bring insights into the challenges and opportunities embedded in the legal and administrative design of multi-layer tax institutions. Academic contributions, policy implications and topics for future research are discussed in each chapter and synthesized in the concluding remarks in **Chapter 6**.

ACKNOWLEDGEMENTS

My most profound gratitude goes to my PhD supervisors, Prof. Dr. Arno Riedl, Prof. Dr. Grégoire Rota-Graziosi, and Dr. Kaj Thomsson, for their commitment and research guidance. Thank you for believing in my doctoral project, from the start, and in me, even when I doubted myself the most. I am eternally grateful for your kindness, your eagle eyes and your patience with countless revisions of each chapter. You have helped me articulate my visions and define myself as a young researcher. Thank you for granting me the optimal balance between the freedom to pursue my research interest and the pressure to deliver quality outcomes. I am also grateful to the members of the assessment committee, namely Prof. Dr. Franziska Gassman, Prof. Dr. Simone Bertoli, Prof. Dr. Thierry Madiès, Dr. Bob Rijkers and Dr. Pui-Hang Wong, for taking the time to read my dissertation and provide valuable comments.

I want to extend my appreciation to the faculty members and academic staff of UNU-MERIT/MGSoG, Maastricht University, and the CERDI-CNRS/Université Clermont-Auvergne. I have been inspired by your dedication to research. I am thankful for every fruitful conversation, and for your thorough comments on my papers and presentations at the internal seminars and conferences. I have been privileged to engage in teaching activities alongside amazing course coordinators: Prof. Dr. Alain Jousten, Dr. Maty Konte, Dr. Dietrich Stephan, Dr. Mindel van de Laar, Dr. Bruno Marterano, Dr. Pui-Hang Wong, Dr. Nyasha Tirivayi and my supervisor Dr. Kaj Thomsson. Thank you all for your insightful and critical suggestions regarding my teachings. To Dr. Maty Konte, Dr. Stephan Dietrich and Dr. Emilie Caldeira: I am also grateful for the opportunity to collaborate with you on research and third-party projects over the past few years.

I am heavily indebted to the administrative staff of UNU-MERIT. To Eveline in de Braek: thank you for your unwavering emotional support and for holding my hands, ever since day one, and even tighter (literally and figuratively) in the months ahead of the PhD defence. I am also thankful to the PhD program Directors, Prof. Dr. Robin Cowan and Dr. Tatiana Skripka, for their guidance throughout the PhD journey; to Herman Pijpers for his responsiveness and his brilliance in solving all my IT-related issues; to Marc Vleugles and Susan Roggen for their assistance on budgeting and finance; and to Elke Lucas for organizing the supervisory team meetings and for assisting me in the administrative procedures related to the PhD defence.

Navigating between two PhD programs and universities turned out more challenging than I expected. I am therefore also thankful to the administrative staff of the CERDI-CNRS and Université Clermont-Auvergne. To Prof. Dr. Martine Audibert, Prof. Dr. Sonia Schwartz, Mme Francine Beybot Batisson, Mme Marie Huc-Vialard, Mme Rosa Campos, and Mr Johan Guiot: thank you for your assistance during my stays at the CERDI-CNRS and throughout this journey, and for smoothening the process towards obtaining the double degree.

To my research assistants, Karol Rodriguez, Hancito Garçon, and Johnny Joseph: thank you from the bottom of my heart. For more than two years, you have spent numerous hours researching, reading and storing fiscal documents and archives, translating, fact-checking and coding the dataset at the core of this dissertation. What began as an overly ambitious project was successfully completed because of you. I command your intellectual curiosity; and much beyond our collaboration, I am grateful for your friendship.

To the 2015/2016 UNU-MERIT PhD Cohort, namely Bart, Beatriz, Danilo, Emmanuel, Giulia, Halefom, Joseph, Kaleab, Patima, Tamara, and Victor: I am immensely proud of each and all of you, and I am deeply honoured to have shared this journey with you. Thank you for your collegiality, your friendship, and for the lovely memories. I want to emphasize my gratitude towards Patima, Victor and Tamara. I thank God for the opportunity to know you. I continue to be surprised by your generosity and attentiveness towards me, especially in 2020. Thank you for always being on the other side of the line, any day and at any time.

I would also like to thank former and current PhD colleagues and office mates with whom I have shared unforgettable conversations, delicious meals and laughs: Annie, Michelle, Racky, Gideon, Hassen, Robert, Chen, Tatenda, Elisa, Alison, Davina, Mario, Godsway, Omar, and Gintare. To Annie: thank you for letting me be part of the small and exclusive "Asians by heart" club at UNU-MERIT and beyond. I look forward to having more delirious conversations about Asian movies, music and gastronomy.

To Isabelle Chatry, Charlotte Lafitte, and Sean Dougherty of the OECD: thank you for sharing my passion for understanding the multi-layer structure of government and tax institutions. I have greatly benefited from your network and the opportunity to contribute to the World Observatory of Sub-national Finance and Investment. To friends and former colleagues at the GIZ office in Benin, the International Centre for Tax and Development, the UNU-WIDER, the World Bank, and to all researchers met at academic conferences and international fora: your challenging feedback, critical comments and suggestions have profoundly enriched my research journey, and I am

immensely grateful for that.

To my parents, Aliette and Marc-Arthur: thank you for teaching and showing me the true value of education, for shaping me as a person, and for loving me the way you do. To my sister Gess, my niece Andrelle, my brother-like cousin Jeff, my boyfriend Johel, my prayer companions Phtama Esther and Carla, family members and friends that have become family: thank you for keeping me going and for also being part of this journey. I am grateful for your wisdom and compassion, prayers and thoughts, kisses and hugs (most of them virtually), silly jokes and smiles that were often more effective than what I call the "medi(s)" (medication and meditation). I am often not sure of being worthy of all of it, but within the depths of my heart, I hope to have made you proud.

And to all of you who have thought me fortitude and resilience: thank you.

To my parents, Aliette and Marc-Arthur;
to my current and former teachers;
to all cancer patients and survivors;
and in loving memory of Ibrahima and Johanna.

Contents

List of Tables

List of Figures

Chapter 1

Introduction

1.1 Motivation and Objectives

The search for efficient state institutions and equitable access to public goods and services has contributed to placing decentralization of the public sector at the centre-stage of policy experiments in many countries in recent years. Through assigning responsibilities and fiscal resources to lower-tier authorities, decentralization is argued to promote public allocation efficiency by lessening information asymmetry (Hayek, 1948; Oates, 1972, 1977; Seabright, 1996) – as lower-tier authorities are likely to have a more holistic understanding of the needs and preferences of their constituents – and by providing a sorting mechanism that matches such preferences to public provision (Tiebout, 1956, 1961; Oates, 1977; Besley and Coate, 2003). The prominence of the reform since the early 2000s has triggered new waves of academic and policy debates on the impact of fiscal decentralization on various socio-economic dimensions (Martinez-Vazquez et al., 2017) including on economic growth (Lin and Liu, 2000; Martinez Vazquez and McNab, 2003; Baskaran et al., 2016), public services delivery (Ahmad et al., 2005; Ahmad and Brosio, 2009; Caldeira et al., 2012), corruption (Fisman and Gatti, 2002; Fjeldstad, 2004) and so forth.

Yet, unlike expenditure responsibilities and fiscal transfers, the assignment of revenue and taxes to lower-tier government authorities has received far less empirical considerations in the existing literature. First, there remain limited empirical resources on tax assignment across countries and across tiers of government. Second, the existing literature falls short on the implications of the multi-layer tax structure for various economic and policy outcomes. This dissertation is thus written with the main objectives of ***(i)*** fostering a greater understanding of the multi-layer structure of tax institutions and tax responsibilities across layers of governments and across countries, ***(ii)*** filling the empirical gap on the linkages between tax assignment and socio-economic and behavioural outcomes, such as tax compliance and tax burden on private enterprises, especially in developing and emerging economies, and ***(iii)***

providing insights into the origins of cross-country differences in the multi-layer design of tax institutions.

To date, the conventional view on tax assignment in multi-layer governments remains that tax bases suitable for economic redistribution or stabilization are (or should be) assigned to central-level governments whereas those with low inter-jurisdictional mobility are assigned to lower-tier authorities. This conventional approach is, nevertheless, non-unanimous across experts. Bird (1999), for instance, argues that it is embedded in a purely normative stance that does not necessarily reflect the reality, given that tax assignment appears to result from the exercise of political and bargaining power which is not accounted for in this approach. Liberati (2011) also points out that these theories fail to adequately explain the practice of tax assignments in the framework of the traditional theory where the public sector is regarded as a benevolent player.

Most importantly, recent developments in the fiscal federalism literature emphasize the working of political and fiscal institutions, the incentives that they embody and the resulting behaviours of stakeholders across the multi-layer structure of governments. Unlike the pioneering research on the economics of decentralization, which was primarily centred around the canonical role of the government and the state's efficient provision of public services, the new literature on fiscal federalism revisits the possible transaction-cost minimizing role of the state, the proper assignment of decision rights among government tiers, and the alignment of incentives in the vertical structure of the public sector (Garzarelli, 2004, p. 5). This new strand also departed from the conventional – and somewhat restrictive – approach by emphasizing the potential incentivizing effects of proper tax and revenue assignment in a multi-layer structure. Weingast (2009, p. 280), for instance, argues that different systems of taxation and intergovernmental transfers directly affect local governmental behaviour and policy choice.

Indeed, countries rely on their tax system to finance essential public goods and services. Notwithstanding, a country's tax system does not only respond to distributional resources demands but also constitutes a driver of economic growth by providing adequate incentives to different groups of stakeholders. An essential aspect of a country tax system is the structure across different layers of government. Whether public goods provision is delegated or undertaken, the intergovernmental fiscal structure sets the basis not only for interactions across government layers but also within and between local actors – be they authorities, residents and the private sector. Such structure is thereby expected to influence policy outcomes to various degrees, as postulated in the recent fiscal federalism literature.

As many countries, especially developing and emerging markets, further their decentralization policies, understanding the constraints and opportunities embedded in the multi-layer structure of tax institutions requires moving beyond the conventional approach to studying fiscal decentralization, and towards considering the legal assignment of taxing powers to different authorities, understanding the different shapes and forms of taxing rights granted to lower-tier governments, the drivers of inter-governmental tax arrangements and the ramifications of such institutional design for the tax bases, tax revenue collection and other socio-economic and policy outcomes.

The dissertation delves into these latter. It combines four empirical essays written through the lens of a comparative cross-country approach and using content analysis and quantitative empirical methods. It connects existing theoretical frameworks in Public, Behavioural and Institutional Economics. The dissertation is primarily an empirical research project which aims to provide a better understanding of the assignment of tax-related decisions to different tiers of government, and to bring solid cross-country empirical evidence into the ramifications of multi-layer tax arrangements for firms, residents, and countries. In doing so, it brings insights into the challenges and opportunities embedded in the legal and administrative design of multi-layer tax institutions, and the deep-rooted origins of cross-country differences in inter-governmental tax arrangements.

The dissertation begins with a study of the legal and administrative structure of tax institutions across tiers of governments through content analysis of laws and regulations in more than one hundred countries. It proposes a conceptual approach into capturing the discretionary power of all governments tiers over the tax system, principal tax instruments, and decision dimensions such as the setting of tax rates and tax administration. All this information is aggregated into a new dataset on the multi-layer tax structure covering many countries, most of which are emerging and developing economies. The data contributes to answering a key empirical question: *"Who Taxes, Where, and What?"*, which is in line with the seminal question on the tax assignment problem, succinctly summarized by Musgrave (1983) as *"Who Should Tax, Where and What?"* and echoed by the existing literature (Oates, 1996; McLure, 2001; Martinez-Vazquez, 2015; Ambrosanio and Bordignon, 2015). The outcomes from this first step convey a level of granularity into the structure of the tax system across tiers of governments and countries so far veiled in the existing literature.

The dissertation continues with empirical enquiries into the linkages between the hierarchical structure of tax institutions and socio-economic and behavioural outcomes. To date, cross-country research on the effects of inter-governmental tax

arrangements on outcomes such as economic performance, the tax burden on firms and tax compliance has often faced a data limitation, especially for middle- and low-income countries. Academic contributions that dig into the effects of fiscal decentralization predominantly do so by measuring fiscal decentralization through budgetary ratios – such as the share of sub-national tax revenue in consolidated general government tax revenue. However, as it has been numerously highlighted (see for e.g. Stegarescu, 2005; OECD, 2013; Vo, 2014; Morozov, 2018), this accounting approach does not convey the real decision autonomy of different tiers of authorities. Such an approach also fails to reflect the decision structure on critical dimensions – such as the setting of tax rates or tax administration – which is crucial for understanding the channels through which the hierarchical structure of tax decisions by different authorities influences key stakeholders and the economy as a whole. By palliating the data constraint through the development of the new dataset on multi-layer tax structure, the dissertation provides new insights into how the administrative and legal design of tax institutions influences socio-economic and behavioural outcomes in a large sample of countries. It also provides an overview of how the design of fiscal institutions at the macro-level drives micro-level outcomes such as the fiscal burden perceived by private enterprises and tax compliance of residents.

Lastly, the dissertation questions the origins of cross-country differences in the design of multi-layer tax institutions. While the existing literature has contended on the rationales (Oates, 1972; Tiebout, 1956), and determining factors of fiscal decentralization more broadly (Patsouratis, 1990; Panizza, 1999; Arzaghi and Henderson, 2005; Letelier, 2005; Bodman and Hodge, 2010), it fails to empirically establish why tax assignment and the design of intergovernmental tax institutions differ across countries and more specifically in recently decentralized settings. The variation in multi-layer tax institutions goes beyond the traditional classification of countries into federal and unitary. For instance, while Austria, Malaysia and Argentina are both federal countries, the tax system in Austria and Malaysia are highly centralized whereas in Argentina, some provincial governments may have independent tax authorities with decision-making power on key parameters such as audit schedules. In Tanzania, a unitary country, the local finance systems have developed without much interference from the central level (Fjeldstad, 2001), whereas in Benin, also a unitary country, a large part of what is defined as own-revenues of local governments is administratively collected by the central treasury administration and redistributed to respective jurisdictions (Caldeira and Rota-Grasiozi, 2014; Dafflon and Madiès, 2012; OECD and UCLG, 2019). Using an empirical framework, the dissertation brings into light some of the deep-rooted factors and historical trajectories that explain the variations in intergovernmental tax arrangements across a number of countries.

The following sub-section summarizes the main theoretical views on tax assignment in multi-layer governments and sets the broader framework within which the empirical works of this dissertation are conducted. The proceeding section presents the outline of the dissertation, provides an overview of the different chapters and highlights their respective contributions to the existing literature.

1.2 Theoretical Perspectives on Tax Assignment

The public economics approach to tax assignment in multi-layer governments has been theorized with consideration to different elements such as integrated economic space, fiscal erosion, fiscal equivalence and fiscal incentives to different government authorities. The most prominent theoretical views can be divided into two main branches, both of which attempt to bring insights into the optimal design of the tax and revenue system across tiers of government (see for e.g. Liberati, 2011; Ambrosanio and Bordignon, 2015; Martinez-Vazquez, 2015).

The first is known as the traditional approach in which governments are assumed to be benevolent players. This approach stipulates that taxes should be allocated to different government tiers based on the optimal assignment of expenditure (Musgrave, 1983; Oates, 1972). Its deductions draw from Musgrave (1959)'s distinction of the canonical role of government understood as resource allocation, economic stabilization and income redistribution. Because of expenditure spillovers across jurisdictions, it is inferred that central governments ought to handle tax instruments that are used for economic stabilization and income redistribution. As a result, tax instruments such as personal and cooperate income taxes should be assigned to central authorities, whereas those related to resources allocation function can be handled by both central and local authorities. From that branch, it is also derived that local governments may be allowed to impose benefit taxes if only those concern immobile tax bases as a way to prevent harmful competition.

The prescriptions of the traditional view on tax and revenue assignment, and the potential threats of a decentralized tax system appear to have inspired the design of the public sector in most developing and emerging countries given the limited decision-making power granted to most sub-national governments. The inter-jurisdictional competition literature also comes in corroboration of the conventional prescription for a limit on sub-national governments' taxing rights by highlighting the threats and damages of competition for mobile tax bases which ultimately results in the sub-optimal provision of public goods (Wilson, 1995, 1999).

The existing literature also suggests that the probability that a common pool problem occurs in a multi-layer tax structure is high (Keen and Kotsogiannis, 2002, 2004; Brülhart and Jametti, 2006). Even when different tax bases are assigned to different tiers, their collection may overlap in real terms, leading to higher tax rates in equilibrium, the shrinking of overall tax collection, and inefficient provision of public goods and services if two or more layers of governments poorly coordinate and fail to recognize the revenue constraints of the others (Gordon, 1954; Keen and Kotsogiannis, 2002, 2004). In developing countries more particularly, the lack of well-functioning fiscal institutions may render government authorities unable to commit to tax policies. In Tanzania, for instance, Fjeldstad and Semboja (1999) suggest that the poor coordination between different government layers had led to double taxation of the same revenue base, which increased the fiscal burden on the taxpayers. Brülhart and Jametti (2006), Keen and Kotsogiannis (2004) and others have attempted to explore the impact of tax competition in the presence of both horizontal and vertical externalities. The results suggest that the common pool problem tends to dominate and often renders high tax rates much higher, which could ultimately hurt residents and firms.

The second theoretical perspective on tax assignment is anchored in the broader Public Choice literature, which argues that politicians behave as Leviathans and, as such, use tax instruments to maximize their gains from the private sector. Hence, in contrast to the traditional perspective, Brennan and Buchanan (1980) departed from the benevolent government approach to consider the political and bargaining powers that come into the design of intergovernmental tax arrangements. According to this perspective, local authorities should be able to levy taxes on mobile bases, and the resulting inter-jurisdictional competition would contribute to restrain the greed of local authorities and reduce monopolies. This perspective is also aligned with the broader view that the benefits of decentralization rely on the wholeness of the reform, and that accountability of local authorities is embedded in their autonomy. In fact, decentralization scholars have long emphasized the need for tying local expenditure to revenue generation as a mean to restrain them from confiscatory demands (Rodden, 2002; Fisman and Gatti, 2002; Lockwood, 2005).

Both perspectives have their share of merits and criticisms. On the one hand, the assumption of benevolent governments in the classical literature is, to many extents, questionable. It has been pointed out that this approach is embedded in a normative stance that does not reflect the reality across countries, and where the allocation of taxing rights to different tiers of government appear to have resulted from a historical trajectory and the structure of the economy of most countries (Bird, 1999; McLure Jr,

1994; McLure, 2001; Liberati, 2011; Ambrosanio and Bordignon, 2015). On the other, the assumptions of inter-jurisdictional mobility, especially in developing countries, are also questionable. Lower-tier authorities are less likely to hold monopolistic decisions, and thus the assumption of the mobility of resources and capital might be overstated (Bardhan, 2002; Liberati, 2011; Ambrosanio and Bordignon, 2015).

Notwithstanding, the Public Choice stand (or positive view) on tax assignment is predominant in recent developments of the fiscal federalism literature, which underscore the incentives embedded in multi-tier government institutions (Weingast, 1995; Qian and Weingast, 1997; Garzarelli, 2004; Oates, 2005, 2008; Weingast, 2009, 2014). The so-known Second-Generation Theory on Fiscal Federalism has also withdrawn from the benevolent government assumption to considering authorities as self-interested officials. It bridges insights from behavioural economics and contemporary organization theory in the studies of the working of political and fiscal institutions and the resulting behaviours of stakeholders across the multi-layer structure of government. Adherents to this new strand, for instance, contend that the incentive problems are similar in government hierarchies as in firms: political institutions serve to authorities what firms are to managers (Qian and Weingast, 1997, p. 91). Oates (2005, p. 356) also argues that officials do not simply act on behalf of the welfare of their constituents; as other participants in the political process, they have their objective functions that they seek to maximize in a political setting that provides constraints on their behaviour. Hence, just like market competition pressures firm managers to reflect the interests of shareholders, competition among local governments helps to limit government's predatory behaviour – such as imposing debilitating taxes or excessive regulation (Qian and Weingast, 1997, p. 88). Any departure from this stance would put the authorities in a competitive disadvantage as excessive regulation is likely to lower entrepreneurial activity and shrinks the governmental tax base (Montinola et al., 1995; Oates, 2005, 2008).

Yet, to date, empirical evidence on the incentivizing role of tax and revenue assignment is scarce and often limited to case studies. Be it within the normative or positive theoretical perspectives, cross-country analyses on the multi-layer tax structure and its ramifications are lacking. Such gap is partly attributed to the limited availability of cross-country comparative information on the vertical structure of tax decisions – an aspect that is crucial to the debate on the incentivizing role of multi-layer tax arrangements, and its relevance for revenue mobilization, sustainable development, fiscal governance, private sector growth, and other aims of economic policies.

The dissertation thus proposes to complement the theoretical perspectives by bringing an empirical glance into the legal assignment of taxing rights to different tiers of

government in a large number of countries, and by investigating the ramifications of sub-national taxing rights and discretion over tax decisions on various economic and behavioural outcomes. The following sub-section details the contents of each chapter of the dissertation and provides a first glance into the main results of the empirical enquiries.

1.3 Dissertation Outline

This dissertation consists of four empirical essays. In what follows, *Chapter 2* presents the outcomes of a major empirical endeavour towards understanding the multi-layer tax structure across countries and across tiers of governments. Due to limited data and cross-country comparative information on inter-governmental tax arrangements, part of this doctoral project involved the creation of a novel dataset on tax and revenue assignment, primarily through content analysis of legal and regulatory documents that describe the assignment of tax-related decisions to different tiers of governments across a large number of countries. *Chapter 2* thus sets the stage by describing the dataset, its underlying methodology and the derived indicators that are used in various empirical enquiries of the dissertation. *Chapter 3* and *Chapter 4* bring evidence into the ramifications of intergovernmental tax arrangements for firms' business operations and tax compliance. In doing so, they contribute to showing how macro-level characteristics of multi-layer fiscal institutions are linked to micro-patterns of firms' and individuals' behaviours and perceptions. *Chapter 5* takes on a more comprehensive approach into investigating the deep-rooted origins of cross-country variations in intergovernmental tax institutions observed in the dataset described in *Chapter 2*. An overview of each chapter is presented as follows.

CHAPTER 2 of the dissertation presents the new dataset on the multi-layer government tax structure across 171 countries. The dataset provides a comprehensive picture of the discretionary power of all government tiers over the fiscal space and tax instruments. It was built through in-depth reviews of legal documents – such as the Constitutions, Tax Codes, Local Taxation Acts, and decrees and laws on public finance – that define the governance of the tax system and the attributions of different government tiers in the setting and the management of specific tax revenue instruments. The legal texts are corroborated by policy documents, scientific and grey literature, other databases and fiscal archives from the International Bureau of Fiscal Documentation (IBFD). The dataset, in itself, contributes to the existing literature in two important ways. First, it offers extensive coverage with the inclusion of many developing and emerging countries. It also stands among the first

attempts to document legal information on intergovernmental tax arrangements in least-developed economies. Second, the dataset lends itself to numerous empirical applications and is versatile in its use. The coding procedures allow users to generate comprehensive indicators that compare multi-layer tax arrangements across countries, both in terms of specific tax instruments – such as income, consumption and property taxes – and in terms of specific decisions – such as the setting of tax rates and tax administration. It thus provides an alternative picture to the traditional classification of countries into federal and unitary states.

Using the collected legal information, I derive several indicators that inform on the level of taxing rights of sub-national government authorities over the fiscal space, and including their discretionary power over specific instruments and specific decision dimensions. Stylized facts from these indicators point to significant variations in inter-governmental tax arrangements across countries and suggest that the vertical decision structure over the tax system is much more complex than so far highlighted in the literature. Inter-governmental tax arrangements vary across countries, across tax instruments, and across the types of decision that are assigned to different tiers of government.

Using the new indicators, the chapter also revisits the empirical enquiry on the relationship between fiscal decentralization and economic performance in a sample of 125 countries, 90 of which are developing and emerging economies. Fiscal decentralization is proxied by the novel indicators on taxing rights of sub-national governments, including their discretion over specific decision dimensions and instruments. For *non*-OECD countries, the results point to an inverted U-shaped relationship between sub-national taxing rights and economic performance (proxied by the average per capita GDP growth rate). For OECD member states, however, there is no statistically significant linkage between sub-national taxing rights and economic performance. Zooming into the different types of decision components, the findings suggest that there might be an economic dividend to granting subnational governments some discretionary power over the setting of tax rates in *non*-OECD countries, although a broad discretion would be detrimental in the long run.

CHAPTER 3 investigates the effects of sub-national government taxing rights on private sector development across 111 countries and using a sample of 94,000 firms. The public choice view on tax assignment in multi-layer government and the dominant framework of the second generation literature on fiscal federalism posit that lower-tier authorities are incentivized to promote economic activities when they control revenues generated within their jurisdictions. Authors within this literature strand argue that competition among local governments helps to limit predatory behaviour –

such as imposing debilitating taxes or excessive regulation, restrains the greed of local authorities and reduces monopolies. Yet, as previously stated, the empirical evidence on the incentivizing role of tax assignment is scarce and often limited to case studies.

The new dataset presented in *Chapter 2* allows me to test whether assigning fiscal decision powers to lower-tier authorities has a positive impact on the business climate and business operations of firms in developing and emerging markets. The chapter also investigates how the assignment of specific tax-related decisions – such as the ability of lower-tier authorities to set the tax rates or to administer the revenues from tax instruments affects private sector operations. It explores the subject on a global scale by adjoining the new indicators on sub-national taxing rights to micro-level firm data from the World Bank Enterprises Surveys. The Enterprises Surveys provide extensive details on the characteristics of the firms and inform on their interactions with tax and government officials, as well as their perception of how regulations and fiscal institutions affect their business operations. The results show that the greater the sub-national governments' taxing rights, the higher the fiscal burden on private enterprises and private production. Lower-tier governments' ability to set the tax rates on key instruments is particularly harmful to business operations in the sample of countries. Sub-national taxing rights and their discretion on tax administration also translate into a higher probability of being audited, a greater amount of time spent dealing with government regulations and a higher propensity of tax officials requesting bribe payments from business managers during tax audits.

CHAPTER 4 studies the influence of intergovernmental tax arrangements on tax compliance. It provides empirical evidence regarding the effects of sub-national discretion over the tax system on tax compliance attitudes of citizens in approximately 49 Latin-American and African countries, and through using renowned public opinion survey data that capture individual attitudes towards tax payments (Afrobarometer, 2016; Latinóbarometro, 2015). Existing research on tax compliance generally considers the government-taxpayer relationship as a bilateral one. In practice, however, governments consist of many layers, and taxpayers have multiple payment obligations and often towards more than one layers. Coercive mechanisms such as the setting of tax instruments, including the probability of being caught and the fines, as well as public accountability, may differ across layers. By bridging the tax compliance and fiscal federalism literature, *Chapter 4* argues for the consideration of the multi-layer structure of tax institutions in attempts to understand tax compliance. First, the chapter explores the channels through which the multi-tier structure of taxation could impact on individual tax compliance, using existing frameworks within the public finance and political economy literature. Second, it zooms not only into the discretion of

sub-national authorities over tax matters more broadly but also their discretion over different dimensions, such as the setting of tax rates and tax administration, and their respective effects on tax compliance. Similar to *Chapter 3*, *Chapter 4* bridges macro-level characteristics of tax institutions to micro-behaviours of residents in the country sample.

The empirical findings confirm the overarching hypothesis that the multi-layer structure of taxation matters in the analysis of tax compliance. The results indicate that the higher the level of taxing rights of sub-national authorities, the lower the likelihood of citizens fully complying with their tax payments. It is also revealed that sub-national discretion over tax administration reduces tax compliance. In addition, the findings indicate that the marginal effects of sub-national taxing rights and discretion over tax administration are positive in low-income countries, thereby suggesting that there might be some added-value to having lower-tier authorities being involved in the governance of the tax system in low-income economies. Notwithstanding, the empirical results point to strong evidence that the lack of tax knowledge exacerbates the negative effect of sub-national taxing rights or discretion over tax administration on tax compliance. Lastly, the chapter questions whether the adverse effects are due to the design of intergovernmental tax institutions or the overall compliance costs in each given country. The findings, yet, suggest that country-level compliance costs do not trump the relevance of sub-national authorities' control over the fiscal space. Therefore, the observed negative effects are likely due to factors embedded in the multi-layer design of tax institutions or other parameters such as the lack of tax knowledge. More broadly, the chapter shows that a complex tax structure may affect revenue mobilization in developing and emerging economies. It also contributes to the literature on how incentives embedded in intergovernmental fiscal institutions could also drive individual attitudes and choices towards tax payments.

CHAPTER 5 investigates the deep-rooted factors that explain the cross-country variation in multi-layer tax institutions observed in the new dataset. Economic theories suggest that intergovernmental fiscal relations and institutions are shaped by heterogeneous demands embedded in regional, cultural and ethnic diversity. Notwithstanding, institutions persist, and a growing amount of empirical studies show that institutions are path-dependent and carry within them features of pre-colonial and pre-modern societies. Based on insights from the institutional economics and economic history literature, I develop an analytical framework through which I postulate that, similarly to other institutions, inter-governmental tax arrangements could have emerged and persisted through time even when they deem inefficient in view of economic rationales.

In the empirical enquiry, I connect proxies of ethno-cultural and geographical diversity to features of pre-colonial, pre-modern institutions and colonial legacy in an attempt to explain the modern-day level of sub-national authorities' discretionary power over the tax system. The results point to a statistically significant and robust impact of pre-colonial state centralization and institutions on the modern-day level of sub-national taxing rights. Lower-tier governments in countries with a higher degree of pre-colonial state centralization also tend to have greater discretionary power over tax administration and the setting of tax rates today. The path out of colonization also matters: countries that have experienced a violent independence movement tend to have a more centralized tax structure. Yet, unlike the predominant view on the origins of decentralized institutions, ethno-cultural diversity falls short in explaining the legal assignment of taxing rights across government layers in the sample of 76 countries. To the best of my knowledge, *Chapter 5* is a first in empirically showing how the historical trajectories of countries in Africa, the Middle East and Asia shape their modern-day multi-layer fiscal institutions.

CHAPTER 6 synthesizes the key findings of the different chapters and the dissertation more broadly, provides a critical discussion of the limitations of the empirical enquiries and identifies potential avenues for future research.

Bibliography

Afrobarometer (2016). Round 6.

Ahmad, E. and G. Brosio (2009). *Does decentralization enhance service delivery and poverty reduction?* Edward Elgar Publishing.

Ahmad, J., S. Devarajan, S. Khemani, and S. Shah (2005). *Decentralization and service delivery*. The World Bank.

Ambrosanio, F. and M. Bordignon (2015). Normative versus positive theories of revenue assignments in federations. In E. Ahmad and G. Brosio (Eds.), *Handbook of multilevel finance*, pp. 231–263. Cheltenham: Edward Elgar.

Arzaghi, M. and J. V. Henderson (2005). Why countries are fiscally decentralizing. *Journal of Public Economics 89*(7), 1157–1189.

Bardhan, P. (2002). Decentralization of Governance and Development. *Journal of Economic Perspectives 16*(4), 185–205.

Baskaran, T., L. P. Feld, and J. Schnellenbach (2016). Fiscal Federalism, Decentralization, and Economic Growth: A Meta-analysis. *Economic Inquiry 54*(3), 1445–1463.

Besley, T. and S. Coate (2003). Centralized versus Decentralized Provision of Local Public Goods: A Political Economy Analysis. *Journal of Public Economics 87*(12), 2611–2637.

Bird, R. M. (1999). Rethinking Subnational Taxes: A New Look at Tax Assignment. IMF.

Bodman, P. and A. Hodge (2010). What Drives Fiscal Decentralisation? Further Assessing the Role of Income. *Fiscal Studies 31*(3), 373–404.

Brennan, H. G. and J. M. Buchanan (1980). *The power to tax: Analytical foundations of a fiscal constitution* (2006 ed.). Cambridge: Cambridge University Press.

Brülhart, M. and M. Jametti (2006). Vertical versus horizontal tax externalities: An empirical test. *Journal of Public Economics 90*(10-11), 2027–2062.

Caldeira, E., M. Foucault, and G. Rota-Graziosi (2012). Does decentralization facilitate access to Poverty-Related Services? Evidence from Benin.

Caldeira, E. and G. Rota-Grasiozi (2014). The Crowding-in Effect of Simple Unconditional Central Grants on Local Own-Source Revenue: The Case of Benin. *Journal of African Economies 23*(3), 1–27.

Dafflon, B. and T. Madiès (2012). *The Political Economy of Decentralization in Sub-Saharan Africa: A New Implementation Model in Burkina Faso, Ghana, Kenya, and Senegal*. Washington DC, USA: The World Bank Group.

Fisman, R. and R. Gatti (2002). Decentralization and corruption: Evidence across countries. *Journal of Public Economics 83*(3), 325–345.

Fjeldstad, O.-H. (2001). Taxation, coercion and donors: Local government tax enforcement in Tanzania. *The Journal of Modern African Studies 39*(02), 289–306.

Fjeldstad, O.-H. (2004). *Decentralisation and corruption. A review of the literature*. Chr. Michelsen Institute.

Fjeldstad, O.-H. and J. Semboja (1999). Local government taxation and tax administration in Tanzania. Bergen, Norway.

Garzarelli, G. (2004). Old and new theories of fiscal federalism, organizational design problems, and tiebout. *Journal of Public Finance and Public Choice 22*(1-2), 91–104.

Gordon, H. S. (1954). The Economic Theory of a Common-Property Resource: The Fishery. *Journal of Political Economy 62*(2), 124–142.

Hayek, F. A. (1948). *Individualism and economic order*. Chicago, USA: University of chicago Press.

Keen, M. J. and C. Kotsogiannis (2002). Does Federalism Lead to Excessively High Taxes? *American Economic Review 92*(1), 363–370.

Keen, M. J. and C. Kotsogiannis (2004). Tax competition in federations and the welfare consequences of decentralization. *Journal of Urban Economics 56*(3), 397–407.

Latinóbarometro (2015). 2015.

Letelier, L. S. (2005). Explaining Fiscal Decentralization. *Public Finance Review 33*(2), 155–183.

Liberati, P. (2011). Which Tax or Which Tax for What? Tax Assignment in the Theory of Fiscal Federalism. *Public Finance Review 39*(3), 365–392.

Lin, J. Y. and Z. Liu (2000). Fiscal Decentralization and Economic Growth in China. *Economic Development and Cultural Change 49*(1), 1–21.

Lockwood, B. (2005). Fiscal Decentralization: A Political Economy Perspective.

Martinez-Vazquez, J. (2015). Tax assignments at the regional and local levels. In E. Ahmad and G. Brosio (Eds.), *Handbook of multilevel finance*, pp. 358–388. Cheltenham: Edward Elgar.

Martinez-Vazquez, J., S. Lago-Peñas, and A. Sacchi (2017). The Impact of Fiscal Decentralization: A Survey. *Journal of Economic Surveys 31*(4), 1095–1129.

Martinez Vazquez, J. and R. M. McNab (2003). Fiscal Decentralization and Economic Growth. *World Development 31*(9), 1597–1616.

McLure, C. E. (2001). The Tax Assignment Problem: Ruminations on How Theory and Practice Depend on History. *National tax journal 54*(2), 339–363.

McLure Jr, C. E. (1994). The Tax Assignment Problem: Ends, Means, and Constraints. *Austl. Tax F. 11*, 153.

Montinola, G., Y. Qian, and B. R. Weingast (1995). Federalism, Chinese Style: The Political Basis for Economic Success in China. *World Politics 48*(01), 50–81.

Morozov, B. (2018). Decentralization and Economic Growth: Specification, Measurement, and Direction of Causal Relationship. *International Journal of Public Administration 41*(9), 684–699.

Musgrave, R. A. (1959). *The theory of public finance: A study in public economy*. New York: McGraw-Hill.

Musgrave, R. A. (1983). Who should tax, where, and what? In C. E. McLure (Ed.), *Tax assignment in federal countries*, pp. 2–19. Canberra and Canberra and New York: Centre for Research on Federal Financial Relations, Australian National University, in association with the International Seminar in Public Economics and Distributed by ANU Press.

Oates, W. E. (1972). *Fiscal federalism*. The Harbrace series in business and economics. New York: Harcourt Brace Jovanovich.

Oates, W. E. (1977). *The Political economy of fiscal federalism*. Lexington, Mass.: Lexington Books.

Oates, W. E. (1996). Taxation in a federal system: The tax-assignment problem.

Oates, W. E. (2005). Toward a second-generation theory of fiscal federalism. *International Tax and Public Finance 12*(4), 349–373.

Oates, W. E. (2008). On The Evolution of Fiscal Federalism: Theory and Institutions. *National tax journal 61*(2), 313–334.

OECD (2013). *Measuring Fiscal Decentralisation*. OECD Fiscal Federalism Studies. Paris, France: Organisation for Economic Co-operation and Development.

OECD and UCLG (2019). 2019 Report on the World Observatory on Subnational Government Finance and Investment: Key Findings. Paris.

Panizza, U. (1999). On the determinants of fiscal centralization: Theory and evidence. *Journal of Public Economics 74*(1), 97–139.

Patsouratis, V. A. (1990). Fiscal Decentralization in the EEC Countries. *Public Finance = Finances publiques 45*(3), 423–439.

Qian, Y. and B. R. Weingast (1997). Federalism as a Commitment to Reserving Market Incentives. *Journal of Economic Perspectives 11*(4), 83–92.

Rodden, J. (2002). The Dilemma of Fiscal Federalism: Grants and Fiscal Performance around the World. *American Journal of Political Science 46*(3), 670.

Seabright, P. (1996). Accountability and decentralisation in government: An incomplete contracts model. *European Economic Review 40*(1), 61–89.

Stegarescu, D. (2005). Public Sector Decentralisation: Measurement Concepts and Recent International Trends*. *Fiscal Studies 26*(3), 301–333.

Tiebout, C. M. (1956). A Pure Theory of Local Expenditures. *Journal of Political Economy 64*(5), 416–424.

Tiebout, C. M. (1961). An economic theory of fiscal decentralization. In National Bureau for Economic Research (Ed.), *Public finances: Needs, sources, and utilization*, pp. 79–96. Princeton University Press.

Vo, D. (2014). The Economics of Measuring Fiscal Decentralisation: Part II: New Fiscal Decentralisation Indices.

Weingast, B. (1995). The Economic Role of Political Institutions: Market-Preserving Federalism and Economic Development. *Journal of Law, Economics and Organization 11*(1), 1–31.

Weingast, B. R. (2009). Second generation fiscal federalism: The implications of fiscal incentives. *Journal of Urban Economics 65*(3), 279–293.

Weingast, B. R. (2014). Second Generation Fiscal Federalism: Political Aspects of Decentralization and Economic Development. *World Development 53*, 14–25.

Wilson, J. D. (1995). Mobile Labor, Multiple Tax Instruments, and Tax Competition. *Journal of Urban Economics 38*(3), 333–356.

Wilson, J. D. (1999). Theories of Tax Competition. *National tax journal 52*(2), 269–304.

Chapter 2

Multi-Layer Tax Structure in Advanced, Emerging and Developing Economies

Abstract

This chapter presents a novel and comprehensive dataset on tax revenue assignment covering a large number of countries. The dataset is built upon in-depth reviews of legal and policy documents that define the governance structure of the tax system across government layers and countries. It is coded to reflect the attributions of power to all government tiers over specific tax instruments and across four types of decisions: the setting of tax rates, tax administration, the definition of taxable bases, and the design and implementation of an instrument. Using a scoring approach, I derive a set of indicators that inform on the taxing rights of sub-central authorities over the range of tax instruments and decision dimensions. The chapter illustrates the use of the dataset by revisiting the empirical analysis of the relationship between fiscal decentralization – proxied by the new indicators on sub-national governments' taxing rights – and economic performance in a sample of 125 countries, 90 of which are developing and emerging economies. The results point to an inverted U-shaped relationship between economic performance and sub-central governments' discretion over the tax system in *non*-OECD countries, while there is no evidence of statistically significant linkages for OECD member states. The results also indicate that there might be an economic dividend to lower-tier governments being involved in the setting of tax rates in *non*-OECD countries, although an extensive discretion would be detrimental in the long-run.

Keywords: Data Collection; Tax Assignment; Fiscal Federalism; Fiscal Decentralization
JEL Codes: H7; C8; C55; O1

2.1 Introduction

An essential aspect of a country's tax system is the structure across territorial divisions and government tiers. Whether public goods provision is centralized or delegated, the multi-layer structure of tax institutions is expected to influence regulatory outcomes and economic performance as it shapes behavioural responses of authorities, firms and residents (Oates, 2005; Weingast, 2009). To date, however, cross-country empirical enquiries into the ramifications of inter-governmental tax arrangements remain scarce. Academic contributions that estimate the various effects of fiscal decentralization predominantly do so by measuring fiscal decentralization through budgetary ratios – such as the share of sub-national tax revenue in consolidated general government tax revenue. Yet, as it has been previously highlighted in the literature, this accounting approach does not convey the real decision autonomy of each tier of government (Stegarescu, 2005; OECD, 2013; Vo, 2014; Morozov, 2018). Such an approach also fails to reflect the decision structure on critical dimensions such as the setting of tax rates or tax administration by different authorities across the tax system.

The academic debate on tax and revenue assignment in multi-layer governments has long been of great interest in the public finance literature. The so-called *tax assignment problem* is succinctly summarized by Musgrave (1983) and analyzed by others (Oates, 1996; McLure, 2001; Martinez-Vazquez, 2015) as *"Who Should Tax, Where and What?"*. In line with that seminal question, an overview of inter-governmental tax arrangements in any given country should convey answers to the question of *"Who Taxes, Where and What?"*. This latter question calls for a level of granularity that goes far beyond the fiscal balance of different government tiers. Enquiries into the tax assignment problem thus ought to, among others, convey the attributions of each layer on tax-related matters and across the vertical spectrum.

To date, however, very few empirical tools have allowed researchers to grasp the essence of inter-governmental tax arrangements on a cross-country and comparative basis. Cross-country empirical enquiries into the linkages between the hierarchical structure of tax systems and economic and behavioural outcomes have often faced a data limitation which I contribute to overcoming in this research. This first chapter presents a new and comprehensive dataset on tax and revenue assignment, which aims at filling the gap on cross-country comparative information on multi-layer tax institutions. The dataset is coded to reflect the vertical decision structure on tax matters and the legal attribution of power to all government tiers, either over specific tax instruments – such as income, consumption and property taxes – or types of decisions

– such as the setting of tax rates, the definition of tax bases and tax administration. The new dataset differs from existing works in some important ways.

First, it offers extensive coverage with the inclusion of more than one hundred countries, most of which are developing and emerging economies. The dataset also stands among the first empirical attempts to document legal information on multi-layer tax institutions in least-developed economies. It was mostly built through in-depth reviews of more than two thousand legal and policy documents that define the governance of the tax system and the attributions of different government tiers in the setting and management of specific tax revenue instruments. The legal and policy sources include, among others, the Constitutions, the Tax Codes, the Local Taxation Acts, decrees and laws on public finance, fiscal decentralization policy documents, and territorial management plans. The legal and policy sources are corroborated by scientific and grey literature, and archives from the International Bureau of Fiscal Documentation (IBFD). The IBFD (2017)'s Tax Research Platform traces and reports tax-related information for many countries in a timely manner, in the forms of news reports or published policy notes. The IBFD has also previously been used in the construction process of other databases on fiscal matters (see for e.g. Amaglobeli et al., 2018).

Second, the dataset lends itself to numerous empirical applications and is versatile in its use. The coding procedures, described in subsection 2.4.2, allow users to generate comprehensive indicators that compare multi-layer tax arrangements across countries, both in terms of specific tax instruments and types of decisions granted to each government tier. By allowing such contrasts, the dataset facilitates in-depth analyses of the effectiveness of centrally- and locally-assigned tax decisions in included countries. By focusing specifically on the tax dimension of decentralization, it also provides an alternative picture to the traditional classification of countries into federal or unitary states.

Third, the dataset integrates the hierarchical structure of tax administration and the discretion of different government layers over the design and implementation of specific tax instruments as part of the measurement of taxing rights of government authorities. The discretion over the setting of tax instruments is of utmost relevance. In the United States, for instance, state-level governments may decide whether or not to levy a state income tax. Such leeway points to a high level of discretionary power which is rarely granted to sub-federal or sub-national authorities in other countries. The involvement of different tiers of authorities in tax administration also implies significant responsibilities in terms of auditing and monitoring of taxpayers. The hierarchical structure of tax administration is key to the scholarly discussions on fiscal

coordination, revenue mobilization, and tax compliance of firms and residents. By considering these elements, the new dataset also conveys a set of information that goes beyond existing approaches of measuring tax and fiscal autonomy – such as in the OECD tax autonomy (OECD, 1999, 2000, 2020).

Using an aggregation methodology, described in subsection 2.4.3, I derive a set of indicators that reflect the decision-making power of sub-national and sub-federal authorities over the range of tax instruments overall, and over specific dimensions such as the setting of tax rates and tax administration. The comparative analysis of these indicators reveals that the multi-layer structure of tax institutions is far more complex than so far highlighted in the literature. Inter-governmental tax arrangements vary across countries, across tax instruments, and across the types of decision that are assigned to different tiers of government. An aggregated index, labelled the *Tax Assignment Index*, conveys the overall taxing rights of sub-national authorities based on their discretion over existing tax instruments and the decision dimensions in which they are involved. Separate indicators on sub-national governments' discretion over tax rates and tax administration, for instance, also convey the extent to which they are legally assigned such decision-making powers over specific or the range of tax instruments.

The chapter illustrates the empirical application of the dataset by revisiting one of the most prominent empirical enquiries in the fiscal federalism literature: the effects of fiscal decentralization on economic performance. Instead of using conventional indicators of fiscal decentralization – such as the ratios of sub-national expenditure or (tax) revenue in general government expenditure or (tax) revenue, I use the newly constructed indicators on sub-national governments' taxing rights and proxy economic performance with the average growth rate of per capita GDP.

The focus on the taxing rights dimension of decentralization is relevant for many important reasons. As taxation plays a crucial role in macroeconomic stabilization (Martinez-Vazquez and McNab, 2006), scholars and policy-makers have traditionally been sceptical about assigning taxing powers to lower-tier authorities, especially on benefit taxes (Oates, 1972; Bird, 1999; Martinez-Vazquez, 2015). Fiscal erosion and disintegrated economic space are also often listed as potential threats to the decentralization of the tax system (Prud'Homme, 1995; Rodden, 2006). Yet, existing empirical contributions that link economic performance to sub-national governments' taxing rights or tax autonomy are scarce and primarily circumscribed to developed economies, despite the recent prominence of decentralization reforms in numerous developing and emerging economies (see section 2.2).

The empirical application contributes to the existing literature in two important ways. First, it considers a much larger sample of countries than so far explored in the literature. Second, it focuses primarily on the taxing rights of sub-national authorities in lieu of a comprehensive measurement of fiscal decentralization. Furthermore, the analysis does not only highlight the linkages between sub-national taxing rights and economic performance more broadly but also zooms into specific decision dimensions – such as the legal rights of sub-national authorities over the setting of tax rates and tax administration. By linking these dimensions to the economic performance of countries, I investigate the underlying institutional channels through which intergovernmental tax arrangements may influence economic performance.

The results point to no statistically significant linkages between the aggregate index of sub-national taxing rights and economic performance in OECD countries – a finding that is in line with previous research contributions (Thornton, 2007; Bodman, 2011; Baskaran and Feld, 2013; Asatryan and Feld, 2015) and which is also robust to using the OECD tax autonomy indicator as an alternative proxy. For *non*-OECD member states, however, the empirical estimates point to an inverted U-shaped relationship between the level of sub-national taxing rights and economic performance. This latter result is novel to the literature and stands as the first to convey the influence of the tax dimension of decentralization on the economic performance of 90 developing and emerging economies. Exploring sub-national governments' discretion over specific decisions, the findings suggest that there might be an economic dividend to granting sub-central authorities in *non*-OECD countries some discretionary power over the setting of tax rates. Similar to the estimates using the overall indicator of sub-national taxing rights, there is an inverted U-shaped relationship between the discretion over the setting of tax rates and the average growth rate of per capita GDP in *non*-OECD member states.

The remainder of the chapter is organized as follows. Section 2.2 provides an overview of existing and comparable data sources. Section 2.3 highlights the main features and contributions of the dataset. Section 2.4 details the underlying methodology, including the coding and scoring techniques. Section 2.5 presents some core findings from a comparative analysis of the new indicators. Section 2.6 discusses the limitations and validation of the new data and findings. Section 2.7 illustrates the application of the dataset by revisiting the empirical enquiry of the relationship between fiscal decentralization and economic performance. Concluding remarks are found in Section 2.8.

2.2 Overview of Comparable Datasets

Intergovernmental tax arrangements have long been a central topic in the public finance literature. Although the multi-dimensional concept of decentralization is difficult to measure, public finance economists have contented on several proxies for fiscal decentralization in existing empirical research, most of which rely on national accounts statistics and point to, for instance, the ratio of sub-central (tax) revenue or expenditure in consolidated general government (tax) revenue or expenditure (see for e.g. Martinez-Vazquez and McNab, 2006; Vo, 2014; Canavire-Bacarreza et al., 2020). This accounting approach does not, however, reflect the vertical decision power of different tiers of authorities over tax and revenue instruments and tends to over or under-estimate the extent of fiscal decentralization (OECD, 1999; Ebel and Yilmaz, 2002; Stegarescu, 2005; OECD, 2013; OECD and UCLG, 2019; Chatry and Vincent, 2019).

In view of these shortcomings, a number of initiatives were taken by public finance economists and policy institutions towards providing a more accurate overview of sub-national fiscal autonomy and the degree to which lower-tier authorities are involved in the governance of fiscal institutions. These include, among others, the OECD Fiscal Network's tax autonomy dataset (OECD, 1999, 2013, 2020), the Fiscal Autonomy component of the Regional Authority Index (Hooghe et al., 2016), the World Bank Qualitative Decentralization Indicators (World Bank Group, 2000), and most recently the World Observatory on Sub-national Finance and Investment (OECD and UCLG, 2016, 2019). While they differ in scope and contents, they share a similar objective which is to meet the ever-growing demand for cross-country data on intergovernmental fiscal relations.

The OECD Tax Autonomy dataset stands as one of the most appraised efforts to inform on the real autonomy of sub-central government units over their tax revenues. The concept of *"tax autonomy"* hereby indicates the degree to which sub-central governments can set the tax rates, define the tax base or grant allowances to individuals and firms in OECD member states (OECD, 1999, 2013, 2020). The Fiscal Design Survey of the OECD is the primary information source. The survey data inform on the discretionary power of lower-tier authorities based on five categories ranked in decreasing order: *(a)* the full power of sub-central authorities over tax rates and tax base, *(b)* the full power over tax rates representing the "piggy-packing" type of tax, *(c)* the power over the tax base, *(d)* the tax sharing arrangements, and *(f)* no discretionary power over the base and the rates at all. The tax-sharing arrangements *(c)* ought to represent the various rules and institutions for the government to determine and

change their share if defined by existing legal provisions. The resulting tax autonomy indicators convey the share of subnational government tax revenues as a percentage of GDP or total tax revenues upon which sub-central authorities have discretion given the above dimensions. These indicators do not convey the level of discretion in tax administration which deems not relevant to the conceptual definition of tax autonomy.

The Regional Authority Index (RAI) dataset (Hooghe et al., 2016) is another renowned attempt to measure the level of autonomy of regional governments. The RAI tracks political, legal, and administrative decision-making at the regional level on an annual basis from 1950 to 2010 in a sample of 81 countries. The dataset covers primarily OECD and EU member states, countries in Latin America, and a few others located in Eastern and Central Europe, the Pacific and South-East Asia. The aggregated *"Regional Authority Index"* captures ten dimensions: institutional depth, policy scope, fiscal autonomy, borrowing autonomy, representation, lawmaking, executive control, fiscal control, borrowing control, and constitutional reform of regional governments. The Fiscal Autonomy component of the RAI shares some methodological similarities with the OECD tax autonomy. It measures the extent to which regional governments can independently tax its population along with four main categories: *(a)* central government sets base and rate of all regional taxes, *(b)* regional government sets the rate of minor taxes, *(c)* regional government sets base and rate of minor taxes, *(d)* regional government sets the rate of at least one major tax: personal income, corporate, value-added, or sales tax, *(e)* regional government sets base and rate of at least one major tax. The fiscal autonomy component, therefore, reflects regional governments' discretion over fiscal matters. The scores are built for each regional authority and then aggregated to the national level.

Aside from these two major sources, other attempts at measuring fiscal or tax autonomy include the works of Arzaghi and Henderson (2005) and Stegarescu (2005). Arzaghi and Henderson (2005) constructed a nuance index of effective federalism through an assessment of fiscal, legislative, political and administrative responsibilities of sub-national governments. The scores are constructed for five-year intervals between 1960 and 1995, and cover some developing countries such as Mozambique or Bangladesh. The fiscal autonomy aspect points to the raising revenue capability of local governments with *0 = no capability* and *4 = full capability*. The disaggregated fiscal component is not publicly available and cannot therefore be used for comparative analysis within the scope of this research. Stegarescu (2005), on the other hand, used the analytical framework provided by the OECD tax autonomy and estimated an accurate measure of revenue decentralization by weighting the level of autonomy by sub-national governments own-source revenues. The results show that conventional

measures of tax decentralization (i.e. the ratio of sub-national governments tax revenue in consolidated general government tax revenue) tend to considerably overestimate the extent of fiscal decentralization.

Other existing indicators of decentralization found in the literature are either too comprehensive – combining administrative, legislative, political, and other aspects of decentralization – or the publicly available datasets are not disaggregated enough to allow proper comparisons of the design of multi-layer tax institutions across countries. These include, among others, the contributions of Lijphart (1999), Lane and Ersson (1999), and Brancati (2006). Additional attempts at qualitatively informing on sub-national tax-related decision powers include the World Bank Qualitative Decentralization Indicators (World Bank Group, 2000), the World Observatory on Sub-national Finance and Investment (OECD and UCLG, 2016, 2019) which are limited in terms of empirical applications as they do not convey comparative indicators on the multi-layer tax structure across included countries.

The new dataset, presented in this chapter, is a complement to the above attempts. The coding procedures extend from the proposed matrix of tax and revenue assignment by the World Bank Qualitative Decentralization Indicators (WBQD) (World Bank Group, 2000). On the tax assignment dimension, the WBQD was limited both in scope and contents. Using it as a starting point, I have developed a systematic tool that tracks and records intergovernmental tax relations across government tiers and across countries. The collected legal and administrative information is then used to generate comprehensive indicators for empirical and comparative analyses. On information sources, the new dataset also resembles the Regional Authority Index (Hooghe et al., 2016) as it relies primarily on legal documents such as Constitutions, tax codes, statutes, and decrees on local taxation and public finance. The following section describes its main features and contributions to the existing literature.

2.3 Features and Contributions

In comparison to other aspects of decentralization reforms – such as grants or expenditure – the vertical structure of tax-related decisions has so far received minimal empirical considerations. The *Tax and Revenue Assignment dataset (TRA)*, presented in this chapter, paves the way for empirical enquiries into how intergovernmental tax arrangements, either concerning existing tax instruments or specific decision structure, impact on regulatory, socio-economic and behavioural outcomes such tax burden on firms, tax compliance of residents, and policy responses of government authorities,

some of which are addressed in this dissertation. Compared to the above-described data sources, the *TRA* has two main distinctive features: coverage and granularity.

First, it provides comprehensive information on tax instruments and tax-related decision in more than a hundred countries. While the OECD Tax Autonomy and the Regional Authority Index are increasingly expanding, they predominantly cover high-income countries as per their latest editions. The *TRA* is a step towards documenting and coding legal and administrative details on the multi-layer tax structure in several low-income economies.

Second, the new dataset is constructed with a high level of granularity which facilitates analyses into the complexity of multi-layer tax arrangements across countries. It provides comparative information on tax-related decisions – such as the definition of tax bases, the setting of tax rates and tax administration – and on specific tax instruments – such as income, consumption and property taxes. Such a level of granularity offers a unique overview of the heterogeneity in tax-related decisions across countries. As illustrated in section 2.5, future users can generate alternative indicators that assess and contrast the vertical decision structure based on research demands.

Furthermore, the dataset allows for the comparison of the design of tax administration regarding specific or a range of tax instruments. The multi-layer structure of tax administration is of significant relevance given that it implies some responsibilities in the auditing and monitoring process of taxpayers – an aspect that is also crucial to the debate on revenue mobilization, fiscal coordination and competition. The *TRA* thus helps to explore new research avenues related to whether the administration of specific tax instruments by lower-tier or central authorities induces higher or lower compliance, among other outcomes.

Through these two features, the *TRA* lends itself to numerous applications in public finance and political economy. To the best of my knowledge, no other existing datasets provide this level of details on the tax system across countries. Despite being cross-sectional, the first edition sets a collaborative tool to track, expand and integrate public finance reforms in specific countries as information on sub-national government is increasingly becoming available – such as in OECD and UCLG (2016, 2019).

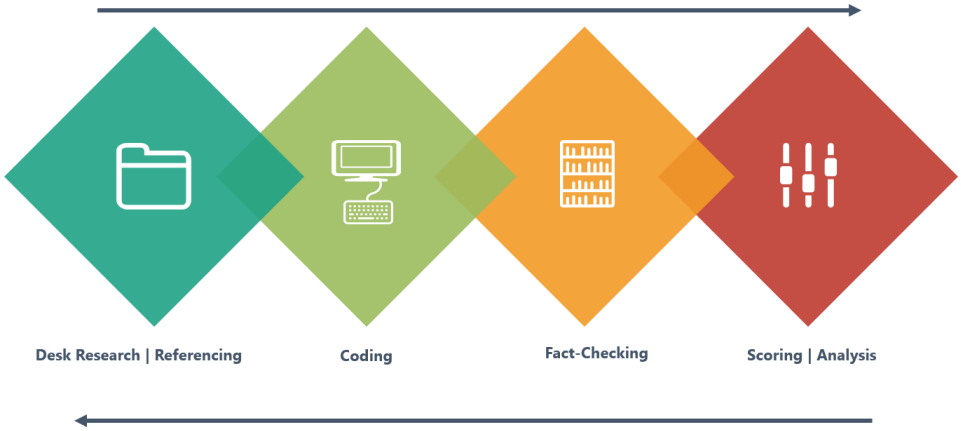
2.4 Methodology

The construction process of the dataset involves four major steps which are repeated whenever new information sources are collected or provided by reliable sources (as indicated by the arrows in Figure 2.1). The first step consists in gathering information from various legal texts, policy documents, archives, scientific and grey literature that inform on the discretionary power of each government tier over existing tax instruments in each country, and across the decision dimensions such as the setting of tax rates and tax administration. A systematic referencing system tracks and records the information sources for each country.

The second step consists in expanding and filling a matrix adapted from the World Bank Qualitative Decentralization Indicators (World Bank Group, 2000). The matrix, described in subsection 2.4.2, includes the most commonly identified tax and revenue instruments across countries. The coding also takes into account countries' specificities and integrates non-generalizable tax revenues sources, such as the *tax for local development* in Benin, which can be of interest to other users.

The third step consists in checking the accuracy of the collected legal and policy information by comparing those records with details from scientific and grey literature, as well as archives from the International Bureau of Fiscal Documentation for each country (IBFD, 2017). This step also involves reaching out to policy experts and tax authorities at the country-level for insights and feedback on the coding mechanisms.

Figure 2.1: Construction Process of the Tax and Revenue Assignment dataset



In the fourth and final step, the coded information is aggregated using a scoring approach, described in subsection 2.4.3, to derive comparable indicators for analytical purposes. Yet, the use of the *TRA* is not limited to the herein proposed scoring method.

It is expected that users will derive new sets of indicators based on their research demands and questions. In the third and fourth steps, the derived indicators are also compared with existing and comparable ones such as the OECD tax autonomy and the fiscal autonomy component of the Regional Authority Index. These comparisons serve to validate the new indicators, despite significant methodological differences. They also help to identify remaining gaps to be addressed in future research.

2.4.1 Data and Information Sources

The dataset was built through in-depth reviews of more than two thousand documents which inform on the discretionary power of government layers over the tax instruments in a country. The primary sources of information are summarized in Table 2.1. In the coding process, legal documents and official policy reports take precedence over scientific and grey publications. While I acknowledge that the legal provisions may not reflect the practice in some countries, they best convey the constitutional and legal rights of each government tier, and the extended possibilities of claiming those rights.

The legal texts include the constitution, the tax codes, statutes, laws and decrees on local public finance and taxation, the local government acts, the national budget laws, most of which are collected from on-line and on-site libraries, websites of public institutions (e.g. National Assembly, Ministry of Interior, Ministry of Finance, Local Government Associations) and third-party entities (e.g. UN agencies, CELAC, World Bank, IMF, OECD, the African Union). The legal information is complemented with decentralization policy documents, reports on territorial and public administration reforms, national development plans or strategy documents, public financial reports, local public administration reports, academic and grey publications.

Academic and grey publications were gathered from major literature databases. These include Google Scholar, Scopus, Web of Science, EconLit, with using, on the one hand, the *country names*, and on the other keywords related to public finance structure such as *"tax code"*, *"taxing powers"*, *"local taxation"*, *"local tax"*, *"local revenue"*, *"tax decentralization"*, *"fiscal decentralization"* and so on. The gathered information is triangulated with archives of the International Bureau of Fiscal Documentation (IBFD, 2017). The IBFD traces fiscal reforms and fiscal changes in most countries. Its archives include news (announcements of new reforms), scientific publications as well as technical reports compiled by tax experts at the country level. The archives provide very detailed information on changes in the tax structure or policies in a timely manner,

and have previously been used in the construction of other tax-related databases (see for e.g. Amaglobeli et al., 2018).

Table 2.1: Primary Sources of Information

Legal Provisions	Tax Codes, Local Government Acts, Laws and Decrees on Local Public Finances and Taxation, Constitutions
Policy Documents	Decentralization Policy document, Territorial and Public Administration reforms documents, Development Strategies, Public Finance Reports, Regional and Local Councils Reports
Archives	International Bureau of Fiscal Documentation - Tax Research Platform
Scientific and Grey Publications	Peer-reviewed publications, edited volumes, working papers, multilateral organizations reports(IMF, World Bank, OECD, UCLG, UN, etc.)
Existing Databases	OECD Tax Autonomy, Regional Authority Index, etc.; Local Public Finance Datasets (when available); IMF GFS

Given the cross-sectional nature of the dataset at this stage, I have limited the collected information to the time period of 2010 to 2017. While seven years might seem extensive for cross-sectional data, countries rarely change their intergovernmental fiscal structure, especially concerning the governance and management of tax and revenue instruments. The structure of the tax system is long-lasting as it is regulated by legal texts that are approved by the legislative body of most countries. As a result, the aggregated indicators do not vary much in time, even when minor changes in one tax instrument are added. If a reform occurred between 2010 and 2017, the final coding reflects the latest structure. Examples of these include for instance the new regulations brought by the Local Self-Governance reforms in Albania in 2015 (Law Nº 139/2015), the new regulations on the motor vehicle tax in the Slovak Republic (Act Nº 361/2014) or the recent directive on local government authorities in the Republic of Niger (Directive Nº 104/2014/CAB/PM of 11 August 2014). The coding does, however, not reflect changes that legally occurred throughout 2018 and 2019. Examples of those include, for instance, the Law Nº 50/2018 and Law Nº 51/2018 which revised the Local Finance Law in Portugal, the new Law on Immovable Property Tax in Kosovo or the 2018 amended Law on Tax Procedures and Tax Administration in Serbia.

2.4.2 Coding Procedures

Using the matrix shown in Table 2.2, the discretionary power of each layer of government is coded for each identified tax revenue source, and across four types of decision dimensions: instrument, base, rates and administration. Following the

conceptual basis of tax assignment (Shah, 1994), the four dimensions are described as follows:

- *Instrument* refers to the ability of each government tier to establish or alter an existing instrument. In most countries, the tax instruments are introduced by central authorities and applicable to all jurisdictions.
- *Base* refers to the discretionary power of each government tier over defining the taxable base or granting reliefs.
- *Rate* refers to the discretionary power of each government tier over the setting of tax rates. In cases where central authorities define an interval, and sub-national authorities set the appropriate rate for their respective jurisdictions, the coding reflects a joint decision.
- *Administration* refers to the involvement of different government tiers in tax and revenue administration.

The three most common government layers are identified as *"C"* for the central or federal government, *"I"* for the intermediate level (state or provincial authorities), and *"L"* for the local government. A full discretion by one government layer is identified as such by a single letter referring to that layer, whereas a joint decision – carried out by more than one layers – is identified as such through a combination of letters. For instance, if the vehicle tax rate is jointly set by central and local authorities, the coding is set as *"C,L"* in the corresponding cell (see Table 2.2). The matrix thus conveys the assignment of tax-related decisions to the government tiers in each country. The unit of analysis is the country level. Unlike the Regional Authority Index, the *TRA* does not convey the discretion of autonomous or special regions within a country over tax matters, but rather the rights granted to broader jurisdictions or tiers of government based on existing legal texts.

In cases where central authorities define an interval for the tax rates, and sub-central authorities set the appropriate rate for their respective jurisdictions, the coding reflects a joint decision. The setting of tax rates on property taxes often occurs as a joint decision. In South Africa for instance, while the municipality can set the tax rates on property tax according to the Constitution (229-2-a), the Municipal Property Rates Act of 2014 imposes limits on the tax rates, as a preventive measure to constrain harmful consequences of local tax policies and competition. Sub-national discretionary powers over the tax rates and tax base do not necessarily go hand in hand. For instance, in Bulgaria, while municipalities can set the rates of local taxes within the legal limits,

Table 2.2: Coding Procedures

	Income				Property		Consumption			Others				
C: Central I: Intermediate L: Local	Corporate Income Tax	Business Tax	Personal Income Tax	Payroll/Withholding	Property	Transfers of Property	Sales/VAT/Turnover	Excise	Fuel	Industry and Trade	Vehicles	Gambling	Stamps	Natural Resources
Country Name														
Instrument	C	C	C	C	C	C	C	C	C	C,I	C	C	C	C
Base	C	C	C	C	C,I	C,L	C	C	C	C,I	C	C	C	C
Rate	C	C	C	C	I,L	I,L	C	C	C	C,I,L	C,I	I,L	C	C
Administration	C	L	C	C,I	I,L	L	C	C	C	C,I,L	I,L	L	C,L	C

Source: Author's. Matrix originally from the WBQD (World Bank Group, 2000).

they are not permitted to set the local tax bases or provides any grant reliefs to taxpayers. In Mauritania, the General Tax Code grants municipalities the authority to levy additional cents from national taxes within their territory as long as it respects the same tax base.

The coding reveals substantial variations across countries and within groups of countries that share a similar political structure – federal or unitary. While in most federal countries, the implementation of specific tax instruments is set by federal law, in the United States, seven states do not carry a state income tax. Such discretionary power thus implies that the coding for "*instrument*" on the personal income tax for the United States reflects both the state and the federal government involvement. The leeway on the tax bases and the granting of reliefs by sub-national authorities are also restricted in some federal countries. For instance, in Austria, the payroll tax base and rate are both fixed uniformly across local jurisdictions whereas in the Federal Republic of Malaysia, local governments have very limited leeway in deciding over the tax rates while the tax bases are set by central authorities.

In some countries, municipal governments are granted the rights to a surtax on the personal income tax – like in Finland, Montenegro or Italy – or a surtax on the corporate profit tax like in Portugal (*derrama*). The surtax is taken into account in the coding if it implies additional discretionary power to some government tiers, either over its implementation, the definition of the base, the rate or its administration. For instance, in Finland, the base of the surtax is set by central authorities – thus a single-handed decision on *"base"* whereas in Italy, the municipal governments have some leeway on the rates of the surtax on personal income (named *imposta addizionale comunale*) although the legal texts state that the rate should be set within a specific limit. The existence of a surtax on income or corporate income tax, yet, remains rare. In most countries, such as in Indonesia, sub-national governments are prohibited by law from

instigating any surtax on nationally defined tax instruments.

The coding on tax administration also indicates some key variations across countries. While Austria and Argentina are both federal countries, the tax administration in Austria is highly centralized compared to Argentina where some provincial governments may have independent tax authorities and where the auditing of the provincial tax offices may proceed under different modalities. In countries like Benin or Haiti, most of the sub-national revenues are collected through a centralized Treasury System (*Direction Générale des Impôts*) that collects local taxes on behalf of local governments. This structure is, however, not generalizable to all developing and emerging economies. In the Federal Republic of Nigeria, each state may legally collect and administer the state taxes. Beyond the federal structure, unitary countries like Cameroon (since 2009) and Uganda grant local authorities some discretion to levy their own taxes and fees. These differences are often not reflected in existing datasets or their underlying coding procedures. Section 2.5 provides some key stylized facts on these cross-country variations.

2.4.3 Scoring Procedures

Conceptually, and as often operationalized in existing empirical research, tax decentralization refers to the assignment of tax revenues across government layers. In the System of National Accounts (SNA 2008/ESA 2010), the share of tax revenues allocated to sub-national authorities include both shared, own-source and self-collected tax revenues, regardless of the vertical decision structure.

The concept of sub-national tax autonomy, on the other hand, conveys the discretionary power of sub-central authorities over the fiscal space. So far, tax or fiscal autonomy, as in the OECD and RAI datasets, has been measured as the ability of sub-central authorities to set tax rates, tax bases and grant reliefs on several tax instruments. As described in the coding procedures above, the *TRA* goes beyond these two dimensions to focus on a much broader framework and also provides a level of granularity on decisions regarding specific instruments – such as income, consumption and property taxes. Therefore, beyond the adopted concept of tax autonomy, I recur to the tax assignment problem – expressed through the seminal question of Musgrave (1983) *"Who Should Tax, Where and What?"* – and the related theoretical perspectives to argue that the concept of "Tax Assignment" is a better reflection of the essence of the *TRA* dataset and its contents, as I attempt to provide empirical answers to the question: *"Who taxes, Where and What?"*.

Using the information from the coding matrix (see Table 2.2), the following scoring method is applied to derive a score for each decision dimension. Let T be the number of tax instruments (e.g. corporate income tax, business tax, personal income tax) and S the number of instruments upon which sub-central governments have a certain degree of authority ($S \leqq T$). D_s is a binary indicator for the involvement of lower-tier governments in the decision-making process. D_s equals 1 if sub-national authorities (intermediate or local, or intermediate and local) are involved in the decision process, or 0 otherwise. α is a scoring weight which is equivalent to $1/2$ for a joint decision and 1 for a single-handed decision. If A_d is a score on each assignment decision, with $d \in \{1 = \text{instrument}, 2 = \text{base}, 3 = \text{rate}, 4 = \text{administration}\}$ (such that A_2 refers to the overall discretionary power of subnational governments over the setting of tax rates), then A_d is given as follows:

$$A_d = \frac{\sum_{s=1}^{S} \alpha D_s}{\sum_{i=1}^{I} T_i} \tag{2.1}$$

$$\text{with} \quad \alpha = \begin{cases} 1/2 & \text{if decided by central AND sub-national authorities (e.g. "C,L")} \\ 1 & \text{if decided by central OR sub-national authorities (e.g. "C" or "L")} \end{cases}$$

The resulting indicators (A_d) on these four dimensions facilitate in-depth analyses into different aspects of the multi-layer tax structure across countries. They allow for comparison of the management of specific tax instruments – such as the personal income tax or property tax – whose base, rate and administration may not be uniformly defined by the same government layer across countries. As I account for central vs sub-central authorities, the main scoring procedure is such that $(C, I, L) = (C, I) = (C, L) = 1/2$. In line with the above discussion, if the rate on a particular instrument is set by national laws but sub-national authorities have some leeway in deciding over the final rate for their respective jurisdictions, the scoring reflects that joint decision through this method.

An overall index is obtained by averaging the scores on the four decision dimensions. It is labelled the *"Tax Assignment Index" (TAI)*. The aggregated indicator stands as the overall taxing rights of sub-national governments over the tax system in each given country and is a reflection of the legal taxing powers granted to lower-tier authorities both across existing instruments and decision dimensions. These scores on the types of decision (A_d) are, by extension, referred to as, for instance, the *"Tax Rate Assignment (TRA)"* and *"Tax Administration Assignment (TAA)"*. The scoring procedure

is illustrated in Table 2.3.

$$TAI = \frac{\sum_{d=1}^{4} A_d}{4} \tag{2.2}$$

Table 2.3: Main Scoring Procedures

	Income				Property		Consumption			Others					Scoring	
C: Central I: Intermediate L: Local	Corporate Income Tax	Business Tax	Personal Income Tax	Payroll/Withholding	Property	Transfers of Property	Sales/VAT/Turnover	Excise	Fuel	Industry and Trade	Vehicles	Gambling	Stamps	Natural Resources	Assignment Score	Tax Assignment Index
Country Name																***0.22***
Instrument	C	C	C	C	C	C	C	C	C	C,I	C	C	C	C	0.04	
Base	C	C	C	C	C,I	C,L	C	C	C	C,I	C	C	C	C	0.11	
Rate	C	C	C	C	I,L	I,L	C	C	C	C,I,L	C,I	I,L	C	C	0.29	
Administration	C	L	C	C,I	I,L	L	C	C	C	C,I,L	I,L	L	C,L	C	0.46	

Source: Author's. Matrix originally from the WBQD (World Bank Group, 2000).

In addition to the *Tax Assignment Index (TAI)*, it can also be derived indicators related to specific tax instruments or decisions. For instance, a joint score combining the discretion solely over rates and administration can be derived as follows: $TAI_{2,3} = \frac{A_3+A_4}{2}$. An aggregate score can also be calculated by considering the main tax instruments – income, consumption and property taxes, leaving aside other tax revenues such as on vehicles, gambling and stamps. Inversely, the relative importance of central versus sub-national authorities in deciding over tax matters can also be quantified using the same matrix for each country.

Alternative Scoring Procedures

In many countries, including some unitary states, the intermediate level of government carries discretionary power over the tax system, as displayed by the coding matrix (Table 2.3). Regional governments can either single-handedly decide over specific dimensions or join the central and (or) local-level authorities in taking such decisions. Bundling the intermediate and local levels and assigning a single weight to *"sub-national"* authorities as a whole might undermine the relevance of regional and local authorities relatively to the central government. Therefore, an alternative scoring approach is adopted whereby I assign a specific weight to regional authorities such that, in joint decisions that involve the central, intermediate and local governments *"(C, I, L)"*, $\alpha = 2/3$ instead of $1/2$. As indicated in Table 2.4, the alternative scoring procedure induces a minor deviation in the overall *"Tax Assignment Index"*, and the

said deviation is only observed for a few countries (see Figure A2.1 in Appendix 2).

Table 2.4: Alternative Scoring Procedures

	Income				Property		Consumption			Others					Scoring	
C: Central I: Intermediate L: Local	Corporate Income Tax	Business Tax	Personal Income Tax	Payroll/Withholding	Property	Transfers of Property	Sales/VAT/Turnover	Excise	Fuel	Industry and Trade	Vehicles	Gambling	Stamps	Natural Resources	Assignment Score	Tax Assignment Index
Country Name																***0.23***
Instrument	C	C	C	C	C	C	C	C	C	C,I	C	C	C	C	0.04	
Base	C	C	C	C	C,I	C,L	C	C	C	C,I	C	C	C	C	0.11	
Rate	C	C	C	C	I,L	I,L	C	C	C	C,I,L	C,I	I,L	C	C	0.30	
Administration	C	L	C	C,I	I,L	L	C	C	C	C,I,L	I,L	L	C,L	C	0.48	

Source: Author's. Matrix originally from the WBQD (World Bank Group, 2000).

2.5 Core Findings

Figure 2.2 illustrates the *"Tax Assignment Index"* across countries. The dataset covers a total of 171 countries, most of which are developing and emerging economies. For each country, it is identified at least the major tax instruments: income, consumption and property taxes. The overall index ranges from 0 to 0.793, with the highest scores associated with federal countries such as the United States, Switzerland and Canada where the federated states, cantonal and provincial governments are greatly involved in tax-related decisions. In the United States, more particularly, most tax instruments can be altered by state-level policies.

Notwithstanding, some important variations exist across federal countries. Compared to the United States, Switzerland or Germany, the Federal Republic of Malaysia and Austria score very low on the index as the discretionary power of sub-federal governments on tax matters in those countries is very limited and to some extent comparable to nominally unitary states. The Islamic Republic of Sudan stands out as a peculiar case in Sub-Saharan Africa. In-depth research suggests that the score is driven by an uncoordinated fiscal system where sub-national governments have discretion over the setting of rates on several revenue sources (Fjeldstad, 2017). It is also noted that the tax system remains highly centralized in many countries as depicted in Figure 2.2.

Figure 2.3 depicts the *"Tax Assignment Index"* according to the income status of countries in 2016 (based on the World Bank income classification). While it might be assumed that sub-central governments in rich countries have greater bureaucratic

capacity and, thus, a greater ability to levy taxes and fees, the data show that sub-national governments in some high-income countries have a comparable level of taxing rights (as measured by the *Tax Assignment Index*) with middle-income countries and vice-versa. Therefore, income level and economic performance do not appear to be the main or the sole determinants of the observed variations across countries.

2.5.1 Primary Instruments: Income, Consumption, and Property Taxes

Income, consumption and property taxes constitute the bulk of tax revenue in most countries. While there are minor cross-country differences in other tax instruments, those are uniform across most countries in the dataset. The indicators that are therefrom derived might seem more appropriate for certain empirical enquiries. Figure 2.4 shows the correlation between the main indicator (*Tax Assignment Index*) and the one constructed with solely income, consumption and property taxes. The overall ranking remains unchanged with respect to most countries. Sub-central authorities in federal countries such as the United States, Canada and Switzerland remain highly involved in decisions regarding income, consumption and property taxes.

However, the correlation depicted in Figure 2.4 suggests some deviations for countries such as Argentina, Belgium and the Czech Republic which score much higher in the former (*Tax Assignment Index*). The figure suggests that sub-federal or sub-central authorities in these countries have high-level of decision-making across the board but much less discretion over these three primary tax revenue instruments. Explanations for these deviations are found in the literature and information sources. Argentina, for instance, is known for having a high-level of tax sharing system based on the principle of *coparticipación* which leaves little scope to provincial governments to decide over income and consumption tax revenues, although provincial authorities carry a type of sales tax known as *Ingresos Brutos* (Besfamille et al., 2017). The reverse is observed for Brazil whereby the *"Tax Assignment Index (Income, Consumption Property)"* is much higher than the former, which is explained by the discretion of state governments over consumption taxes (State VAT) and the property tax.

A tax on the value of properties (lands and buildings) is the most commonly assigned to local governments. The debate on the nature of property tax has regained importance since the 1990s as many developing and emerging economies joined the waves of decentralization reforms. Public finance economists have recommended property tax as an ideal revenue source for lower-tier governments (Oates, 1972;

Figure 2.2: Discretionary Power of Sub-Central Governments over the Tax System: The Tax Assignment Index

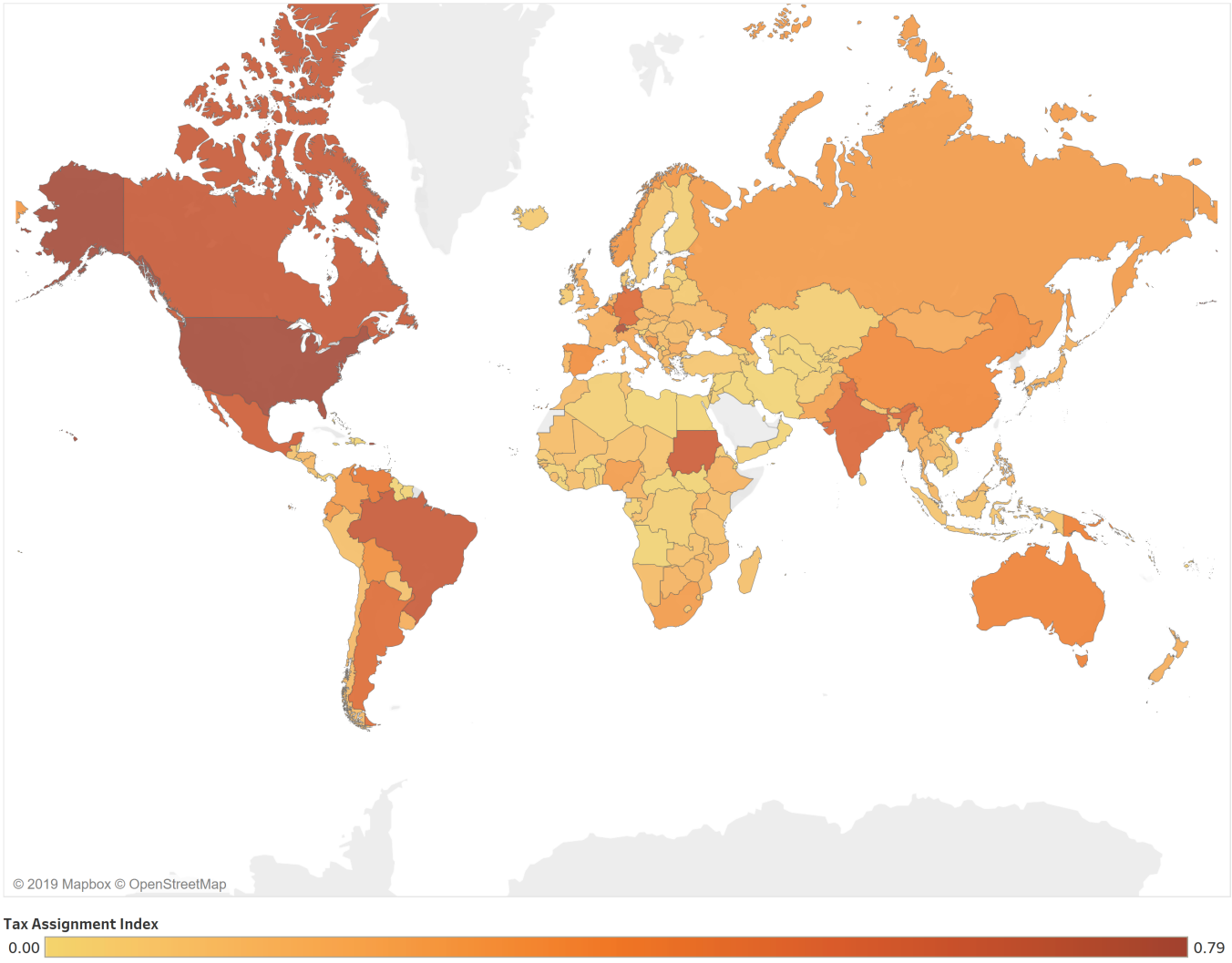


Figure 2.3: Discretionary Power of Sub-Central Governments over the Tax System:
The Tax Assignment Index by Income Level

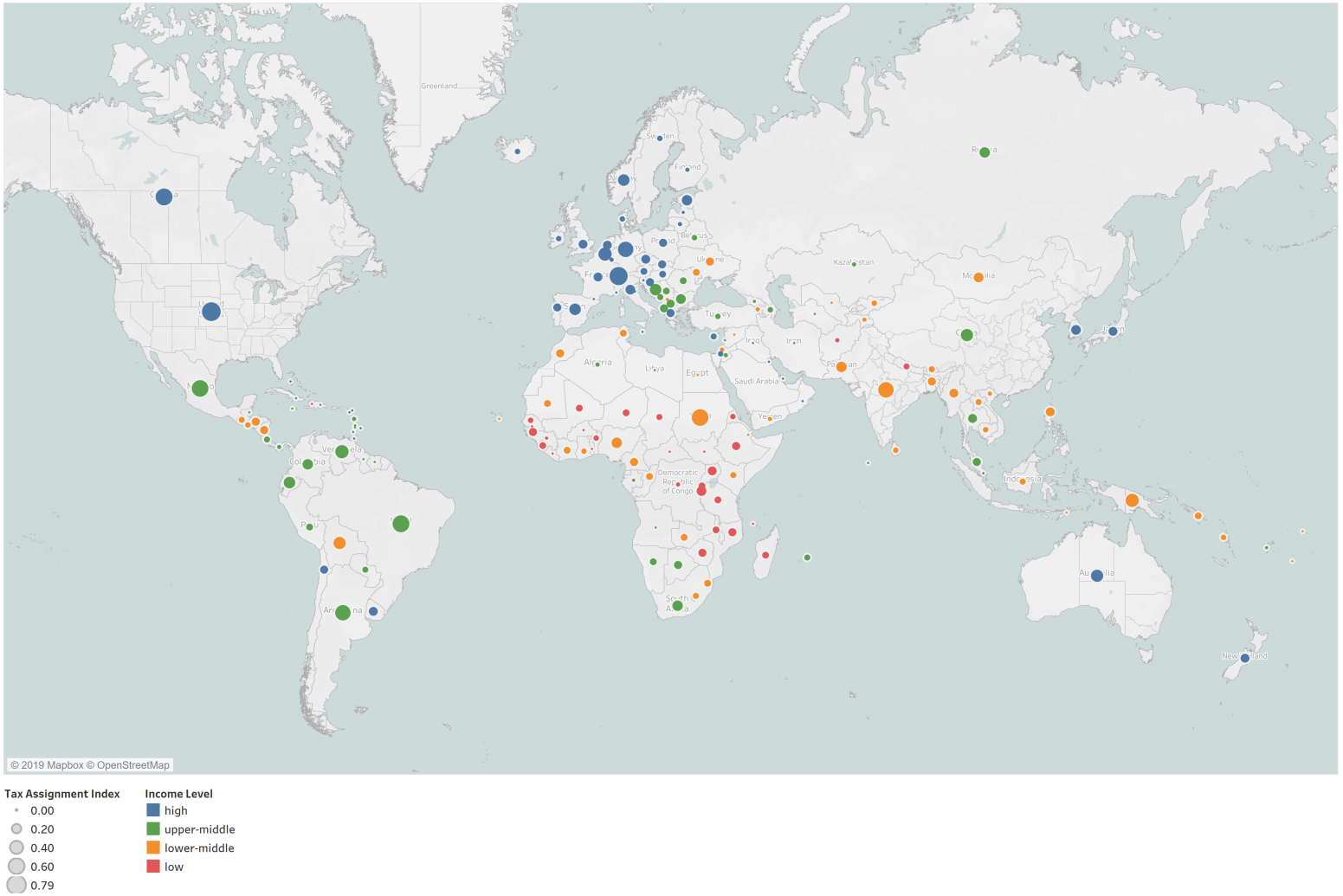


Figure 2.4: Discretion of Sub-Central Governments over the Tax System
Overall vs Main Tax Instruments (Income, Consumption and Property)

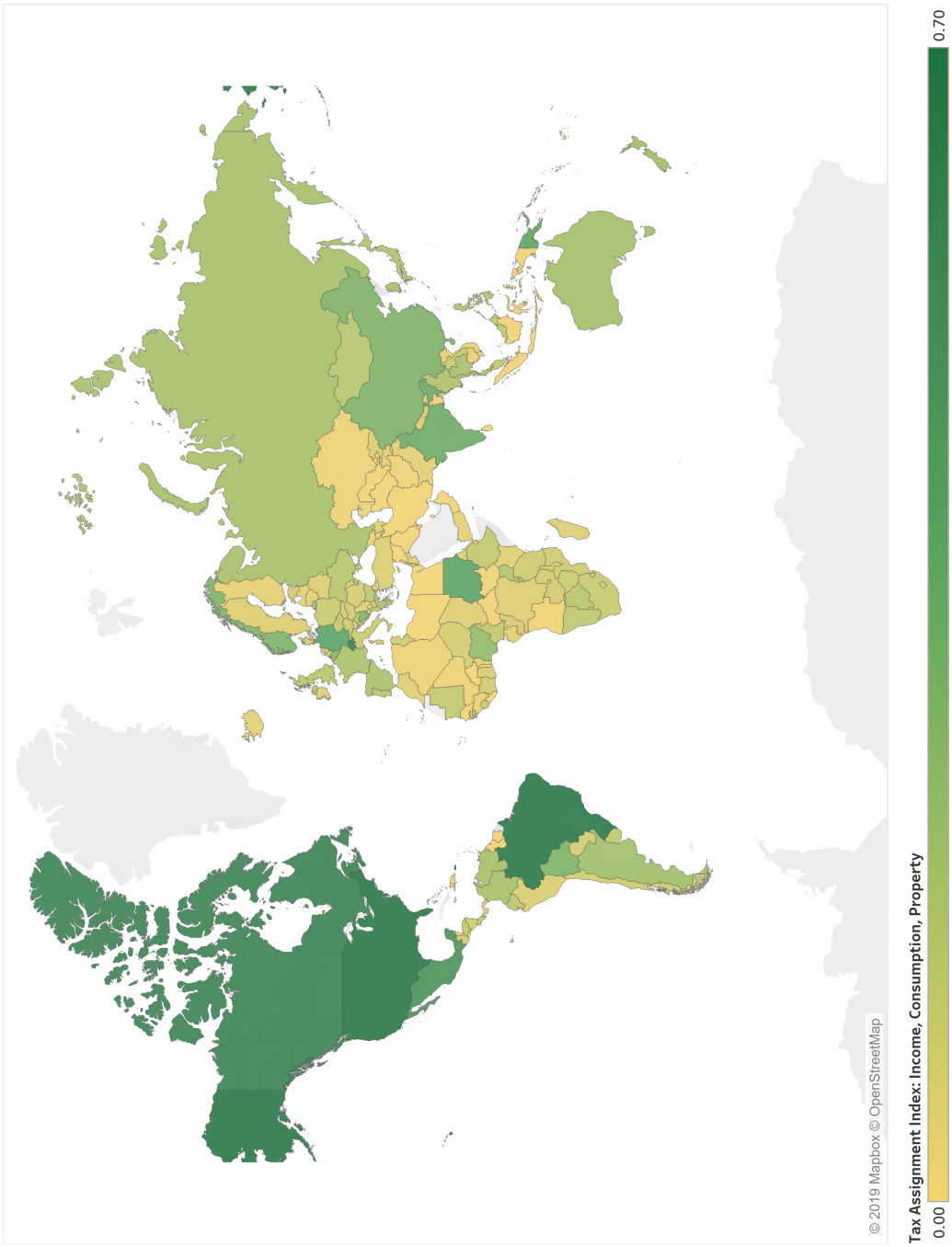


Figure 2.5: Discretion of Sub-Central Governments over the Tax System
Income, Consumption and Property Taxes

Bird, 1999). However, it has also been pointed out that sub-central governments in many decentralized countries have predominantly been unable to efficiently mobilize revenues from property tax (McCluskey, 1999; Martinez-Vazquez and Rider, 2008).

While the discussion on the appropriate level of property tax assignment is beyond the scope of this chapter, an indicator of sub-central decision-making power on property tax is derived for the country sample. It is evidenced that, in many countries, sub-national government authorities have some discretion over property taxes, especially on the setting of tax rates and tax administration (see Figure A2.2 in Appendix 2). The coding from the dataset also often reflects the coordination between central and sub-national authorities on the setting of property tax rates – a feature which is regarded as a joint decision and coded as such (see subsection 2.4.2).

2.5.2 Sub-national Discretion over Tax Rates and Tax Administration

As suggested above, the *Tax and Revenue Assignment* dataset facilitates in-depth analyses of the types of decision assigned to different government tiers. In Figure 2.6, I compare the sub-central discretionary power over the setting of the tax rates and tax administration. It indicates that countries differ quite significantly in the decisions that are assigned to sub-central governments. The contrasts between the size of the bubble (administration) and the colour shades (rate) point to considerable variations across countries, although it is denoted a positive and significant correlation between the two indicators.

While sub-federal governments in the United States and Germany have comparable involvement in tax administration, the discretionary power over the setting of tax rates is much lower in Germany in comparison to the United States. In China, while the provincial governments are actors in tax administration (until 2017), their discretion over the setting of tax rates on primary tax instruments is somewhat limited. These comparisons put forward the complexity of the tax structure across government layers and across countries, which is very much under-researched in the existing literature. They also shed lights on the discrepancy between the conventional classification of countries into unitary and federal states, and the legal assignment of discretion power over the tax system.

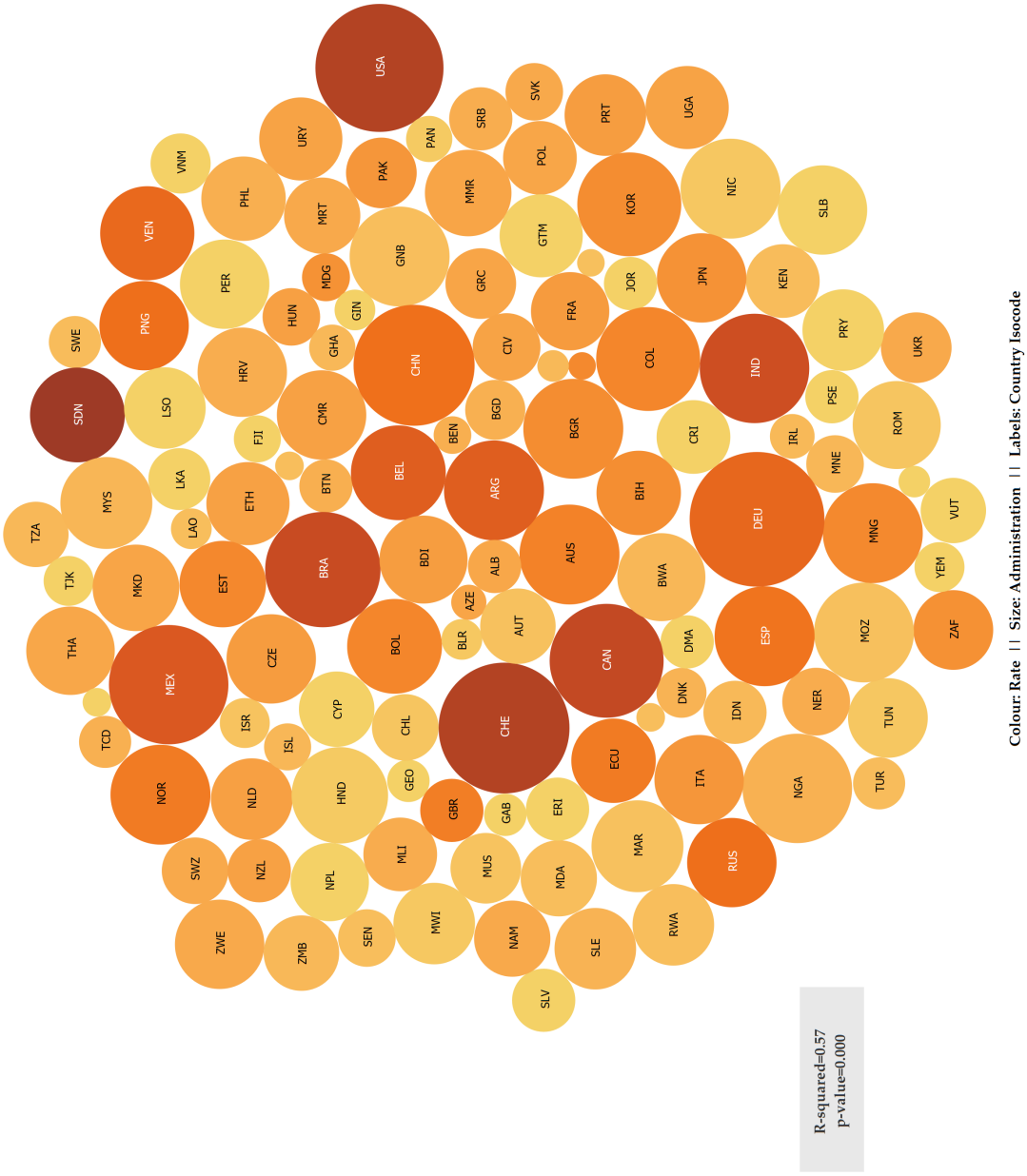


Figure 2.6: Sub-Central Government Discretion over Tax Rates and Tax Administration

2.5.3 Contrast with National Accounts Statistics

The most conventional measure of tax decentralization is the ratio of sub-national tax revenue in consolidated general government (or public) tax revenue. This proxy however fails to inform on the vertical decision structure over tax revenue instruments, as so frequently pointed out in the existing literature (Stegarescu, 2005; OECD, 2013). Still, in Figure 2.7, I contrast the ratio of sub-national government in consolidated general government tax revenue for income, property and consumption taxes for the fiscal year of 2016, with the corresponding *"Tax Assignment Index (Income, Consumption, Property)"* for the same instruments. The limited availability of national accounts statistics constrains this comparison to a sample of 75 countries. While there exists a positive and significant correlation between the two, the data suggest that for several countries, the budgetary ratio overestimates the extent of tax decentralization.

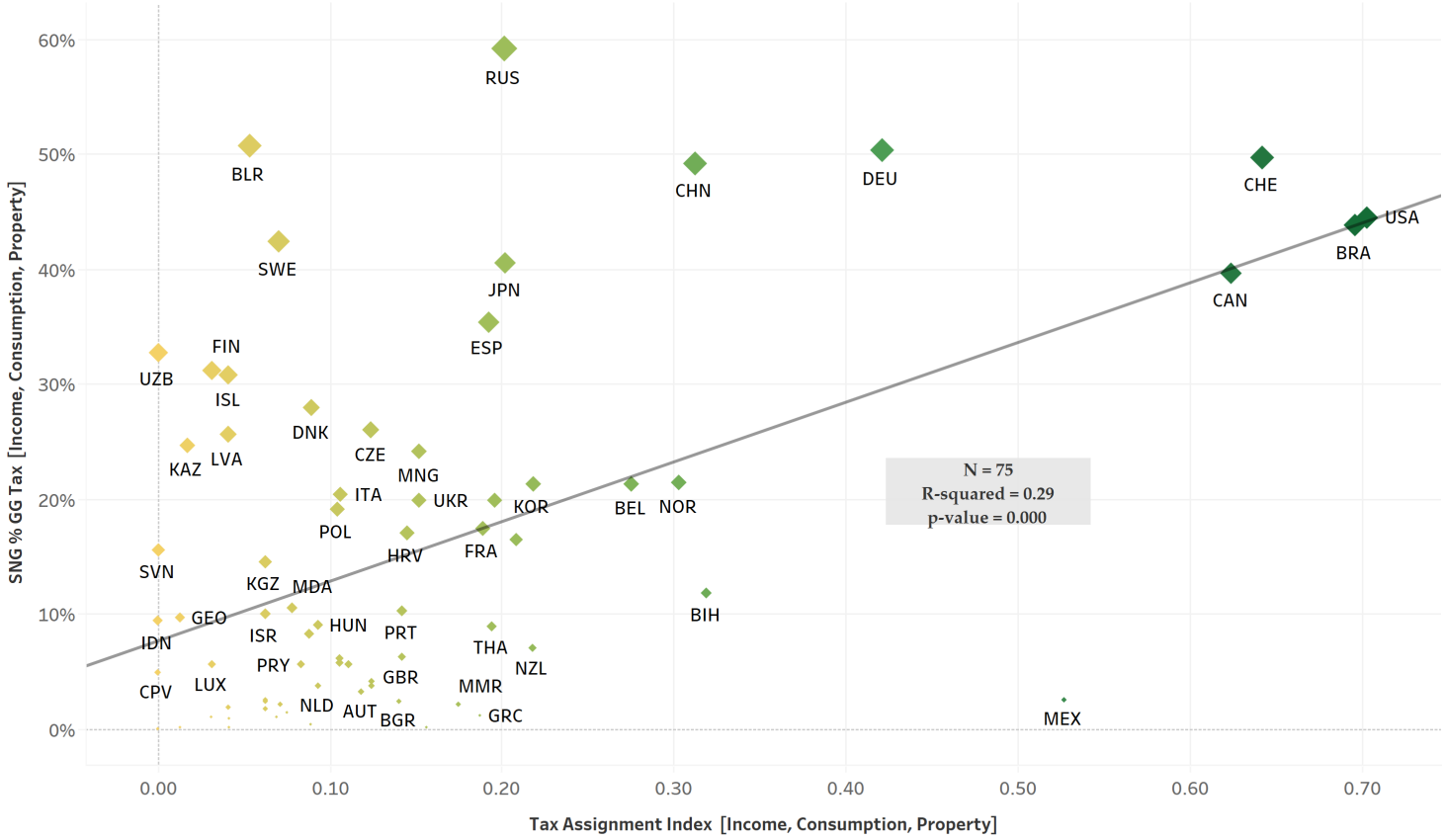
In countries such as Russia, Belarus, Sweden, and Japan, sub-central authorities carried more than 40% of the total tax revenues on income, consumption and property taxes in 2016. However, sub-central authorities have limited power over these instruments, and the high budgetary shares are likely to be driven by shared tax revenues. It must also be pointed out that in most developing and emerging economies, consumption and income tax revenues are transferred as fiscal grants, and are often not reflected as tax revenues in national accounts.

2.6 Validation and Limitations

Section 2.5 describes some of the key comparative findings from the *TRA* dataset. Overall, the data suggest that the discretionary power of sub-central governments over existing tax instruments varies quite significantly across countries and types of decision. While most of these features, described in section 2.3, are new to the literature, the new dataset remains a complement rather than a substitute to previous works. It is therefore worth assessing how these newly constructed indicators on sub-national governments taxing rights resemble or differ from the most comparable existing ones.

Table 2.5 displays the correlation between the newly constructed indicators, the OECD tax autonomy index (which is weighted by the monetary size of own-tax revenues) and the RAI fiscal autonomy. I also include the conventional measures of tax decentralization which have been at the centre of most empirical research in the field.

Figure 2.7: The Tax Assignment Index vs. Budgetary Ratio on Tax Revenue
Income, Consumption and Property Taxes



Notes

Budgetary Ratio (SNG % GG Tax Revenue): Share of Subnational Government in Consolidated General Government Tax Revenue for Income, Consumption and Property Tax

Data Sources: International Monetary Fund - Government Finance Statistics, Fiscal Year: 2016

The table suggests a positive and statistically significant correlation between the new indicators from the *TRA* and the proxies of tax autonomy and tax decentralization. It is noted that the correlation with the OECD tax autonomy is much higher when I follow the same strategy by weighting the *Tax Assignment Index* with the share of sub-national tax revenue in consolidated general government tax revenue for OECD member states, and despite the methodological differences. The correlation with the fiscal autonomy component of the RAI is also high, which may partly be explained by the larger sample size and the inclusion of emerging economies in Latin-America, for instance.

The new dataset also has some limitations which are addressed in here. First, it is so far cross-sectional; yet, the dataset should be seen as an evolving one. The integration of new details regarding tax reforms in each country is worth pursuing in the near future. As intergovernmental fiscal data remain scarce, time-series information on multi-tier fiscal relations would facilitate research on a broader range of topics at the cross-section of public, institutional and development economics.

Second, the nature of the information sources used in the construction process is heterogeneous. As indicated in subsection 2.4.1, the sources range from legal provisions to policy reports to scientific and grey literature. While the legal and policy documents take precedence over the other sources of information, I acknowledge that there might be some discrepancies between the legal prescriptions and the reality within countries. It is, however, understood that the legal prescription provides each government authority the means to claim their rights over specific tax instruments.

Third, unlike the RAI, the *TRA* is constructed with the country level as the unit of analysis. As such, it does not differentiate between regions or provinces within a given country. Special rights and attributions to autonomous governments are thus not taken into account given that the coding reflects the right granted to broader jurisdictions in each given country. Any regional discretion over the design or implementation of a tax instrument is captured through the dimensions listed in the coding matrix. Apart from income, consumption and property taxes, the nature of other tax instruments also varies. Comparative analyses of the discretionary power over minor taxes are to be done with care to avoid any misleading conclusions. It is, however, reassuring that the aggregated indicators with or without other taxes do not differ much for most countries (see Figure 2.4).

Table 2.5: Correlation of Key Indicators: Tax Assignment Index, Tax Autonomy and Tax Decentralization

	TAI	TAI(*)	TAI (*I,C,P)	TAI (base & rate)	SNG % GG Tax	SNG % GG Revenue	TAI × SNG%GG Tax	TAI(*) × SNG%GG Tax	RAI Fiscal Autonomy	OECD Tax Autonomy
TAI	1									
TAI(*)	0.999***	1								
TAI (*I,C,P)	0.961***	0.961***	1							
TAI (base & rate)	0.990***	0.989***	0.948***	1						
SNG % GG Tax	0.557***	0.563***	0.590***	0.524**	1					
SNG % GG Revenue	0.634***	0.642***	0.612***	0.625***	0.765***	1				
TAI × SNG%GG Tax	0.874***	0.874***	0.885***	0.852***	0.797***	0.651***	1			
TAI(*) × SNG%GG Tax	0.873***	0.873***	0.884***	0.850***	0.803***	0.655***	1.000***	1		
RAI Fiscal Autonomy	0.759***	0.768***	0.747***	0.762***	0.576***	0.635***	0.688***	0.692***	1	
OECD Tax Autonomy	0.522**	0.525**	0.566***	0.508**	0.921***	0.775***	0.756***	0.759***	0.583***	1

Notes: Significance level * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. (*) implies that the indicator has been revised to account for the relevance of intermediate level of governments in joint decisions with central and local authorities; (I,C,P) refers to measurements that solely take into account the discretion over income, consumption and property taxes. TAI stands for the *Tax Assignment Index*. TAI(base&rate): Tax Assignment Index which solely takes into account sub-national government discretion over the setting of tax rates and tax base (not including their decision power over the instruments per se or over tax administration). SNG stands for sub-national governments; GG stands for consolidated general government. SNG%GG indicators are averaged over the period of 2010 to 2017. TAI × SNG%GG Tax and TAI(*) × SNG%GG: The Tax Assignment Index (also from the alternative scoring procedures) weighted by the budgetary share of tax revenue assigned to lower-tier authorities.

2.7 Decentralization and Growth Revisited

The global tendency towards decentralizing the public sector in recent decades has triggered a new wave of academic and policy discussion on the benefits and drawbacks of such reforms. Empirical enquiries on the impact of decentralization on economic performance (Woller and Phillips, 1998; Lin and Liu, 2000; Martinez Vazquez and McNab, 2003; Baskaran et al., 2016), public services delivery (Ahmad et al., 2005; Ahmad and Brosio, 2009; Caldeira et al., 2012), corruption (Fisman and Gatti, 2002; Fjeldstad, 2004), or its indirect impact through the rule of law and quality of institutions (Mauro et al., 2018), have considerably expanded.

Pioneer research on the economics of fiscal decentralization was primarily centred around the canonical role of the government, understood as wealth redistribution, resource allocation and macroeconomic stabilization (Musgrave, 1959; Tiebout, 1961; Oates, 1972, 1977). Scholars of this strand – generally referred to as the first-generation literature – questioned the state's efficient provision of public services and developed their works under the assumptions of a benevolent government, guardian of public interest. This strand is particularly notable for theorizing that under certain conditions, decentralization welfare-dominates centralized provision of public services.

Notwithstanding, the mechanisms through which fiscal decentralization could foster economic performance are not straightforwardly theorized or stated. As a result, initial empirical enquiries on the relationship between fiscal decentralization and economic performance derived their hypotheses from the potential benefits of the former – primarily economic efficiency – which are regarded as growth-enhancing. Theoretically, this conjecture is anchored in the premise that the informational advantage of local governments guarantees a certain level of adequacy between residents' demands and public policies, thereby rendering public service delivery economically efficient (Oates, 1972, 1977). With the voting-by-feet (Tiebout, 1956, 1961), citizens would also choose the locality with the set of policies and the tax rates that match their tastes, while communities are forced to keep the production costs at a minimum. Decentralized decision-making is therefore expected to positively correlate with economic growth through better public services delivery and targeting, lower production costs and prices, and better incentives to all economic actors.

The second mechanism through which fiscal decentralization is expected to impact on economic performance growth stems from the public choice literature or the *"Leviathan restraint hypothesis"* proposed by Brennan and Buchanan (1980). Authors of this strand departed from the benevolent view of government to argue that authorities

are revenue maximizers and would pursue their own objectives of extracting most of the economy by raising taxes and acquiring debts even when constitutional mandates dictate otherwise. Hence, by inducing competition for mobile tax bases, fiscal decentralization puts a hold on governments' extractive intents and limits rent-seeking behaviours, which are ultimately growth-enhancing. In the new generation literature on fiscal federalism, Oates (2005), Weingast (1995, 2009, 2014) and others have also argued that under certain conditions, appropriate intergovernmental fiscal arrangements, may foster resource allocation and policy innovation which promote growth. Contributions to the new generation literature often depict China as an example where the intergovernmental fiscal contract of the 1980s appears to have created a credible environment for local authorities to boost enterprises development, which ultimately lead to the economic success of the country (Weingast, 1995, 2009; Qian and Weingast, 1996; Zhuravskaya, 2000).

To date, however, the existing evidence on the linkages between fiscal decentralization and economic growth remains inconclusive and ranges from positive (Iimi, 2005; Buser, 2011; Ligthart and van Oudheusden, 2017), to null (Woller and Phillips, 1998; Enikolopov and Zhuravskaya, 2007; Bodman, 2011; Asatryan and Feld, 2015), to negative (Davoodi and Zou, 1998; Rodriguez-Pose and Ezcurra, 2011). The positive effect of fiscal decentralization on economic performance has been corroborated by numerous case-studies, mostly in federal or quasi-federal countries (Zhang and Zou, 1998; Lin and Liu, 2000; Akai and Sakata, 2002), whereas multiple cross-country studies lean towards a null or a negative effect of the reform.

For instance, Woller and Phillips (1998) studied the relationship between the level of fiscal decentralization and economic growth rates across a sample of 23 least developed countries (LDCs) from 1974 to 1991 and found no systematic relationship among the two. Asatryan and Feld (2015) also found no robust relationship between economic growth and fiscal decentralization in 23 OECD countries. Davoodi and Zou (1998) using data of 46 countries found a negative correlation between fiscal decentralization and growth in developing nations, but none in developed economies. Rodriguez-Pose and Ezcurra (2011), on a set of 21 OECD countries, found a significant and negative association between fiscal decentralization and economic growth, despite the inclusion of several control variables and adjustments to account for differences in expenditure preferences by sub-national governments. Country case-studies to have found a negative correlation include Xie et al. (1999) and Zhang and Zou (1998).

Other contributions have pointed to a U-shaped relationship between fiscal decentralization and economic performance. For instance, Thiessen (2003), analyzing the long-run relationship between decentralization and per capita economic growth,

concluded that the relationship is positive when fiscal decentralization is increasing from low levels, reaches a peak and turns negative. On the case-study front, Yang (2016), on a panel data for 29 Chinese provinces over the period 1990–2012 confirmed the presence of an inverted U-shaped relationship between decentralization and growth. Other research findings suggest that the magnitude or direction of the effect depends on how decentralization is measured (e.g. revenue versus expenditure decentralization). Gemmell et al. (2013), on a set of OECD countries, found that spending decentralization (revenue decentralization) tend to be associated with lower (higher) economic growth. In Baskaran and Feld (2013), fiscal decentralization holds a statistically insignificant negative effect on growth when measured by budgetary ratios, but a statistically negative correlation with indicators of sub-national tax autonomy. Many have also pointed to an indirect effect through institutional frameworks and quality of institutions (Feld and Schnellenbach, 2011), macroeconomic stability and government quality (Martinez Vazquez and McNab, 2003), local social capital (Hooghe and Marks, 2003), civicness and the rule of law (Mauro et al., 2018), inter-regional demand for public goods (Brueckner, 1999), investment in human capital (Brueckner, 2006), and geography (Canavire-Bacarreza et al., 2020).

Table 2.6 provides a summary of the most notable cross-country empirical studies on the relationship between fiscal decentralization and economic performance. It conveys three important facts. First, most of the existing literature focuses on OECD and high-income countries, where the access to reliable and long-series data on central and sub-national governments is more prominent. Second, much of the existing research failed to account for the discretionary power of sub-central authorities. Budgetary ratios such as the share of sub-national government revenue and expenditure in national accounts remain the most common proxies for the level of fiscal decentralization. Third, of the studies that consider the level of tax autonomy or discretionary power of sub-central authorities, none – to the best of my knowledge – has included a large sample of developing and emerging economies.

The empirical analysis in this chapter, therefore, contributes to the existing literature in three important ways. First, it considers a large sample of 125 countries, 90 of which are middle- and low-income economies for which this topic remains highly unexplored. Second, it focuses primarily on the tax assignment dimension of fiscal decentralization and not a comprehensive or national accounts-based measurement of fiscal decentralization. Decentralizing tax-related decisions is often regarded as an extensive form of decentralization given that taxation plays a crucial role in macroeconomic stabilization (Feltenstein and Iwata, 2005; Martinez-Vazquez and McNab, 2006; Feld and Schnellenbach, 2011). To the best of my knowledge, this chapter

Table 2.6: Notable Cross-country Studies on Fiscal Decentralization and Economic Performance

Authors	*Coverage*	*Category*	*Time period*	*Direction of the Effect*	*SNG Tax Autonomy*
Asatryan and Feld (2015)	23	OECD	1975-2000	None	Yes
Baskaran and Feld (2013)	23	OECD	1975-2001	None	Yes
Bodman (2011)	18	OECD	1981-1998	None	Yes
Buser (2011)	20	OECD	1972-2005	Positive (through institutions)	No
Canavire-Bacarreza et al. (2020)	67	OECD & Middle-Income Countries	1981-2012	Positive	No
Castles (1999)	21	OECD	1960-1992	None	No
Davoodi and Zou (1998)	46	OECD & Developing Countries	1970-1989	Negative	No
Enikolopov and Zhuravskaya (2007)	75	OECD & Developing Countries	1975-2000	None	No
Filippetti and Sacchi (2016)	21	OECD	1970-2010	Positive (depending on tax autonomy)	Yes
Gemmell et al. (2013)	23	OECD	1972-2012	Negative (expenditure), positive (revenue)	No
Iimi (2005)	51	OECD & Developing Countries	1992-2001	Positive	No
Ligthart and van Oudheusden (2017)	56	OECD & Developing Countries	1990-2007	Positive	Yes (OECD countries)
Martinez-Vazquez and McNab (2006)	66	OECD & Developing Countries	1972-2003	Negative	No
Mauro et al. (2018)	23	OECD	1975-2010	Positive then negative (inverted U-shaped)	No
Rodriguez-Pose and Ezcurra (2011)	21	OECD	1990-2005	Negative	No
Thiessen (2003)	25	OECD & 4 Developing Countries	1973-1998	Positive then negative (inverted U-shaped)	No
Thornton (2007)	19	OECD	1980-2000	None	Yes
Woller and Phillips (1998)	23	Developing Countries	1974-1991	None	No

Notes: Author's elaboration. SNG Tax Autonomy refers to studies that incorporate a variable that captures sub-national governments' taxing rights or tax autonomy.

is the first to propose such an analysis while taking into account the discretionary power of sub-national government authorities over tax-related matters in low-income countries in Sub-Saharan Africa, Latin-America and East-Asia. By doing so, the chapter joins the limited number of studies which explore how sub-national tax autonomy (so far in OECD member states) impacts on economic performance and whose results are so far inconclusive (Thornton, 2007; Bodman, 2011; Baskaran and Feld, 2013; Asatryan and Feld, 2015; Ligthart and van Oudheusden, 2017). Third, in the empirical framework, I do not only consider the overall *Tax Assignment Index*, described in section 2.4, but also zoom into specific decision structures – such as the setting of tax rates and tax administration. Such an approach allows me to investigate the relationship between different tax-related decision dimensions and economic performance for the country sample.

2.7.1 Model Specification and Data Sources

I use a non-formally derived growth regression model in which F stands for the level of fiscal decentralization with the corresponding coefficient of interest δ. Fiscal decentralization is primarily proxied by the *Tax Assignment Index*, which measures the level of sub-national taxing rights, as described in section 2.4. However, in sensitivity analyses, I also proxy fiscal decentralization with existing indicators such as the OECD tax autonomy or budgetary ratios (e.g. the share of subnational governments' tax revenue in consolidated general government tax revenue from national accounts statistics).

The model is built with insights from Davoodi and Zou (1998), which propose a formalization of the effect of decentralization on economic growth. Given the cross-sectional nature of the dataset, an ordinary least-squares model (OLS) is estimated as previously done in the literature (Ebel and Yilmaz, 2002; Thiessen, 2003; Iimi, 2005; Enikolopov and Zhuravskaya, 2007; Rodriguez-Pose and Ezcurra, 2011). Following Mauro et al. (2018) and Thiessen (2003), I postulate a non-linear relationship between the indicators of sub-national government taxing rights and economic performance. A quadratic term – F_i^2 – is therefore added to all specifications as indicated in Equation 2.3.

$$G_i = \alpha_0 + \delta F_i + \rho F_i^2 + \gamma' \mathbf{X} + \theta' \mathbf{I} + \psi' \mathbf{R} + \varepsilon_i \tag{2.3}$$

The dependent variable – G_i – is the average annual per capita GDP growth rate from

2010 to 2017. **X** is a vector of variables that capture the levels of human and physical capital and which are traditionally used in growth regression analyses. Physical capital is proxied by the average annual growth rate of gross fixed capital formation, whereas human capital is proxied by the average of the net enrolment rate for secondary school over the period of 2010 to 2017.

The vector **I** is a set of control variables that capture the countries' institutional context. These are, for instance, the corruption perception index, size of government, an indicator of the rule of law and property rights, quality of regulations, trade openness (trade as % of GDP), and the annual average population density. R_i are the regional dummies (North-America, South-America, East-Asia, South and Central Asia, Western Europe, Eastern Europe, Pacific Region, Sub-Saharan Africa, Middle-East and North-Africa) which are added to all regression estimations in order to capture potential regional spillovers in the level of sub-national taxing rights or decentralization. I use regional dummies to limit the loss of degrees of freedoms that could be associated with the inclusion of country dummies. ε_i is the error term.

2.7.2 Results and Discussion

Figure 2.8 suggests an inverted U-shaped relationship between the tax assignment index and the average per capita GDP growth rate throughout 2010–2017. However, that relationship is less relevant for OECD countries. It also suggests a differing trend for OECD and *non*-OECD countries.

Table 2.8 reports the results of the baseline estimations using the *Tax Assignment Index* as a proxy for the sub-national governments' taxing rights. The coefficient estimates point to a positive and statistically significant relationship between the newly constructed indicator and the average annual growth of per capita GDP in *non*-OECD countries yet not in OECD member states. In line with the findings of Thiessen (2003) and Akai et al. (2007), the positive correlation turns negative for higher levels of the discretionary power of sub-central government authorities – thus an inverted U-shaped relationship. It is also noted that legal and property rights system and the average gross capital formation are among the most significant drivers of economic performance, whereas a greater level of corruption depletes economic growth in *non*-OECD countries.

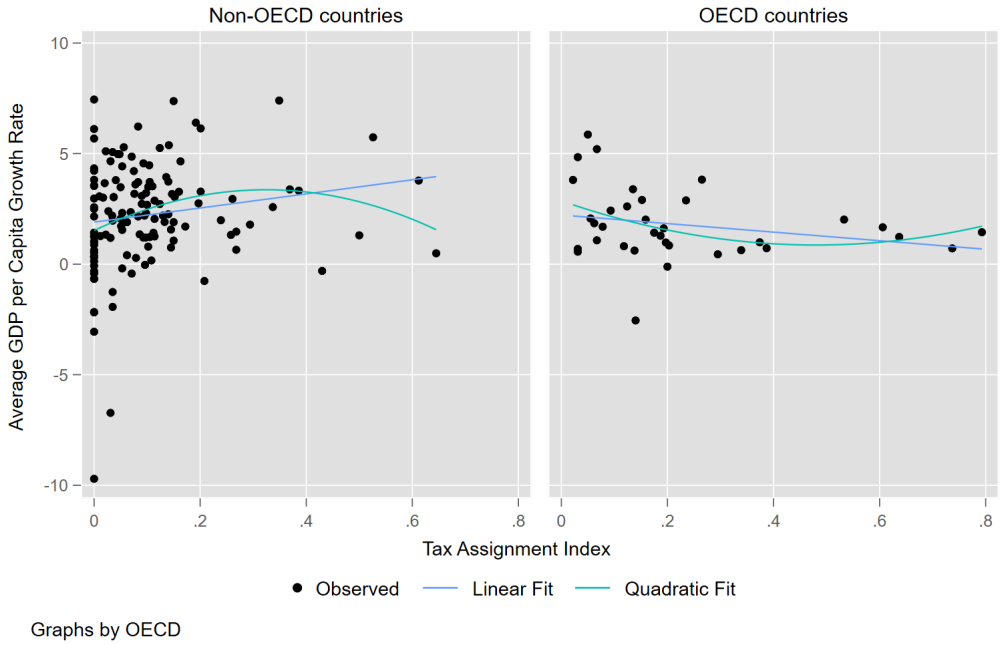
In Table 2.9, I zoom into the different decision components as described in subsection 2.4.3. I thereby investigate the linkages between sub-national governments' discretionary power over the setting of tax rates, the definition of the tax base,

Table 2.7: Summary Statistics and Data Sources

	N	Mean	SD	Min	Max	Primary Data Sources
Average Annual per Capita GDP Growth Rate[b]	170	2.132	2.264	-9.707	7.446	World Development Indicators
Gross Fixed Capital Formation[b]	146	5.050	5.649	-7.738	34.379	World Development Indicators
Secondary School Enrolment[b]	154	80.242	28.709	9.478	159.515	World Development Indicators
Corruption Perception Index[b]	162	42.211	19.861	11.882	91.560	Transparency International
Size of Government[b]	149	6.488	1.231	3.411	9.441	Economic Freedom Fraser Institute
Legal System & Property Rights[b]	149	5.184	1.572	2.175	8.866	Economic Freedom Fraser Institute
Regulation[b]	149	6.962	0.969	3.424	8.994	Economic Freedom Fraser Institute
Trade Openness[b]	165	86.524	48.116	24.449	362.474	Economic Freedom Fraser Institute
Population Density[b]	170	4.284	1.382	0.622	9.852	World Development Indicators
Tax Assignment Index	171	0.125	0.152	0.000	0.793	Author's
Tax Rate Assignment	171	0.138	0.167	0.000	0.800	Author's
Tax Administration Assignment	171	0.229	0.208	0.000	0.923	Author's
Tax Base Assignment	171	0.084	0.166	0.000	0.832	Author's
Tax Instrument Assignment	171	0.050	0.133	0.000	0.785	Author's
Tax Rate Assignment (I,C,P)	171	0.108	0.139	0.000	0.666	Author's
Tax Administration Assignment (I,C,P)	171	0.196	0.196	0.000	0.937	Author's
Tax Base Assignment (I,C,P)	171	0.065	0.144	0.000	0.750	Author's
Tax Instrument Assignment (I,C,P)	171	0.035	0.115	0.000	0.750	Author's
TAI (base & rate)	171	0.111	0.161	0.000	0.800	Author's with IMF GFS Data
OECD Tax Autonomy	35	14.929	12.301	1.070	49.507	OECD Fiscal Network
RAI Fiscal Autonomy	78	0.897	1.401	0	5	Regional Authority Index
SNG % GG Tax Revenue[b]	86	0.140	0.148	0.000	0.560	Author's with IMF GFS Data
SNG % GG Revenue[b]	86	0.256	0.184	0.000	0.756	Author's with IMF GFS Data
SNG % GG Expenditure[b]	83	0.244	0.184	0.000	0.762	Author's with IMF GFS Data
Observations	171					

Notes: (I,C,P) refers to measurements that solely take into account the discretion over income, consumption and property taxes. [b]: variables are averaged over the time period of 2010-2017(2016 for variables from Economic Freedom Index). OECD Tax Autonomy and the Fiscal Autonomy component of the Regional Authority Index (RAI) are as per their latest edition. IMF GFS: International Monetary Fund – Government Finance Statistics Database.

Figure 2.8: Correlation between the Tax Assignment Index, Tax Decentralization and Average Annual Per Capita GDP Growth



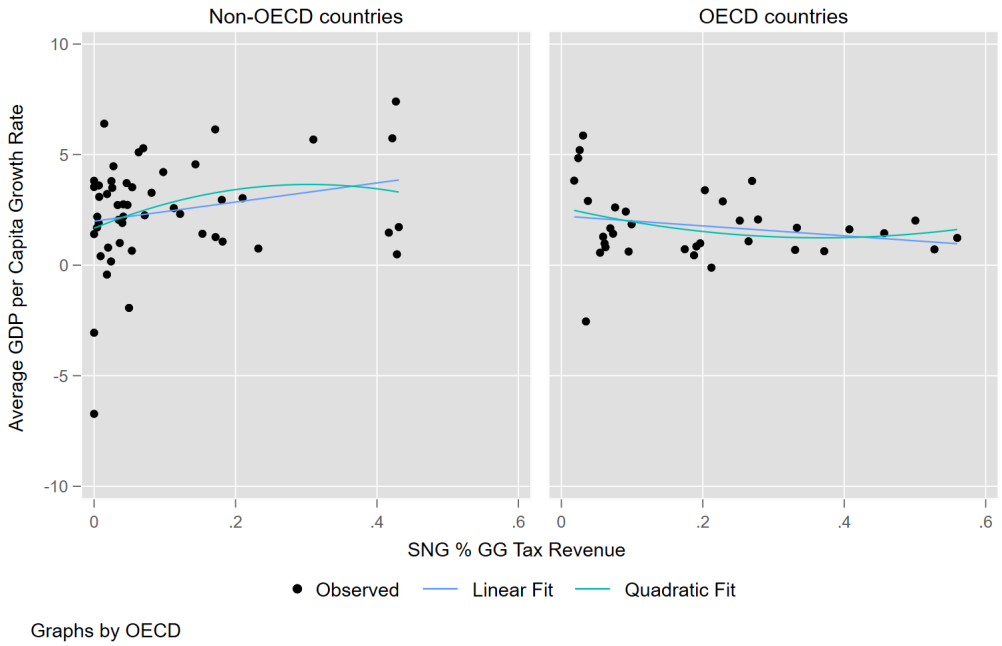


Table 2.8: Fiscal Decentralization and Growth Revisited: Baseline Model

Dependent Variable: Average Annual Growth Rate of Per Capita GDP (2010-2017)			
	(1) Full Sample	(2) OECD	(3) *Non*-OECD
Tax Assignment Index	4.963*	0.656	10.333**
	(2.721)	(2.781)	(3.949)
Tax Assignment Index^2	-8.059**	-3.403	-17.982***
	(3.680)	(3.478)	(6.650)
Gross Fixed Capital Formation	0.184***	0.296***	0.165***
	(0.038)	(0.091)	(0.034)
Secondary School Enrolment	0.013	0.010	0.006
	(0.009)	(0.014)	(0.010)
Corruption Perception Index	-0.065***	0.004	-0.053**
	(0.019)	(0.056)	(0.023)
Size of Government	0.341**	0.575**	0.120
	(0.157)	(0.215)	(0.174)
Legal System & Property Rights	0.916***	-0.627	1.187***
	(0.279)	(0.757)	(0.282)
Regulation	0.066	0.871**	-0.201
	(0.220)	(0.357)	(0.259)
Trade Openness	0.001	0.000	-0.003
	(0.002)	(0.003)	(0.003)
Population Density	0.065	-0.108	0.175
	(0.109)	(0.198)	(0.144)
Constant	-6.828***	-7.313*	-3.659*
	(2.163)	(4.207)	(1.855)
N Countries	125	35	90
R^2	0.512	0.816	0.542
Adjusted-R^2	0.450	0.701	0.464
AIC	453.454	100.611	334.139

Notes: Significance level * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors in parentheses. Regional Fixed Effects are added to all estimations. With the exception of the main indicators of interest, all other variables are averaged over the period of 2010 to 2017 (up to 2016 for Size of Government, Legal System & Property Rights and Regulation). The indicators of interest are constructed using the alternative scoring procedures described in Table 2.4.3.

the introduction or alteration of tax instruments and tax administration, and the average annual growth rate of per capita GDP of countries in the sample. In line with Table 2.8, the results indicate no statistically significant relationship between the different decision dimensions and economic performance for OECD countries. In *non*-OECD countries, however, the coefficients indicate an inverted U-shaped relationship between sub-national governments' discretion over the setting of tax rates and economic performance. The coefficient estimates on gross capital formation, legal and property rights system and corruption are also consistent with the previous table (see Table 2.8).

Sensitivity Analyses

A. Estimations with Sub-national Discretion over Income, Consumption and Property Taxes

Table 2.10 replicates the estimations of Table 2.8 and Table 2.9, yet with the indicators built solely for income, consumption and property taxes. As argued above, these three constitute the bulk of tax revenues in most countries. The findings are in line with previous estimates and suggest no statistically significant correlation between these indicators and economic performance for OECD member countries, as previously echoed in the literature (Bodman, 2011; Baskaran and Feld, 2013; Asatryan and Feld, 2015).

However, there exists an inverted U-shaped relationship between the *Tax Assignment Index* for income, consumption and property taxes and economic performance in the sub-sample of *non*-OECD countries. The coefficient estimates for the different decision components indicate that this latter result is primarily a mirror of the relationship between sub-national discretion over the setting of tax rates and economic performance (it is worth recalling here that the tax assignment index is the average of the scores of the different decision components).

Hence, while establishing a causal relationship is challenging given the structure of the data and the lack of reliable instrumental variables, the inverted U-shaped nature of the relationship between the discretion over tax rates and economic performance (both in Table 2.9 and Table 2.10) indicate that there might be some economic dividends to involving lower-tier governments in the setting of tax rates in developing and emerging economies, although an extensive form of discretion would be detrimental in the long-run. On the co-variates, it is maintained that gross fixed capital formation and the proxy for the rule of law (legal system and property rights) are key drivers

Table 2.9: Fiscal Decentralization and Growth Revisited:
Relevance of Different Tax-Related Decisions

Dependent Variable: Average Annual Growth Rate of Per Capita GDP (2010-2017)								
	OECD				*Non*-OECD			
	(1.1)	(1.2)	(1.3)	(1.4)	(2.1)	(2.2)	(2.3)	(2.4)
Tax Rate Assignment	3.143				10.001***			
	(3.662)				(3.448)			
Tax Rate Assignment^2	-7.670				-16.617**			
	(4.988)				(6.980)			
Tax Administration Assignment		-0.730				5.178*		
		(2.377)				(3.090)		
Tax Administration Assignment^2		0.128				-6.372		
		(2.874)				(5.023)		
Tax Base Assignment			-0.822				2.470	
			(2.239)				(3.489)	
Tax Base Assignment^2			-1.847				-5.607	
			(3.042)				(6.837)	
Tax Instrument Assignment				-1.064				4.039
				(3.077)				(3.826)
Tax Instrument Assignment^2				-1.691				-9.858
				(4.430)				(6.232)
Gross Fixed Capital Formation	0.283***	0.307***	0.291***	0.297***	0.169***	0.159***	0.169***	0.168***
	(0.090)	(0.100)	(0.089)	(0.090)	(0.033)	(0.034)	(0.036)	(0.036)
Secondary School Enrolment	0.013	0.011	0.014	0.009	0.003	0.009	0.007	0.007
	(0.012)	(0.013)	(0.013)	(0.014)	(0.010)	(0.010)	(0.010)	(0.010)
Corruption Perception Index	0.006	0.002	0.007	0.001	-0.059**	-0.058**	-0.059**	-0.060**
	(0.056)	(0.059)	(0.053)	(0.055)	(0.022)	(0.026)	(0.027)	(0.027)
Size of Government	0.653***	0.475	0.612***	0.545**	0.146	0.151	0.123	0.107
	(0.195)	(0.297)	(0.203)	(0.218)	(0.180)	(0.173)	(0.180)	(0.176)
Legal System & Property Rights	-0.615	-0.634	-0.661	-0.623	1.289***	1.100***	1.162***	1.161***
	(0.748)	(0.792)	(0.724)	(0.739)	(0.276)	(0.297)	(0.299)	(0.291)
Regulation	0.985**	0.675*	0.857**	0.942**	-0.194	-0.113	-0.086	-0.081
	(0.353)	(0.355)	(0.368)	(0.357)	(0.264)	(0.250)	(0.265)	(0.264)
Trade Openness	0.000	0.000	0.000	0.000	-0.003	-0.002	-0.005	-0.005
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)
Population Density	-0.116	-0.116	-0.101	-0.115	0.256*	0.131	0.136	0.133
	(0.197)	(0.203)	(0.192)	(0.197)	(0.154)	(0.148)	(0.168)	(0.165)
Constant	-9.773**	-4.709	-7.502*	-7.290*	-4.255**	-3.913**	-3.055	-2.927
	(4.182)	(4.851)	(3.956)	(3.965)	(1.860)	(1.673)	(1.932)	(1.913)
N Countries	35	35	35	35	90	90	90	90
R^2	0.830	0.793	0.824	0.818	0.557	0.526	0.497	0.502
Adjusted-R^2	0.724	0.665	0.715	0.706	0.481	0.445	0.411	0.417
AIC	97.845	104.663	98.935	100.073	331.158	337.201	342.578	341.683

Notes: Significance level * p $<$ 0.10, ** p $<$ 0.05, *** p $<$ 0.01. Robust standard errors in parentheses. Regional Fixed Effects are added to all estimations. With the exception of the main indicators of interest, all other variables are averaged over the period of 2010 to 2017 (up to 2016 for Size of Government, Legal System & Property Rights and Regulation). The indicators of interest are constructed using the alternative scoring procedures described in Table 2.4.3.

of economic performance whereas corruption in *non*-OECD countries is, as expected, harmful to economic growth.

B. Estimations with alternative indicators of tax autonomy

Table 2.11 reports the estimations using the alternative indicators of tax and fiscal autonomy proposed by the OECD and the Regional Authority Index. Given that these indicators primarily take into account the discretion over tax bases and tax rates, I constructed a comparable indicator based on the scores for sub-central decision-making power over the setting of tax rates and definition of the taxable bases. To ensure comparability of the results, I also select the sample of countries that are available in the *TRA* and the OECD or RAI, respectively.

Columns (1.1) to (1.3) corroborate the non-existence of a statistically significant correlation between the tax assignment index or the OECD tax autonomy and average per capita economic growth in OECD countries. The results are again very much in line with previous findings concerning OECD member states (Thornton, 2007; Bodman, 2011; Baskaran and Feld, 2013; Asatryan and Feld, 2015). In columns (2.1) to (2.3), I compare the estimations using the newly built indicators with the one using the fiscal autonomy of the Regional Authority Index. Of the sub-sample of 70 countries in the RAI dataset, 35 of them are also OECD member states. The results are very much in line and show no particular correlation between those indicators and the economic performance in included countries. The coefficient estimates thus point to a consistency in the direction and significance of the new indicators and existing ones.

Table 2.12 reports the coefficient estimates using the conventional indicators of fiscal decentralization, namely the ratios of sub-national governments' in consolidated general government tax revenue, total revenue and expenditure. The results are consistent with previous tables with respect to OECD countries – there is no evidence of a statistically significant relationship between those indicators of fiscal decentralization and economic performance. In *non*-OECD member states, there is a negative yet non-statistically significant correlation between the budgetary ratio on tax revenue. However, coefficient estimates for the ratios on total revenue and expenditure follow the same pattern as those related to the newly built indicators. Total revenue and expenditure decentralization hold an inverted U-shaped relationship with the average per capita GDP growth rate in *non*-OECD member states. These estimations for *non*-OECD countries in Table 2.12 are however less precise due to the limited number of observations (data on sub-national government finance for developing and emerging economies are limited in the IMF Government Finance Statistics database).

Table 2.10: Fiscal Decentralization and Growth Revisited:
Estimations with Indicators based on Income, Consumption and Property Taxes

Dependent Variable: Average Annual Growth Rate of Per Capita GDP (2010-2017)										
	OECD					*Non*-OECD				
	(1.1)	(1.2)	(1.3)	(1.4)	(1.5)	(2.1)	(2.2)	(2.3)	(2.4)	(2.5)
Tax Assignment Index (I,C,P)	2.744					7.295**				
	(4.157)					(3.317)				
Tax Assignment Index (I,C,P)^2	-7.353					-12.212**				
	(5.897)					(4.737)				
Tax Rate Assignment (I,C,P)		3.196					9.659***			
		(5.789)					(2.970)			
Tax Rate Assignment (I,C,P)^2		-9.160					-16.286***			
		(9.632)					(5.234)			
Tax Administration Assignment (I,C,P)			-1.101					4.299		
			(2.784)					(2.662)		
Tax Administration Assignment (I,C,P)^2			1.003					-6.458		
			(3.093)					(4.259)		
Tax Base Assignment (I,C,P)				-0.448					3.041	
				(2.889)					(3.000)	
Tax Base Assignment (I,C,P)^2				-3.101					-6.076	
				(4.457)					(4.349)	
Tax Instrument Assignment (I,C,P)					-2.677					-2.457
					(3.005)					(3.400)
Tax Instrument Assignment (I,C,P)^2					0.232					0.056
					(4.138)					(4.333)
Gross Fixed Capital Formation	0.293***	0.279***	0.313***	0.281***	0.301***	0.165***	0.166***	0.162***	0.169***	0.166***
	(0.094)	(0.094)	(0.104)	(0.091)	(0.088)	(0.035)	(0.033)	(0.036)	(0.036)	(0.035)
Corruption Perception Index	0.004	0.000	0.001	0.003	-0.001	-0.052**	-0.058**	-0.056**	-0.058**	-0.062**
	(0.056)	(0.059)	(0.061)	(0.054)	(0.056)	(0.026)	(0.023)	(0.027)	(0.027)	(0.028)
Legal System & Property Rights	-0.615	-0.534	-0.655	-0.596	-0.601	1.116***	1.243***	1.073***	1.166***	1.186***
	(0.765)	(0.805)	(0.805)	(0.746)	(0.749)	(0.287)	(0.285)	(0.298)	(0.300)	(0.304)
Regulation	0.976***	0.951***	0.654*	0.957**	0.981**	-0.136	-0.148	-0.127	-0.076	-0.127
	(0.345)	(0.306)	(0.349)	(0.399)	(0.372)	(0.258)	(0.261)	(0.260)	(0.257)	(0.268)
Constant	-7.839*	-8.114**	-3.801	-7.798*	-7.492*	-3.603**	-4.390***	-3.320**	-3.282*	-2.541
	(4.013)	(3.779)	(4.781)	(4.039)	(4.003)	(1.686)	(1.661)	(1.616)	(1.795)	(1.755)
N Countries	35	35	35	35	35	90	90	90	90	90
R^2	0.817	0.814	0.790	0.829	0.821	0.521	0.550	0.512	0.500	0.502
Adjusted-R^2	0.704	0.699	0.660	0.722	0.711	0.439	0.473	0.429	0.415	0.416
AIC	100.299	100.909	105.210	98.070	99.521	338.159	332.650	339.880	342.029	341.790

Notes: Significance level * p $<$ 0.10, ** p $<$ 0.05, *** p $<$ 0.01. Robust standard errors in parentheses. Regional Fixed Effects are added to all estimations. With the exception of the main indicators of interest, all other variables are averaged over the period of 2010 to 2017 (up to 2016 for Size of Government, Legal System & Property Rights and Regulation). Additional control variables include: Size of Government, Trade Openness, Population Density – statistically insignificant for both OECD and *non*-OECD samples. (I,C,P) stands for Income, Consumption and Property Taxes. The indicators of interest are constructed using the alternative scoring procedures described in Table 2.4.3.

Table 2.11: Fiscal Decentralization and Growth Revisited:
Sensitivity Checks with Indicators from Alternative Scoring Procedures

Dependent Variable: Average Annual Growth Rate of Per Capita GDP						
	OECD Sample			RAI Sample		
	(1.1)	(1.2)	(1.3)	(2.1)	(2.2)	(2.3)
Tax Assignment Index	0.656			1.870		
	(2.781)			(3.480)		
Tax Assignment Index^2	-3.403			-3.543		
	(3.478)			(4.691)		
Tax Assignment Index (base & rate)		0.679			0.943	
		(2.982)			(2.996)	
Tax Assignment Index (base & rate)^2		-4.021			-2.800	
		(3.991)			(4.461)	
OECD Tax Autonomy			0.002			
			(0.055)			
OECD Tax Autonomy^2			-0.000			
			(0.001)			
RAI Fiscal Autonomy						0.262
						(0.333)
RAI Fiscal Autonomy^2						-0.101
						(0.091)
Gross Fixed Capital Formation	0.296***	0.289***	0.293**	0.315***	0.313***	0.311***
	(0.091)	(0.089)	(0.109)	(0.053)	(0.053)	(0.056)
Secondary School Enrolment	0.010	0.013	0.007	0.034**	0.036**	0.038**
	(0.014)	(0.013)	(0.015)	(0.015)	(0.015)	(0.015)
Corruption Perception Index	0.004	0.003	0.014	-0.025	-0.027	-0.030
	(0.056)	(0.055)	(0.063)	(0.035)	(0.036)	(0.035)
Size of Government	0.575**	0.601***	0.416	0.544**	0.535**	0.511**
	(0.215)	(0.207)	(0.294)	(0.206)	(0.203)	(0.206)
Legal System & Property Rights	-0.627	-0.611	-0.763	0.194	0.201	0.202
	(0.757)	(0.749)	(0.845)	(0.562)	(0.568)	(0.547)
Regulation	0.871**	0.940**	0.775	-0.109	-0.111	-0.017
	(0.357)	(0.344)	(0.450)	(0.272)	(0.282)	(0.300)
Trade Openness	0.000	0.000	0.001	0.001	0.000	0.000
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Population Density	-0.108	-0.109	-0.219	0.058	0.053	0.059
	(0.198)	(0.192)	(0.255)	(0.183)	(0.185)	(0.184)
Constant	-7.313*	-8.377**	-4.592	-6.924*	-6.836*	-7.498**
	(4.207)	(3.990)	(4.690)	(3.504)	(3.495)	(3.300)
N Countries	35	35	35	70	70	70
R^2	0.816	0.825	0.775	0.605	0.607	0.608
Adjusted-R^2	0.701	0.717	0.628	0.513	0.515	0.517
AIC	100.611	98.688	102.424	234.235	233.831	233.543

Notes: Significance level * p $<$ 0.10, ** p $<$ 0.05, *** p $<$ 0.01. Robust standard errors in parentheses. Regional Fixed Effects are added to all estimations. With the exception of the main indicators of interest, all other variables are averaged over the period of 2010 to 2017 (up to 2016 for Size of Government, Legal System & Property Rights and Regulation). The indicators of interest are constructed using the alternative scoring procedures described in Table 2.4.3. RAI: Regional Authority Index.

Table 2.12: Fiscal Decentralization and Growth Revisited: Estimations with Budgetary Ratios

Dependent Variable: Average Annual Growth Rate of Per Capita GDP (2010-2017)						
	OECD			*Non*-OECD		
	(1.1)	(1.2)	(1.3)	(2.1)	(2.2)	(2.3)
SNG % GG Tax Revenue	-1.272			11.761		
	(4.222)			(11.419)		
SNG % GG Tax Revenue^2	1.004			-27.860		
	(7.823)			(23.239)		
SNG % GG Revenue		1.239			17.130**	
		(4.429)			(6.858)	
SNG % GG Revenue^2		-2.657			-28.071***	
		(5.447)			(10.050)	
SNG % GG Expenditure			0.451			20.096**
			(4.032)			(7.532)
SNG % GG Expenditure^2			-1.767			-37.883***
			(5.000)			(12.825)
Gross Fixed Capital Formation	0.299**	0.294**	0.293***	0.208**	0.201**	0.187**
	(0.116)	(0.105)	(0.103)	(0.082)	(0.083)	(0.083)
Secondary School Enrolment	0.010	0.012	0.012	0.011	0.015	0.022
	(0.014)	(0.018)	(0.017)	(0.021)	(0.021)	(0.020)
Corruption Perception Index	0.010	0.012	0.012	-0.085*	-0.050	-0.055
	(0.061)	(0.060)	(0.060)	(0.047)	(0.047)	(0.048)
Size of Government	0.458	0.470	0.481	0.437	0.507	0.507*
	(0.310)	(0.296)	(0.291)	(0.392)	(0.315)	(0.272)
Legal System & Property Rights	-0.750	-0.784	-0.780	1.352**	0.901*	1.028*
	(0.812)	(0.814)	(0.815)	(0.566)	(0.528)	(0.545)
Regulation	0.758	0.751*	0.766*	-0.273	-0.393	-0.321
	(0.481)	(0.413)	(0.401)	(0.429)	(0.370)	(0.343)
Trade Openness	0.001	0.001	0.001	-0.002	0.003	0.006
	(0.003)	(0.003)	(0.003)	(0.006)	(0.007)	(0.007)
Population Density	-0.198	-0.197	-0.200	0.389	0.295	0.067
	(0.199)	(0.223)	(0.226)	(0.342)	(0.303)	(0.262)
Constant	-4.825	-5.205	-5.394	-6.191	-6.659**	-7.497***
	(5.219)	(5.006)	(4.860)	(3.844)	(3.148)	(2.621)
N Countries	35	35	35	41	41	39
R^2	0.790	0.792	0.792	0.577	0.645	0.683
Adjusted-R^2	0.661	0.664	0.664	0.373	0.474	0.519
AIC	105.107	104.765	104.799	159.428	152.251	139.782

Notes: Significance level * p $<$ 0.10, ** p $<$ 0.05, *** p $<$ 0.01. Robust standard errors in parentheses. Regional Fixed Effects are added to all estimations. With the exception of the main indicators of interest, all other variables are averaged over the period of 2010 to 2017 (up to 2016 for Size of Government, Legal System & Property Rights and Regulation). The indicators of interest are constructed using the alternative scoring procedures described in Table 2.4.3. SNG stands for Sub-national Governments; GG stands for General Government. SNG%GG indicators are averaged over the period of 2010 to 2017.

2.8 Conclusion

This chapter introduces a new and comprehensive dataset on tax and revenue assignment in more than one hundred countries. The *Tax and Revenue Assignment (TRA)* dataset aims at contributing to the empirical evidence on cross-country multi-layer tax structure and thereby answering the question of *"Who Taxes, Where and What?"* in a large number of countries. Built upon an array of legal and policy documents supplemented by archives and scientific and grey literature, the dataset records and reports the discretionary power of all government tiers over primary tax revenue instruments and across four types of decisions – the design and implementation of a tax instrument, the definition of the taxable base, the setting of the tax rates and tax administration. The coding procedure thus facilitates the creation of multiple indicators that compare and contrast intergovernmental tax arrangements across countries.

Core findings from the dataset suggest that the multi-layer tax structure varies significantly across countries, across tax instruments, and across the types of decisions that are assigned to different tiers. Using a scoring technique, I derive a series of indicators that inform on the discretionary power of sub-central governments over the fiscal space more broadly, over specific instruments (e.g. income, consumption and property taxes) and specific decision dimensions (e.g. the setting of tax rates and tax administration). Validation steps corroborate a positive and highly significant correlation between the newly constructed indicators and existing proxies of tax autonomy and tax decentralization, despite differences in methodology, scope and sample size. The new dataset, however, differs from the existing ones in critical aspects. First, it offers a more extensive coverage with the inclusion of a large number of developing and emerging economies. Second, it provides a level of granularity which facilitates analyses into the complexity of multi-layer tax arrangements across countries, across tax instruments and decision dimensions. Despite it being cross-sectional at this stage, the first edition offers a collaborative tool to track, expand and integrate public finance reforms in specific countries as information on sub-national governments is increasingly becoming available (OECD and UCLG, 2016, 2019).

This chapter also illustrates the use of the dataset by revisiting the empirical enquiry on the effects of fiscal decentralization on economic performance. I focus mainly on *non*-OECD countries which have so far been left out of most cross-country empirical research on the relationship between sub-national tax autonomy and economic performance – a literature gap which can be partly attributed to the lack of comparative data on sub-national governments' taxing rights with respect to those countries. The

results of the empirical application indicate no statistically significant relationship between the newly constructed indicators of sub-national taxing rights and economic performance in OECD countries, as previously indicated in the literature (Thornton, 2007; Bodman, 2011; Baskaran and Feld, 2013; Asatryan and Feld, 2015).

In a sub-sample of 90 *non*-OECD countries, however, the results point to an inverted U-shaped relationship between the primary indicator of sub-national governments' taxing rights and the average annual GDP per capita growth. Zooming into sub-national authorities' discretion over specific decision dimensions, the results indicate that in *non*-OECD member states, there might be an economic dividend to granting sub-central governments some discretionary power over the setting of tax rates, although an extensive form of discretion might be detrimental as indicated by the inverted U-shaped relationship.

There remain limitations to be addressed by future research. First, the *TRA* dataset is so far cross-sectional, preventing time-series analyses of the relationship between the derived indicators and economic performance of included countries. Nevertheless, as sub-central fiscal data are increasingly becoming available for a wide range of countries, the coding shall facilitate the tracking and the integration of public finance reforms, either concerning specific tax instruments or decision components. Second, while the legal sources of information take precedence, I acknowledge that they may not always reflect the reality within each country. The primary assumption is that the legal provisions grant each layer of government the ability to claim their rights in deciding on tax matters. Identifying the status of implementation of these legal provisions would be an added value to empirical works in the field. The underlying infrastructure of the dataset allows researchers and users to modify the coding and replicate the results shall any misinformation be detected.

The dataset creates a new avenue for research into cross-country regulatory and fiscal outcomes and how these outcomes are influenced by the multi-layer structure of tax institutions and fiscal arrangements. Countries vary significantly in how they design their tax system across government tiers and the types of decision assigned to lower-tier authorities. The *TRA* dataset thus goes beyond the conventional classification of countries into federal and unitary to depict the variations within groups of countries that share a similar political structure or level of economic development. To the best of my knowledge, no prior data source provides this level of granularity. Going forward, the *TRA* shall lend itself to numerous applications in economic sciences, especially concerning developing and emerging economies where empirical enquiries on taxation and tax institutions have become prominent in recent years.

Bibliography

Ahmad, E. and G. Brosio (2009). *Does decentralization enhance service delivery and poverty reduction?* Edward Elgar Publishing.

Ahmad, J., S. Devarajan, S. Khemani, and S. Shah (2005). *Decentralization and service delivery*. The World Bank.

Akai, N., Y. Nishimura, and M. Sakata (2007). Complementarity, Fiscal Decentralization and Economic Growth. *Economics of Governance 8*(4), 339–362.

Akai, N. and M. Sakata (2002). Fiscal decentralization contributes to economic growth: Evidence from state-level cross-section data for the United States. *Journal of Urban Economics 52*(1), 93–108.

Amaglobeli, D., V. Crispolti, E. Dabla-Norris, P. Karnane, and F. Misch (2018). Tax Policy Measures in Advanced and Emerging Economies: A Novel Database. Washington D.C, USA.

Arzaghi, M. and J. V. Henderson (2005). Why countries are fiscally decentralizing. *Journal of Public Economics 89*(7), 1157–1189.

Asatryan, Z. and L. P. Feld (2015). Revisiting the link between growth and federalism: A Bayesian model averaging approach. *Journal of Comparative Economics 43*(3), 772–781.

Baskaran, T. and L. P. Feld (July 2013). Fiscal Decentralization and Economic Growth in OECD Countries: Is There a Relationship? *Public Finance Review 41*(4), 421–445.

Baskaran, T., L. P. Feld, and J. Schnellenbach (2016). Fiscal Federalism, Decentralization, and Economic Growth: A Meta-analysis. *Economic Inquiry 54*(3), 1445–1463.

Besfamille, M., N. Grosman, D. Jorrat, and O. Manzano (2017). Public Expenditures and Debt at the Subnational Level: Evidence of Fiscal Smoothing from Argentina.

Bird, R. M. (1999). Rethinking Subnational Taxes: A New Look at Tax Assignment. Washington DC, USA.

Bodman, P. (2011). Fiscal decentralization and economic growth in the OECD. *Applied Economics 43*(23), 3021–3035.

Brancati, D. (2006). Decentralization: Fueling the Fire or Dampening the Flames of Ethnic Conflict and Secessionism? *International Organization 60*(3), 651–685.

Brennan, G. and J. M. Buchanan (1980). *The power to tax: Analytical foundations of the fiscal constitution / Geoffrey Brennan, James M. Buchanan*. Cambridge: Cambridge University Press.

Brueckner, J. K. (1999). Fiscal Federalism and Capital Accumulation. *Journal of Public Economic Theory 1*(2), 205–224.

Brueckner, J. K. (2006). Fiscal federalism and economic growth. *Journal of Public Economics 90*(10-11), 2107–2120.

Buser, W. (2011). The impact of fiscal decentralization on economics performance in high-income OECD nations: an institutional approach. *Public Choice 149*(1-2), 31–48.

Caldeira, E., M. Foucault, and G. Rota-Graziosi (2012). Does decentralization facilitate access to Poverty-Related Services? Evidence from Benin.

Canavire-Bacarreza, G., J. Martinez-Vazquez, and B. Yedgenov (2020). Identifying and disentangling the impact of fiscal decentralization on economic growth. *World Development 127*, 104742.

Castles, F. G. (1999). Decentralization and the post–war political economy. *European Journal of Political Research 36*(1), 27–53.

Chatry, I. and R. C. Vincent (2019). A global view of sub-national governments in Asia: Structure and finance. In OECD (Ed.), *Fiscal Decentralisation and Inclusive Growth in Asia*, OECD Fiscal Federalism Studies, pp. 27–57. Paris, France: OECD Publishing.

Davoodi, H. and H.-f. Zou (1998). Fiscal Decentralization and Economic Growth: A Cross-Country Study. *Journal of Urban Economics 43*(2), 244–257.

Ebel, R. D. and S. Yilmaz (2002). On the Measurement and Impact of Fiscal Decentralization. Washington D.C, USA.

Enikolopov, R. and E. Zhuravskaya (2007). Decentralization and political institutions. *Journal of Public Economics 91*(11), 2261–2290.

Feld, L. P. and J. Schnellenbach (2011). Fiscal federalism and long-run macroeconomic performance: A survey of recent research. *Environment and Planning C-Government and Policy 29*(2), 224–243.

Feltenstein, A. and S. Iwata (2005). Decentralization and macroeconomic performance in China: Regional autonomy has its costs. *Journal of Development Economics 76*(2), 481–501.

Filippetti, A. and A. Sacchi (2016). Decentralization and economic growth reconsidered: The role of regional authority. *Environment and Planning C-Government and Policy 34*(8), 1793–1824.

Fisman, R. and R. Gatti (2002). Decentralization and corruption: evidence across countries. *Journal of Public Economics 83*(3), 325–345.

Fjeldstad, O.-H. (2004). *Decentralisation and corruption. A review of the literature*. Chr. Michelsen Institute.

Fjeldstad, O.-H. (2017). Revenue mobilization at sub-national levels in Sudan. Bergen, Norway.

Gemmell, N., R. Kneller, and I. Sanz (2013). Fiscal Decentralization And Economic Growth: Spending Versus Revenue Decentralization. *Economic Inquiry 51*(4), 1915–1931.

Hooghe, L. and G. Marks (2003). Unraveling the Central State, but How? Types of Multi-Level Governance. *American Political Science Review 97*(2), 233–243.

Hooghe, L., G. Marks, A. H. Schakel, S. Niedzwiecki, S. C. Osterkatz, and S. Shair-Rosenfield (2016). *Measuring regional authority: A postfunctionalist theory of governance*. Transformations in governance. Oxford, United Kingdom: Oxford University Press.

IBFD (Access: 2015-2017). Tax Research Platform.

Iimi, A. (2005). Decentralization and economic growth revisited: an empirical note. *Journal of Urban Economics 57*(3), 449–461.

Lane, J.-E. and S. O. Ersson (1999). *Politics and society in Western Europe* (4th ed. ed.). London and Thousand Oaks, Calif.: SAGE Publications.

Ligthart, J. E. and P. van Oudheusden (2017). The Fiscal Decentralisation and Economic Growth Nexus Revisited. *Fiscal Studies 38*(1), 141–171.

Lijphart, A. (1999). *Patterns of democracy: Government forms and performance in thirty-six countries / Arend Lijphart*. New Haven, Conn. and London: Yale University Press.

Lin, J. Y. and Z. Liu (2000). Fiscal Decentralization and Economic Growth in China. *Economic Development and Cultural Change 49*(1), 1–21.

Martinez-Vazquez, J. (2015). Tax assignments at the regional and local levels. In E. Ahmad and G. Brosio (Eds.), *Handbook of Multilevel Finance*, pp. 358–388. Cheltenham: Edward Elgar Publishing.

Martinez-Vazquez, J. and R. McNab (2006). Fiscal Decentralization,Macrostability, and Growth. *Hacienda Publica Española - Review of Public Economics 179*(4), 25–49.

Martinez Vazquez, J. and R. M. McNab (2003). Fiscal Decentralization and Economic Growth. *World Development 31*(9), 1597–1616.

Martinez-Vazquez, J. and M. Rider (2008). The Assignment of the Property Tax: Should Developing Countries follow the Conventional Wisdom. Georgia, USA.

Mauro, L., F. Pigliaru, and G. Carmeci (2018). Decentralization and growth: Do informal institutions and rule of law matter? *Journal of Policy Modeling 40*(5), 873–902.

McCluskey, W. J. (1999). *Property tax: An international comparative view / edited by William McCluskey*. Aldershot: Ashgate.

McLure, C. E. (2001). The Tax Assignment Problem: Ruminations on How Theory and Practice Depend on History. *National tax journal 54*(2), 339–363.

Morozov, B. (2018). Decentralization and Economic Growth: Specification, Measurement, and Direction of Causal Relationship. *International Journal of Public Administration 41*(9), 684–699.

Musgrave, R. A. (1959). *The theory of public finance: A study in public economy*. New York: McGraw-Hill.

Musgrave, R. A. (1983). Who should tax, where, and what? In C. E. McLure (Ed.), *Tax assignment in federal countries*, pp. 2–19. Canberra and Canberra and New York: Centre for Research on Federal Financial Relations, Australian National University, in association with the International Seminar in Public Economics and Distributed by ANU Press.

Oates, W. E. (1972). *Fiscal federalism*. The Harbrace series in business and economics. New York: Harcourt Brace Jovanovich.

Oates, W. E. (1977). *The Political economy of fiscal federalism*. Lexington, Mass.: Lexington Books.

Oates, W. E. (1996). Taxation in a federal system: The tax-assignment problem.

Oates, W. E. (2005). Toward a second-generation theory of fiscal federalism. *International Tax and Public Finance 12*(4), 349–373.

OECD (1999). *Taxing Powers of State and Local Government*, Volume 1 of *OECD Tax Policy Studies*. OECD Publishing.

OECD (2000). Taxing Power of sub-central governments: A taxonomy of tax autonomy.

OECD (2013). *Measuring Fiscal Decentralisation*. OECD Fiscal Federalism Studies. Paris, France: Organisation for Economic Co-operation and Development.

OECD (2020). Tax Autonomy.

OECD and UCLG (2016). Subnational Governments Around the World: Structure and Finance: A first contribution to the Global Observatory on Local Finances.

OECD and UCLG (2019). 2019 Report on the World Observatory on Subnational Government Finance and Investment: Key Findings. Paris.

Prud'Homme, R. (1995). The dangers of decentralization. *The World Bank Research Observer 10*(2), 201–220.

Qian, Y. and B. R. Weingast (1996). China's Transition to Markets: Market-Preserving Federalism, Chinese style. *The Journal of Policy Reform 1*(2), 149–185.

Rodden, J. A. (2006). *Hamilton's Paradox: The Promise and Peril of Fiscal Federalism*. Cambridge University Press.

Rodriguez-Pose, A. and R. Ezcurra (2011). Is fiscal decentralization harmful for economic growth? Evidence from the OECD countries. *Journal of Economic Geography 11*(4), 619–643.

Shah, A. (1994). *The reform of intergovernmental fiscal relations in developing and emerging market economies*. The World Bank.

Stegarescu, D. (2005). Public Sector Decentralisation: Measurement Concepts and Recent International Trends*. *Fiscal Studies 26*(3), 301–333.

Thiessen, U. (2003). Fiscal decentralisation and economic growth in high-income OECD countries. *Fiscal Studies 24*(3), 237–274.

Thornton, J. (2007). Fiscal decentralization and economic growth reconsidered. *Journal of Urban Economics 61*(1), 64–70.

Tiebout, C. M. (1956). A Pure Theory of Local Expenditures. *Journal of Political Economy 64*(5), 416–424.

Tiebout, C. M. (1961). An Economic Theory of Fiscal Decentralization. In National Bureau for Economic Research (Ed.), *Public finances: Needs, sources, and utilization*, pp. 79–96. Princeton University Press.

Vo, D. H. (2014). The Economics of Measuring Fiscal Decentralisation: Part II: New Fiscal Decentralisation Indices.

Weingast, B. (1995). The Economic Role of Political Institutions: Market-Preserving Federalism and Economic Development. *Journal of Law, Economics and Organization 11*(1), 1–31.

Weingast, B. R. (2009). Second generation fiscal federalism: The implications of fiscal incentives. *Journal of Urban Economics 65*(3), 279–293.

Weingast, B. R. (2014). Second Generation Fiscal Federalism: Political Aspects of Decentralization and Economic Development. *World Development 53*, 14–25.

Woller, G. M. and K. Phillips (1998). Fiscal decentralisation and LDC economic growth: An empirical investigation. *Journal of Development Studies 34*(4), 139–148.

World Bank Group (2000). World Bank Qualitative Decentralization Indicators.

Xie, D. Y., H. F. Zou, and H. Davoodi (1999). Fiscal decentralization and economic growth in the United States. *Journal of Urban Economics 45*(2), 228–239.

Yang, Z. (2016). Tax reform, fiscal decentralization, and regional economic growth: New evidence from China. *Economic Modelling 59*, 520–528.

Zhang, T. and H. f. Zou (1998). Fiscal decentralization, public spending, and economic growth in China. *Journal of Public Economics 67*(2), 221–240.

Zhuravskaya, E. (2000). Incentives to provide local public goods: fiscal federalism, Russian style. *Journal of Public Economics 76*(3), 337–368.

APPENDIX: CHAPTER 2

Figure A2.1: Tax Assignment Index: Main vs Alternative Scores

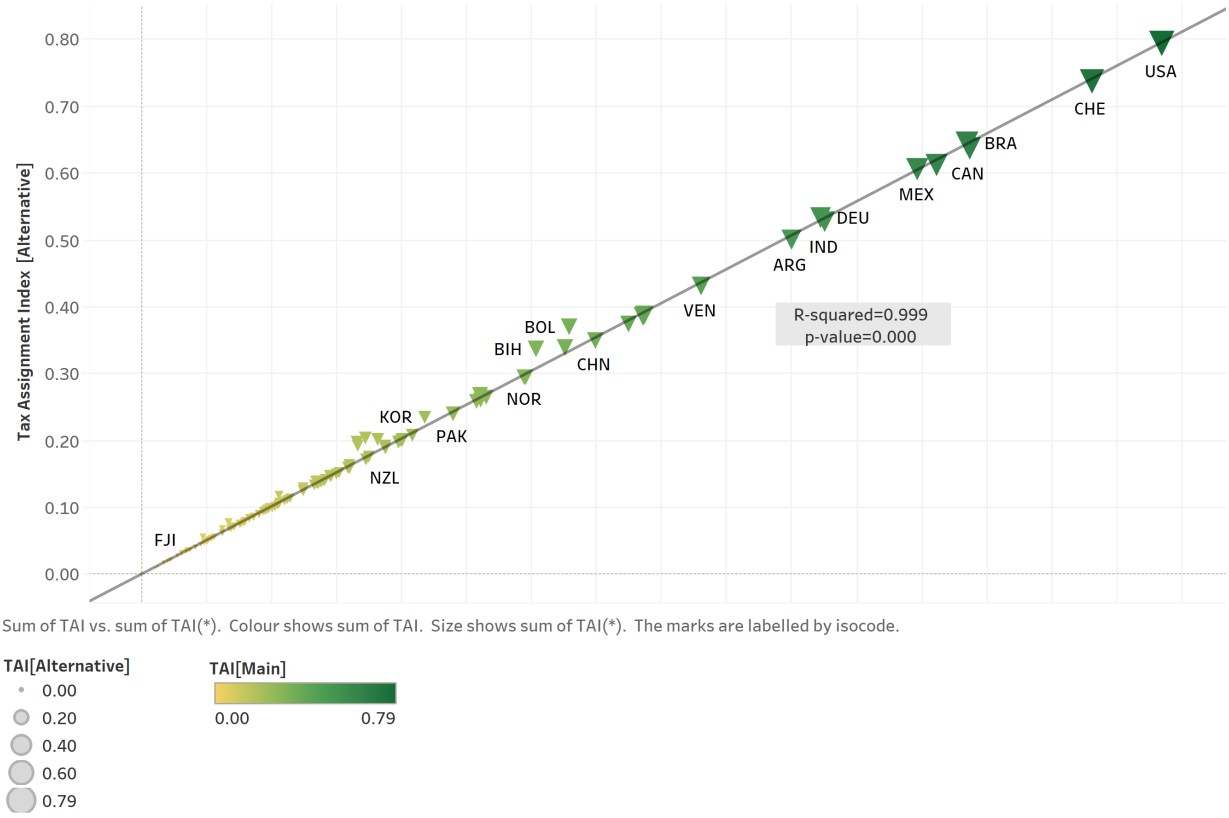


Figure A2.2: Discretionary Power of Sub-Central Governments over Property Tax

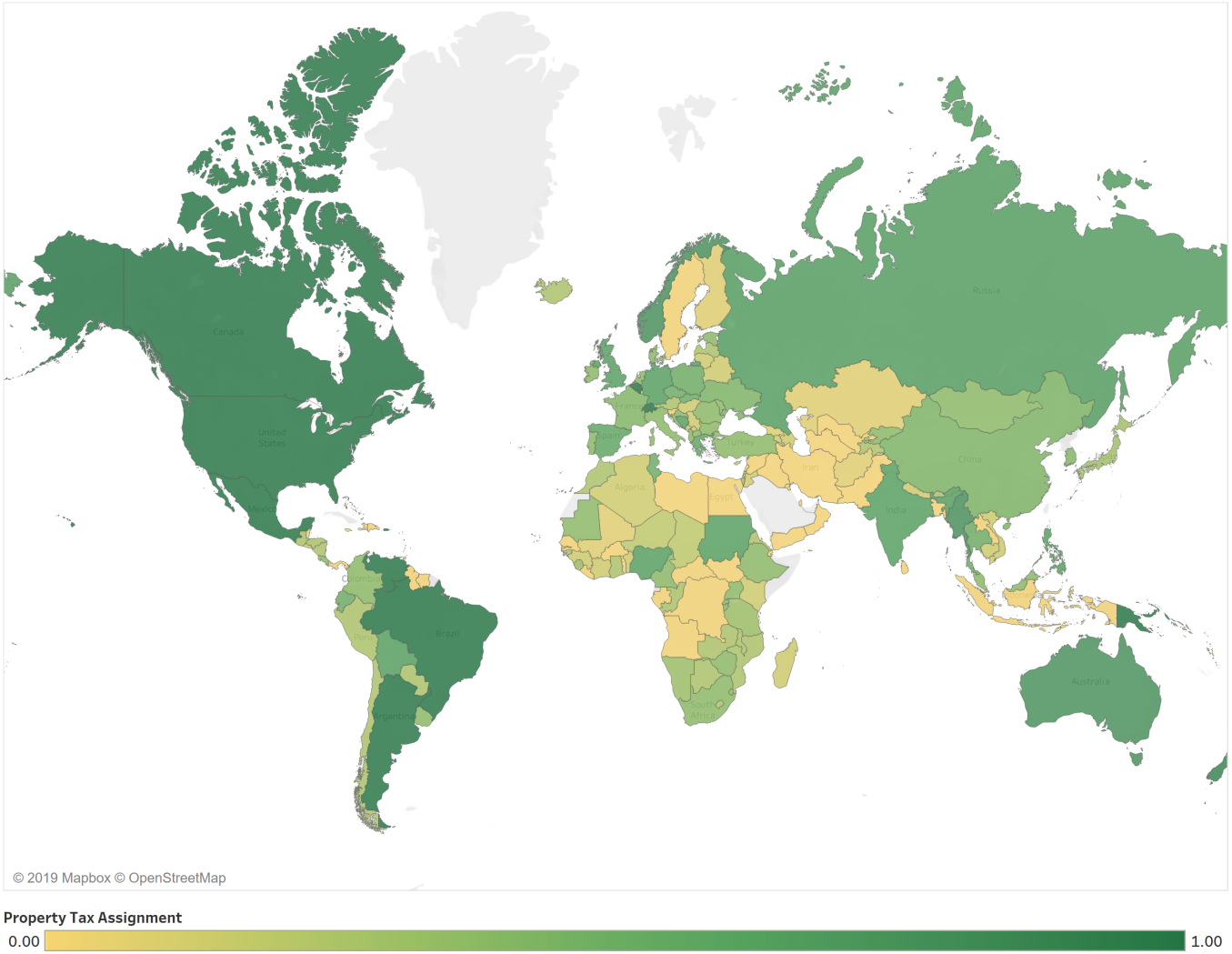
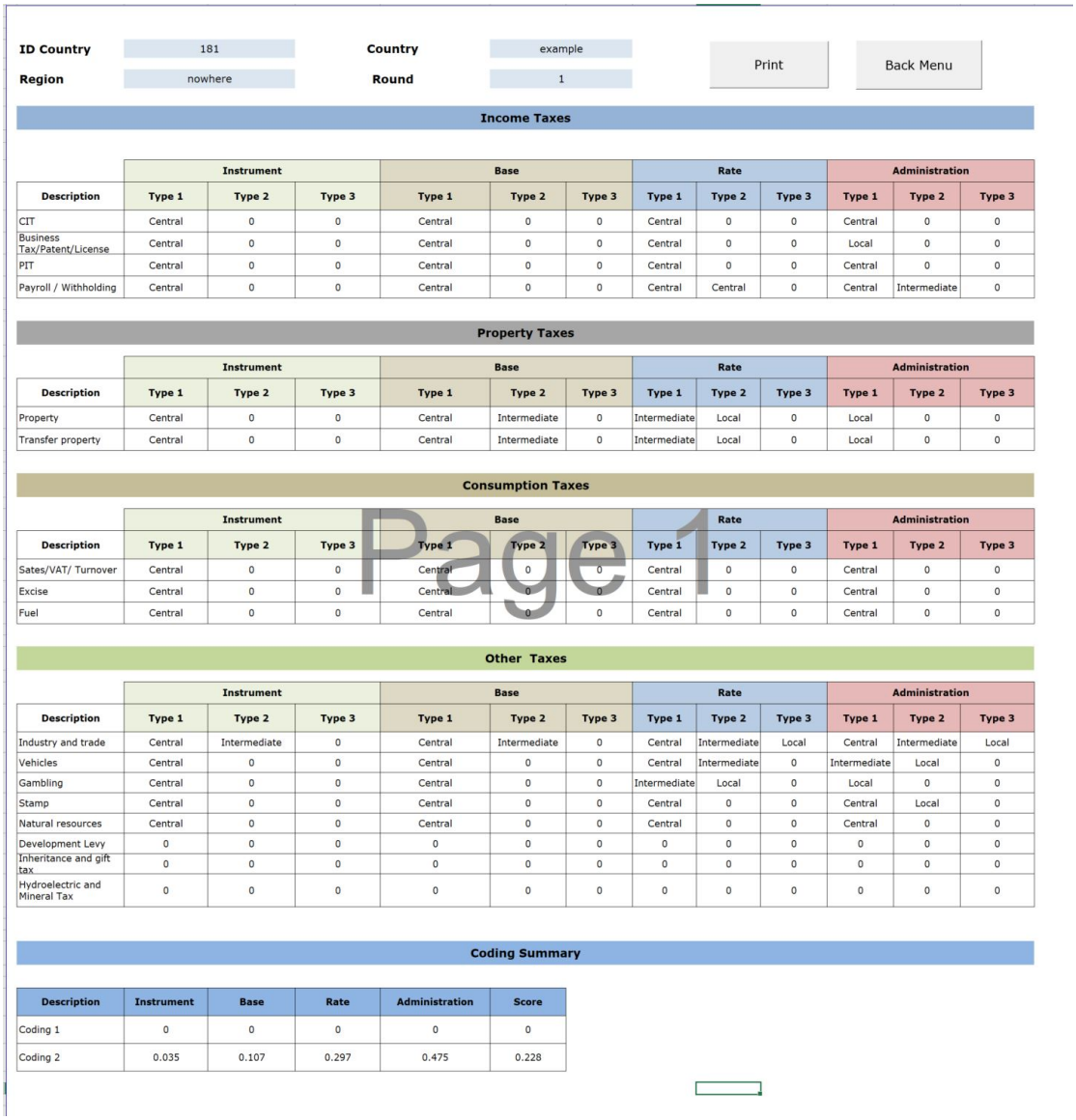


Figure A2.3: Architecture of the dataset

Figure A2.4: Printed Information File on each country



ID Country	181	Country	example	Print	Back Menu
Region	nowhere	Round	1		

Income Taxes

	Instrument			Base			Rate			Administration		
Description	Type 1	Type 2	Type 3	Type 1	Type 2	Type 3	Type 1	Type 2	Type 3	Type 1	Type 2	Type 3
CIT	Central	0	0	Central	0	0	Central	0	0	Central	0	0
Business Tax/Patent/License	Central	0	0	Central	0	0	Central	0	0	Local	0	0
PIT	Central	0	0	Central	0	0	Central	0	0	Central	0	0
Payroll / Withholding	Central	0	0	Central	0	0	Central	Central	0	Central	Intermediate	0

Property Taxes

	Instrument			Base			Rate			Administration		
Description	Type 1	Type 2	Type 3	Type 1	Type 2	Type 3	Type 1	Type 2	Type 3	Type 1	Type 2	Type 3
Property	Central	0	0	Central	Intermediate	0	Intermediate	Local	0	Local	0	0
Transfer property	Central	0	0	Central	Intermediate	0	Intermediate	Local	0	Local	0	0

Consumption Taxes

	Instrument			Base			Rate			Administration		
Description	Type 1	Type 2	Type 3	Type 1	Type 2	Type 3	Type 1	Type 2	Type 3	Type 1	Type 2	Type 3
Sates/VAT/ Turnover	Central	0	0	Central	0	0	Central	0	0	Central	0	0
Excise	Central	0	0	Central	0	0	Central	0	0	Central	0	0
Fuel	Central	0	0	Central	0	0	Central	0	0	Central	0	0

Other Taxes

	Instrument			Base			Rate			Administration		
Description	Type 1	Type 2	Type 3	Type 1	Type 2	Type 3	Type 1	Type 2	Type 3	Type 1	Type 2	Type 3
Industry and trade	Central	Intermediate	0	Central	Intermediate	0	Central	Intermediate	Local	Central	Intermediate	Local
Vehicles	Central	0	0	Central	0	0	Central	Intermediate	0	Intermediate	Local	0
Gambling	Central	0	0	Central	0	0	Intermediate	Local	0	Local	0	0
Stamp	Central	0	0	Central	0	0	Central	0	0	Central	Local	0
Natural resources	Central	0	0	Central	0	0	Central	0	0	Central	0	0
Development Levy	0	0	0	0	0	0	0	0	0	0	0	0
Inheritance and gift tax	0	0	0	0	0	0	0	0	0	0	0	0
Hydroelectric and Mineral Tax	0	0	0	0	0	0	0	0	0	0	0	0

Coding Summary

Description	Instrument	Base	Rate	Administration	Score
Coding 1	0	0	0	0	0
Coding 2	0.035	0.107	0.297	0.475	0.228

Chapter 3

Taxing Rights of Sub-National Governments in Developing and Emerging Economies: *A Helping or A Grabbing Hand?*

Abstract

This chapter investigates the effects of subnational governments' taxing rights on business operations in developing and emerging economies, using a sample of approximately 94,000 firms across 111 countries. The public choice view on tax assignment in multi-layer government posits that local authorities are incentivized to promote economic activities when they have control over revenues generated within their jurisdictions. Nevertheless, empirical evidence on this view is scattered and primarily centred on case studies. This chapter overcomes the lack of cross-country information on intergovernmental tax arrangements by relying on the new dataset on multi-layer tax structure described in the preceding chapter. Indicators created through the new dataset capture the discretionary power of sub-national governments over existing tax instruments, and over specific obligations such as the setting of tax rates and tax administration. The new indicators on subnational governments' taxing rights are merged with firm-level data from the World Bank Enterprises Surveys which inform on the burden of the tax system on business operations in addition to other characteristics. The empirical results suggest that the higher the level of subnational governments taxing rights, the higher the reported fiscal burden on business operations. Lower-tier governments' discretion over the setting of tax rates is particularly harmful to the business climate. Sub-national taxing rights also translate into a greater probability of being audited, a more considerable amount of time spent dealing with government regulations and a higher propensity of tax officials requesting bribe payments. The results are robust to numerous specifications, an array of controls and the use of instrumental variables techniques.

Keywords: Tax Structure; Fiscal Federalism; Fiscal Burden; Business Operations
JEL Codes: H7; H32; M20

3.1 Introduction

Recent decades have witnessed a trend towards the decentralization of the public sector in numerous developing and emerging economies. By devolving power and responsibilities to lower-tier governments, decentralization is argued to promote public allocation efficiency and accountability, which are crucial for economic prosperity. Theories on decentralization suggest that it fosters public efficiency by lessening information asymmetry as lower-tier authorities have a more holistic understanding of the needs and preferences of their constituents (Hayek, 1948; Oates, 1972, 1977; Seabright, 1996) and by providing a sorting mechanism that matches preferences to public services provision (Tiebout, 1956, 1961; Besley and Coate, 2003).

The recent prominence of decentralization reforms has also contributed to reviving the debate on the assignment of fiscal responsibilities to different government tiers. The so-called second-generation theory of fiscal federalism has particularly stressed the relevance of appropriate tax and revenue assignment, thereby echoing the early question of Musgrave (1983) on "*Who Should Tax, Where and What?*". Departing from the conventional – and to some extent normative – view on revenue assignment in multi-layer governments, the new literature strand has furthered the debate by drawing attention to the incentivizing role of proper tax and revenue assignment to sub-national government authorities. With inputs from the public choice literature, contributors to this strand argue that local authorities are inclined to promote business activities within their respective jurisdictions when they have control over revenues generated by those activities. As competition creates incentives for credible market-based commitments, it is expected that lower-tier governments would display less predatory behaviours when their economic interests are tied to the local economic prosperity (Montinola et al., 1995; Qian and Weingast, 1997; Weingast, 1995, 2009, 2014; Oates, 2005; Jin et al., 2005).

To date, however, the literature linking sub-national governments taxing rights to business operations and private sector development remains scarce and based on case studies such as on Russia and China (Qian and Weingast, 1996; Jin et al., 2005; Zhuravskaya, 2000; Yang, 2016). The absence of a comparative tool and data on multi-layer tax arrangements across countries have contributed to limit empirical enquiries into the subject. Conventional indicators of fiscal decentralization, such as budgetary ratios from national accounts statistics, are not suitable for such analysis as they fail to inform on the discretion of different government layers on tax matters, especially in developing and emerging economies. Notwithstanding, understanding such level

of discretion and the multi-layer structure of tax decisions is crucial to the debate on how fiscal incentives emerge and the strategic responses of local authorities, firms and residents.

In this chapter, I contribute to filling the gap by relying on the new dataset on multi-layer tax structure described in chapter 2. The dataset was built through in-depth reviews of an array of legal and policy documents, and archives, including the tax codes, local taxation acts and decrees that outline the legal arrangements in tax matters and the roles of different government tiers. It provides a comprehensive picture of the discretionary power of each government tier over existing tax instruments – such as income, consumption and property taxes, and across four types of decisions – including the ability to set the tax rates and to administer the revenue collected on specific instruments. By exploring the rights of government tiers concerning specific types of decisions, I expand the concept of taxing rights or tax autonomy and investigate how these different decision dimensions impact on private businesses operations in developing and emerging economies.

To the new dataset, I adjoin the World Bank Enterprise Surveys (hereafter WBES) data which so far stand as the most comprehensive cross-country data source on private sector enterprises, especially in low- and middle- income countries. The WBES provide detailed information on the characteristics of the firms, their interactions with government and tax officials, managers' and owners' reports on the effects of regulatory and fiscal institutions on business operations.

The combination of the two data sources facilitates an empirical enquiry into the central hypotheses of the public choice view on tax assignment which is resonated in recent developments of the fiscal federalism literature and which postulates that sub-national control over their taxes is likely to translate into greater policy efforts for private sector development (Montinola et al., 1995; Weingast, 1995, 2009, 2014). Adherents to this strand often depict China as a success model where the incentives generated by the intergovernmental fiscal contract in the 1980s appear to have created a basis for the country's remarkable economic success (Oi, 1992; Montinola et al., 1995; Zhang and Zou, 1998; Berkowitz and Li, 2000; Zhuravskaya, 2000; Jin et al., 2005). Many argue that local governments in China have operated as "helping hands" through efficient regulations and taxation (Walder, 1995; Qian and Weingast, 1996; Chow, 1997). In comparison to China, counter-evidence on sub-national authorities in the Russian Federation points to "grabbing hands" policies throughout the same period (Berkowitz and Li, 2000; Zhuravskaya, 2000). According to Weingast (1995), Zhuravskaya (2000) and Berkowitz and Li (2000), the fiscal contract in China contributed to consolidate the taxing rights of local governments whereas, in Russia,

the multi-layer tax structure emerged in a confusing and fluid way, resulting thereby in harmful policies towards local businesses.

The main contributions of this chapter are threefold. First, it empirically assesses whether the level of taxing rights of sub-national authorities translates into more or lesser fiscal burden on the business operations of approximately 94,000 firms in more than 100 countries. It explores the subject on a global scale using the newly created indicators on sub-national taxing rights described in chapter 2. Second, the chapter expands beyond the overall taxing power of sub-national authorities to zoom into their legal responsibilities over specific tax-related decisions such as the ability to set the tax rates or to administer the revenues from tax instruments. By doing so, I investigate how the discretion over specific decision dimensions affects private sector operations in developing and emerging markets.

Third, the chapter explores alternative outcome variables to the reported fiscal burden of the firms in the WBES. These variables reflect the direct interactions of the firms with their respective governments. These include the percentage of time that management spends dealing with government regulations, the probability of having been audited in the 12 months preceding the survey and the indication of whether tax officials requested bribe payments during audits. Through these, I explore how such interactions could have contributed to shaping the fiscal burden of the tax system on business operations, as reported by the firms' owners and managers.

The empirical results indicate that the level of taxing rights of sub-national authorities does increase the financial and administrative burden of the tax system on private business operations in the country sample. The higher their discretionary power over the fiscal space, the more likely are firms to report that tax rates and tax administration are obstacles to their business operations.

Zooming into the discretion over specific tax-related decisions, the findings suggest that sub-national governments' rights to set the tax rates are harmful to the private sector. The results also indicate that the probability of a firm being audited, the average amount of time that managers spend dealing with government regulations and the likelihood of tax officials requesting bribe during the audits all increase with the level of taxing rights granted to sub-national authorities. For instance, management's time loads increase by 11 percentage points for every basis point increase in the indicator that captures the discretion of lower-tier government authorities over tax administration. The empirical findings are robust to an array of control variables, and the use of instrumental variables techniques to limit the bias in the coefficient estimates.

In what follows, Section 3.2 provides an overview of the background literature. Section 3.3 describes the data sources. Section 3.4 delineates the empirical approaches and discusses the results. Concluding remarks are in Section 3.5.

3.2 Related Literature

The literature on government regulations is divided into two strands: one in which public officials are seen as benevolent players pursuing economic efficiency through the internalization of production externalities, and another branch in which government regulations are regarded as damaging and socially inefficient (Stigler, 1971; Peltzman, 1976; McChesney, 1988). Part of the second branch is at the core of the public choice literature, especially the tool-both view whereby regulations are seen as tools that benefit politicians who seek rents and bribes (Shleifer and Vishny, 1994, 1998; Rowley et al., 1988).

Such view has also been echoed by institutional economists such as North (1994, p. 360) who argues that *"Institutions are not necessarily or even usually created to be socially efficient; rather they, or at least the formal rules, are created to serve the interests of those with the bargaining power to create new rules."* Cross-country empirical research has contributed to reinforcing this thesis by stressing the harmful policies of public officials at the expenses of residents and firms (McChesney, 1988; Djankov et al., 2002; Hopkin and Rodriguez Pose, 2007). In developing and emerging economies, regulations are predominantly portrayed as a "grabbing hand" on businesses (expression from Shleifer and Vishny (1998)), with politicians often pursuing their own objectives through unwieldy and cumbersome rules and taxes (Shleifer and Vishny, 1993; Guasch and Hahn, 1999; Emery et al., 2000; Jacobs and Coolidge, 2006).

Taxation is the most common mean of government regulations. An essential feature of tax institutions is the arrangements across government tiers and jurisdictions in a given country. Such arrangements set the basis upon which interact government authorities, residents and firms. Hence, as other forms of institutions, they are expected to influence economic performance, socio-economic and regulatory outcomes as they trigger or shape behavioural responses of different groups of stakeholders.

The hierarchical structure of the tax system adds to the complexity of government regulations given that the design of tax instruments, of the rules and regulations, may not be set by a single layer of governments, and even less in a cohesive manner (Hindriks and Myles, 2013, p. 585). The potential threats of a decentralized tax system

and the prescriptions of the top-down and conventional view on tax and revenue assignment appear to have inspired the design of the public sector in most developing and emerging countries given the limited decision-making power granted to most sub-national governments (see chapter 2, section 2.5).

Despite the prominence of decentralization reforms in the past decades, the policy agendas have often neglected the legal assignment of taxing powers in the fiscal component. To date, lower-tier authorities in many countries remain primarily financed through top-down grants from central governments (OECD and UCLG, 2019). The inter-jurisdictional competition literature also comes in corroboration of the conventional prescription for a limit on sub-national governments taxing rights by highlighting the threats and damages of competition for mobile tax bases, which ultimately results in the sub-optimal provision of public goods (Wilson, 1995, 1999). Besides, the likelihood of a common pool problem in a multi-layer tax structure is high. Keen and Kotsogiannis (2004) and Brülhart and Jametti (2006), for instance, suggest that the common pool problem tends to dominate, and that the multi-layer tax system often renders high tax rates much higher, which could ultimately harm residents and firms. In developing countries more particularly, the lack of well-functioning fiscal institutions may render government authorities unable to commit to tax policies. In Tanzania, for instance, Fjeldstad and Semboja (1999) suggest that the poor coordination between different government layers had led to double taxation of the same revenue base, which increased the fiscal burden on the taxpayers.

Notwithstanding, the positive view on tax assignment is predominant in recent developments of the fiscal federalism literature which emphasize on the incentivizing role of tax assignment in multi-tier governments. Such a view is anchored in the broader public choice literature which departed from the benevolent government assumption to considering authorities as self-interested individuals or behaving as Leviathans (Brennan and Buchanan, 1980). According to this perspective, government authorities use tax instruments to maximize their gains from the private sector; as such, inter-jurisdictional competition would contribute to restrain the greed of local authorities and reduce monopolies.

More broadly, the new literature bridges insights from the public choice literature, behavioural economics and contemporary organization theory in the studies of the working of political and fiscal institutions and the resulting behaviours of stakeholders across the multi-layer structure of government (Garzarelli, 2004; Oates, 2005, 2008; Weingast, 2009; Vo, 2010). Authors within that strand have revisited the possible transaction-cost minimizing role of the state, the proper assignment of decision rights among government tiers, and the alignment of incentives in the vertical structure of the

public sector (Garzarelli, 2004, p. 5). They contended that the incentive problems are similar in government hierarchies as in firms: political institutions serve to authorities what firms are to managers (Qian and Weingast, 1997, p.91). Oates (2005, p. 356) also argues that officials do not merely act on behalf of the welfare of their constituents; as other participants in the political process; they have their objective functions that they seek to maximize in a political setting that provides constraints on their behaviour.

Therefore, just like market competition pressures firm managers to reflect the interests of shareholders, competition among local governments helps to limit government's predatory behaviour – such as imposing debilitating taxes or excessive regulation (Qian and Weingast, 1997, p. 88). Any departure from this stance would put the authorities in a competitive disadvantage as excessive regulation is likely to lower entrepreneurial activity and shrinks the governmental tax base (Montinola et al., 1995; Oates, 2005, 2008). Notable contributors – such as Barry Weingast and his collaborators – propose a new concept known as the market-preserving federalism whereby the fiscal institutions, under certain conditions, allow politicians to make credible commitments to preserving markets (Montinola et al., 1995; Qian and Weingast, 1997; Weingast, 2009, 2014).

To date, however, empirical evidence on the incentivizing role of tax and revenue assignment is scarce and often limited to case studies such as on China and Russia. The findings on China often suggest that the intergovernmental fiscal arrangements and the fiscal contract system in the 1980s had incentivized local governments to adopt effective regulatory policies and promote business development, which eventually led to the country's remarkable economic success. Under the fiscal contract system, the central government of China codified the tax laws and regulations and let the implementation of tax policies at the discretion of local authorities. As a result, local governments were able to give concessions and use their discretion to promote foreign investments and encourage business development within their jurisdictions with little control from the centre (Oi, 1992; Montinola et al., 1995; Qian and Weingast, 1996; Zhuravskaya, 2000; Jin et al., 2005). Walder (1995), Chow (1997) and others have argued that local governments in China operated as "helping hands" in promoting economic activities. In contrast to China, however, comparative evidence on Russia indicates that the intergovernmental fiscal structure resulted in less favourable private sector-oriented policies, as the country failed to delineate and enforced tax assignment at different levels of governments (Zhuravskaya, 2000; Jin et al., 2005; Berkowitz and Li, 2000; Frye and Shleifer, 1997).

The evidence on China has, however, been questioned. Rodden and Rose-Ackerman (1997), for instance, argue that the second generation literature lacks theories and

evidence to support the claims made. The authors also dispute the value of the competitive view of fiscal federalism proposed by these scholars, the portrayal of China as a model for institutional reform, and argue that any marginal move to increase decentralization may be harmful to nations' prospect of growth. In fact, despite the call for aligning expenditure and revenue assignment (Lockwood, 2005; Rodden, 2006), well-developed federations – such as Russia – have found it advantageous to have a relatively centralized tax system and a relatively decentralized expenditure system. Recent experiences of transition and developing economies – such as Brazil and Argentina – have also shown that local governments policies can not only be hostile to business operations and development but may also lead to higher state capture (Rodden, 2006). Lin and Liu (2000) and Cai and Treisman (2006) also dispute the Chinese case as prime evidence. Cai and Treisman (2006), for instance, found that there is no convincing link between political or fiscal decentralization and China's economic success. Moreover, Yang (2016) demonstrated that the effect of decentralization on local economic growth in China turns negative as the degree of decentralization becomes excessively high.

This chapter first goes beyond the case study approach and overcomes the lack of comparative data with the newly-built dataset on tax assignment described in the preceding chapter (see chapter 2). From the dataset are derived multiple indicators on sub-national governments taxing rights and their discretion over tax-related decisions, and to which I adjoin firm-level data on the perceived fiscal burden of the tax system on business operations from the WBES. In addition, the empirical framework also zooms into specific decision components that are assigned to sub-tier authorities such as the ability to set the tax rates or tax administration whose impact on business operations might well differ. With the new indicators, the chapter also investigates the effects of sub-national discretion over the main categories of tax instruments – namely income, consumption and property taxes – which are the most prone to affect business operations.

3.3 Data Sources and Description

3.3.1 Measuring Sub-national Governments Taxing Rights

Intergovernmental tax and revenue arrangements have long been a central topic in the public finance literature. Indicators that capture such arrangements are often operationalized through national accounts statistics by public finance economists.

These include, for instance, the ratios of sub-national (tax) revenue in consolidated general government (tax) revenue (Dziobek et al., 2011; OECD, 2013; Vo, 2014). Nonetheless, and as argued above, these ratios fail to account for the decision-making structure over tax and revenue instruments by different layers of government in a given country. In view of these shortcomings, alternative measurements are put forward by the OECD tax autonomy database and the Regional Authority Index: the most prominent ones to date. Nevertheless, these sources are either limited in scope and coverage or not disaggregated enough to capture different dimensions of the tax system.

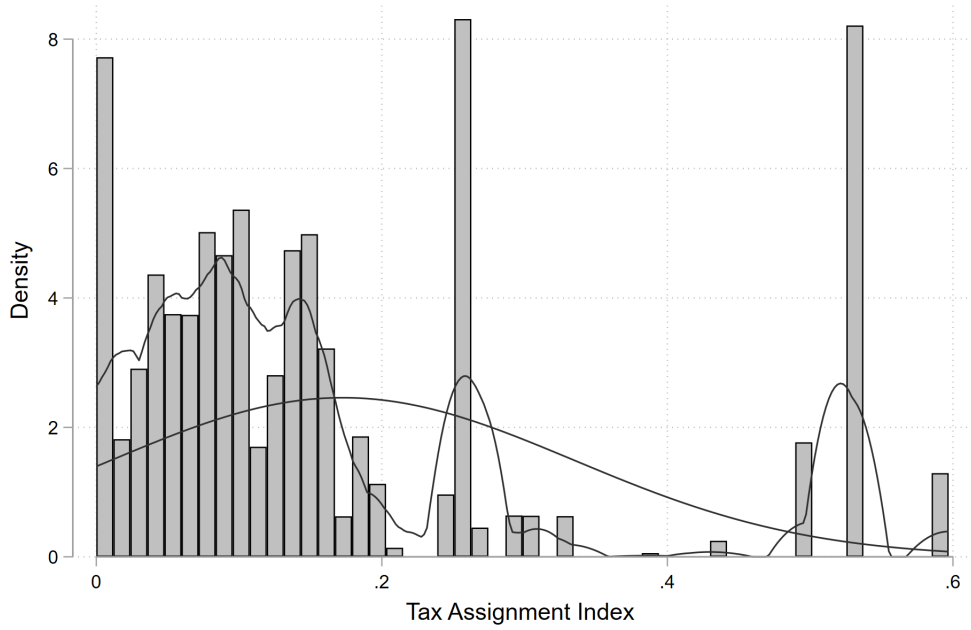
In my research, I address this lack of cross-country information by developing a new dataset on the multi-layer tax arrangements. As described in section 2.3 of the previous chapter, the new dataset differs from existing ones in some important ways. First, it offers more extensive coverage with the inclusion of 143 developing and emerging countries. It thereby provides a first step in documenting comparative information on the multi-layer governance tax system in the least-developed economies. Second, it allows for the creation of comprehensive indicators that contrast the inter-governmental tax arrangements across countries, either for specific tax instruments (such as income, consumption or property) or specific decision structure such as the setting of tax rates or tax administration.

This chapter uses the aggregated *Tax Assignment Index*, derived from the main scoring procedure (see chapter 2, subsection 2.4.3), and which stands as the overall taxing rights of sub-national governments over the tax system. It ranges from 0 to 0.793 in the original dataset, yet from 0 to 0.597 for the sub-sample of countries used in this chapter. A high score indicates that sub-central authorities have, by law, the rights to influence decision-dimensions regarding tax matters and across existing tax instruments. Figure 3.1 indicates that the indicator is skewed to the right given that sub-national taxing powers are limited in most developing and emerging economies.

The chapter also zooms into specific dimensions related to the setting of tax rates and tax administration which, by extension, I label as the *Tax Rate Assignment (TRA)* and *Tax Administration Assignment (TAA)*. A high score indicates that sub-central authorities have, by law, some extensive rights to influence the corresponding dimension. These considerations are of utmost importance due to their implication in revenue mobilization. For instance, a tax administration split across governments layers implies that significant responsibilities in terms of auditing and monitoring of the taxpayers would be undertaken by different enforcement agencies, and enforcement mechanisms might differ significantly from one jurisdiction to another. On the other hand, it might be advantageous to have a centralized tax administration even when

local and intermediate government authorities decide over the setting of tax rates and the tax bases. Central government agencies might administer a tax instrument whose taxable base is defined by local authorities. Likewise, the tax rates on an instrument whose revenue is collected by local authorities might be set by central authorities, even though the local tax collection implies that a more considerable discretion over parameters such as audits and enforcement.

Figure 3.1: Distribution of the Tax Assignment Index for the Country Sample



For robustness purposes, the empirical estimations also consider the indicators that are solely based on income, consumption and property tax and their respective versions from the alternative scoring approach (see Table 2.4.3). Income, consumption and property taxes are regarded as the most important revenue sources and the conventional tax instruments across countries. They are also the most prone to affect the business operations of firms surveyed in the WBES.

As described in sub-section 2.4.3, in many countries, including some unitary states, the intermediate level of government carries discretionary power over the tax system, as displayed by the coding matrix. Regional governments can either single-handedly decide over specific dimensions or join the central and (or) local-level authorities in taking such decisions. Bundling the intermediate and local levels and assigning a single weight to "sub-national" authorities as a whole might undermine the relevance of regional and local governments to the central. In the alternative scoring procedures, I assign a weight to regional authorities such that, in joint decisions that involve central, intermediate and local governments *("C, I, L")*, $\alpha = 2/3$ instead of $1/2$. This approach creates a minor deviation in the leading indicators for a few countries (see Figure A2.1

Table 3.1: Summary Statistics for Country Sample

Variables	N	Mean	SD	Min	Max
Tax Assignment Index	111	0.114	0.111	0	0.597
Tax Assignment Index(*)	111	0.115	0.113	0	0.606
Tax Administration Assignment	111	0.232	0.173	0	0.714
Tax Administration Assignment (*)	111	0.235	0.176	0	0.725
Tax Rate Assignment	111	0.122	0.129	0	0.607
Tax Rate Assignment (*)	111	0.124	0.131	0	0.607
Tax Assignment Index (I,C,P)	111	0.089	0.088	0	0.527
Tax Assignment Index (*I,C,P)	111	0.089	0.089	0	0.527
Tax Rate Assignment (*I,C,P)	111	0.092	0.104	0	0.500
Tax Administration Assignment (*I,C,P)	111	0.193	0.162	0	0.666
N	111				

Notes: (*) implies that the indicator has been revised to account for the relevance of the intermediate level of governments in joint decisions with central and local authorities; (I,C,P) refers to measurements that solely take into account the discretion over income, consumption and property taxes.

in Appendix 2). These alternatives measurements are used to test the robustness and sensitivity of the coefficient estimates. Table 3.1 shows the summary statistics of these indicators for the country sample covered in this chapter.

3.3.2 Firm-level Data and Covariates

The firm-level data are withdrawn from the World Bank Enterprise Surveys (WBES) which so far provide the most comprehensive micro-level firm data for many developing and emerging economies. The underlying methodology of the WBES, including the random selection of the sample and standardized questionnaires, makes empirical estimations comparable across different types of enterprises and countries. The WBES include an extensive description of each surveyed firm (e.g. sector of operation, size, registration date) which helps to capture the heterogeneity of firms within and across countries.

The WBES survey data also encompass the firms' managers and owners' reports on the effects of government regulations on their business operations. Thus, in the absence of comparative data and information on sub-national government regulatory policies, I assess the effects of taxing rights on private sector development by aligning the tax assignment indicators (described in the previous section) to the firms' fiscal burden as reported in the WBES. In each survey round, it is asked of the enterprises' owners and managers to indicate the extent to which tax rates and tax administration are obstacles

to their business operations. The answers range from 0 to 4, with *(0) = no obstacle; (1) = minor obstacle; (2) = moderate obstacle; (3) = major obstacle; (4) = very severe obstacle*. The dependent variables are thus operationalized through these answers as follows:

- ***Financial Burden***: To what extent are tax rates obstacles to current business operations?
- ***Administrative Burden***: To what extent is tax administration an obstacle to current business operations?

The empirical models control for the heterogeneity of firms and countries through an array of variables. At the firm-level, are included, first and foremost, the age of operations, the sector of operations and the size of the firms. The rationales behind these variables are numerous and based on previous research. On the size of firms, the scholarly work on capture theory (see for e.g. Stigler, 1971; Peltzman, 1976) suggests that governments might facilitate firms that can provide a maximum of rents or contribute to unemployment reduction. On the age of operations, however, it is argued that government policies might favour younger firms where efficiency gains are likely to be more significant. While the direction of the effects remains ambiguous, it is expected that both the size and age of operations would explain the fiscal and regulatory burden faced by the enterprises in each country. The industry in which the firm operates is also expected to be a crucial determinant of the fiscal burden. Research findings by Yang (2016), for instance, suggest that the effects of revenue and expenditure decentralization on economic growth vary across sectors of the economy (agriculture, manufacturing, and services), with the most significant impact on the secondary sector. The results also indicate that the tax burden is more harmful to the secondary and tertiary sectors.

In addition to the size, age and sector of operations, I also control for the location of the firms through the size of the city where they are located. The original variable on location size, previously coded as *(1) Over 1,000,000; (2) 250,000–1,000,000;(3) 50,000–250,000; (4) Under 50,000*, has been recoded into a binary variable that equals to 1 if the firm is located within a city of one million or more inhabitants. The location variable aims to capture the size of the immediate market that is available to a given firm, which can also be viewed as the size of the local economy in which it operates.

The empirical estimations account for a firm's openness to trade through a binary variable that equals 1 if a firm is involved in export activities. It is assumed that exporting enterprises might benefit from fiscal and regulatory incentives which may

Table 3.2: Variables Description *(1)*

VARIABLES	DEFINITION	DATA SOURCES
	Dependent Variables	
Financial Burden	Tax Rates as obstacles to business operations: *(0) = no obstacle; (1) = minor obstacle; (2) = moderate obstacle; (3) = major obstacle; (4) = very severe obstacle*	WBES
Administrative Burden	Tax Administration as obstacles to business operations: *(0) = no obstacle; (1) = minor obstacle; (2) = moderate obstacle; (3) = major obstacle; (4) = very severe obstacle*	WBES
Time spent on government regulations	Percentage of time that management spends dealing with government regulations	WBES
Audited in the preceding 12 months	If the firm was audited in the 12 months prior to the survey	WBES
Bribe request by tax officials	If tax inspectors requested bribes from the firm owner at the time of the audit	WBES
	Main Explanatory Variables	
Tax Assignment Index	Tax Assignment Index	Author's
Tax Assignment Index(*)	Tax Assignment Index (alternative scoring)	Author's
Tax Assignment Index (I,C,P)	Tax Assignment Index | Income, Consumption and Property	Author's
Tax Assignment Index (*,I,C,P)	Tax Assignment Index | Income, Consumption and Property (alternative scoring)	Author's
Tax Rate Assignment	Tax Rate Assignment	Author's
Tax Rate Assignment(*)	Tax Rate Assignment (alternative scoring)	Author's
Tax Administration Assignment	Tax Administration Assignment	Author's
Tax Administration Assignment(*)	Tax Administration Assignment (alternative scoring)	Author's
Tax Rate Assignment(*,I,C,P)	Tax Rate Assignment | Income, Consumption and Property (*)	Author's
Tax Administration Assignment(*,I,C,P)	Tax Administration Assignment | Income, Consumption and Property (*)	Author's
Tax Autonomy	Sub-national taxing rights weighted by the ratio of sub-national in general government tax revenues (SNGT/GGT)	Author's
Tax Autonomy (I,C,P)	Sub-national taxing rights (for income, consumption and property taxes) weighted by the ratio of sub-national in general government tax revenues for the same tax instruments (SNGT/GGT for Income, Consumption and Property Taxes)	Author's; IMF GFS
Tax Autonomy (Rate)	Sub-national discretion over the setting of tax rates weighted by the ratio of sub-national in general government tax revenues (SNGT/GGT)	Author's; IMF GFS
Tax Autonomy (Administration)	Sub-national discretion over tax administration weighted by the ratio of sub-national in general government tax revenues (SNGT/GGT)	Author's; IMF GFS

Notes: WBES: World Bank Enterprise Surveys; IMF GFS: IMF Government Finance Statistics. (*) implies that the indicator has been revised to account for the relevance of the intermediate level of governments in joint decisions with central and local authorities. SNGT: Sub-national Tax Revenue; GGT: General Government Tax Revenue.

Table 3.3: Variables Description *(2)*

VARIABLES	DEFINITION	DATA SOURCES
	Firm-level control variables	
Age (ln)	Number of years since a firm started its operation	WBES
Exporting Firm	If a firm exports its products and services	WBES
Ownership (national)	If a firm is owned by citizens	WBES
Branch	If a firm is a branch of a larger firm	WBES
Gender of Manager	If manager if female	WBES
City	If a firm is located in a city with a population of 1 million inhabitants or more	WBES
Firm Size: Small	Small firms (less than 20 employees)	WBES
Firm Size: Medium	Medium-sized firms (between 20 and 99 employees)	WBES
Firm Size: Large	Large firms (100 employees or more)	WBES
Sector: Manufacturing	Sector of operations: Manufacturing	WBES
Sector: Services	Sector of operations: Services	WBES
Sector: Others	Sector of operations: Others	WBES
Sales (ln) FY-1	Sales level of the firm in the year prior to the survey	WBES
Financial Access	Access to a bank account or credit line	WBES
Status: Shareholding with traded shares	Firm Legal Status: Shareholding with traded shares	WBES
Status: Shareholding with non-traded shares	Firm Status: Shareholding with non-traded shares	WBES
Status: Sole partnership	Firm Status: Sole partnership	WBES
Status: Partnership	Firm Status: Partnership	WBES
	Country-level control variables	
Per capita GDP (ln)	Per capita GDP (ln)	WDI
Ethnic Fractionalization	Ethnic Fractionalization	QoG (Alesina et al., 2003)
WB Regulation Quality	WB Regulation Quality	WGI
Region: East Asia and the Pacific	Region 1: East Asia and the Pacific	WDI
Region: Europe and Central Asia	Region 2: Europe and Central Asia	WDI
Region: Latin America and the Caribbean	Region 3: Latin America and the Caribbean	WDI
Region: Middle-East and North Africa	Region 4: Middle-East and North Africa	WDI
Region: South Asia	Region 5: South Asia	WDI
Region: Sub-Saharan Africa	Region 6: Sub-Saharan Africa	WDI

Notes: WBES: World Bank Enterprise Surveys; WDI: World Development Indicators; QoG: Quality of Government Dataset; IMF GFS: IMF Government Finance Statistics.

Table 3.4: Summary Statistics

VARIABLES	N	MEAN	SD	MIN	MAX
Dependent Variables					
Financial Burden					
Tax Rates: (0) = no obstacle	94053	0.235	0.424	0	1
Tax Rates: (1) = minor obstacle	94053	0.190	0.393	0	1
Tax Rates: (2) = moderate obstacle	94053	0.251	0.434	0	1
Tax Rates: (3) = major obstacle	94053	0.213	0.410	0	1
Tax Rates: (4) = very severe obstacle	94053	0.110	0.313	0	1
Administrative Burden					
Tax Administration: (0) = no obstacle	94053	0.333	0.471	0	1
Tax Administration: (1) = minor obstacle	94053	0.222	0.415	0	1
Tax Administration: (2) = moderate obstacle	94053	0.239	0.426	0	1
Tax Administration: (3) = major obstacle	94053	0.143	0.350	0	1
Tax Administration: (4) = very severe obstacle	94053	0.064	0.244	0	1
Time spent on government regulations	86067	11.360	19.439	0	100
Audited in the preceding 12 months	93025	0.583	0.493	0	1
Bribe request by tax officials	50962	0.137	0.344	0	1
Main Explanatory Variables					
Tax Assignment Index	94053	0.173	0.162	0	0.597
Tax Assignment Index(*)	94053	0.174	0.163	0	0.606
Tax Assignment Index (I,C,P)	94053	0.300	0.197	0	0.714
Tax Assignment Index (*,I,C,P)	94053	0.303	0.198	0	0.725
Tax Rates Assignment	94053	0.189	0.191	0	0.607
Tax Rates Assignment(*)	94053	0.190	0.192	0	0.607
Tax Administration Assignment	94053	0.126	0.117	0	0.527
Tax Administration Assignment(*)	94053	0.127	0.118	0	0.527
Tax Rates Assignment(*,I,C,P)	94053	0.145	0.158	0	0.500
Tax Administration Assignment(*,I,C,P)	94053	0.237	0.176	0	0.666
Tax Autonomy	44997	0.023	0.034	0	0.112
Tax Autonomy (I,C,P)	39176	0.024	0.037	0	0.122
Tax Autonomy (Rate)	44997	0.031	0.052	0	0.170
Tax Autonomy (Administration)	44997	0.040	0.055	0	0.176
Firm-level control variables					
Age (ln)	94053	2.640	0.824	-4.605	5.832
Exporting Firm	94053	0.171	0.376	0	1
Ownership (national)	94053	0.902	0.297	0	1
Branch	94053	0.189	0.392	0	1
Gender of Manager	94053	0.160	0.366	0	1
City	94053	0.713	0.453	0	1
Firm Size: Small	94053	0.449	0.497	0	1
Firm Size: Medium	94053	0.345	0.475	0	1
Firm Size: Large	94053	0.206	0.404	0	1
Sector: Manufacturing	94053	0.526	0.499	0	1
Sector: Services	94053	0.193	0.395	0	1
Sector: Others	94053	0.281	0.449	0	1
Sales (ln) FY-1	80808	17.182	3.268	0	34.105
Financial Access	93426	0.867	0.339	0	1
Status: Shareholding with traded shares	93753	0.055	0.229	0	1
Status: Shareholding with non-traded shares	93753	0.404	0.491	0	1
Status: Sole partnership	93753	0.334	0.472	0	1
Status: Partnership	93753	0.206	0.405	0	1
Country-level control variables					
Per capita GDP (ln)	94053	8.884	0.866	6.439	10.461
Ethnic Fragmentation	94053	0.511	0.251	0.039	1
WB Regulation Quality	94053	-0.279	0.635	-2.176	1.473
Region: East Asia and the Pacific	94053	0.125	0.330	0	1
Region: Europe and Central Asia	94053	0.263	0.440	0	1
Region: Latin America and the Caribbean	94053	0.184	0.388	0	1
Region: Middle East and North Africa	94053	0.082	0.274	0	1
Region: South Asia	94053	0.144	0.351	0	1
Region: Sub-Saharan Africa	94053	0.203	0.402	0	1
N	94053				

influence their appraisal of the tax system. Exporting firms are also likely to have higher leverage and more efficient tools to counter excessive fiscal pressure. As foreign firms might be subject to different sets of regulation, enterprises' ownership is added as a covariate and equals 1 if a local (national) individual owns the enterprise, and 0 otherwise. Besides, it is also included dichotomous indicators for the gender of the primary manager *(1=female, 0=male)*, and for whether the enterprise is a branch of a much larger enterprise *(1=branch; 0=sole enterprise)*. In sensitivity analyses, the models also control for the firms' heterogeneity in financial status by including the level of sales in the year preceding the survey, their status (e.g. shareholding or partnership) and their access to financial services in the forms of a bank account or a credit line.

At the country-level, and in addition to the proxies of sub-national governments taxing rights, I control for the country context through variables that account for the scale effects of economic development, the rule of law and ethnic heterogeneity. These include the real per capita gross domestic product (GDP) – a widely used measure of development level; the World Bank Governance Indicator on regulatory quality as a proxy for the rule of law; and an indicator of ethnic fractionalization which proxies the level of heterogeneity in a country. Ethnic diversity has previously been established as a driver of decentralization (Arzaghi and Henderson, 2005), and citizens' preference for decentralized tax administration (Campbell, 2003). In order to capture the trend and not a year-based estimate, the country-level variables are averaged over three years: two years prior and the year of the survey data collection, such that for each response at time t (year of the survey) corresponds an estimate $x_{2sj,t} = \frac{\Sigma_{t=1}^{t-2} x'_{2sj}}{3}$. Table 3.2, Table 3.3 and Table 3.4 provide the description and summary statistics of the variables.

3.4 Estimation Techniques and Results

3.4.1 Cross-Sectional Estimations

Given that the outcome variables are categorical and ordered, the primary identification strategy is a generalized linear mixed-effects ordered probit model in which the firm-level characteristics are nested in-country context (Raudenbush and Bryk, 2002; Rabe-Hesketh and Skrondal, 2012). This estimation technique controls for fixed and random effects in the likes of firms and countries' heterogeneous characteristics, as I argue that both the firms' characteristics and country contexts influence the reported fiscal burden of the enterprises in the country sample.

The generalized mixed-effects methodology is grounded on the premise that the hierarchical structure of data induces a violation of the independence assumption of standard regression models. By relaxing this assumption, the estimation method is expected to deliver more accurate estimates of the extent to which higher-level parameters are accountable for micro-level outcomes. The mixed-effects analysis of economic development has been more systematic in recent years with numerous studies in the field of health and labour economics, linking the macro and micro patterns. Innovation and management studies (see for e.g. Goedhuys and Srholec, 2010) have also argued for the need to consider both firms' capabilities and the national environment. The use of a mixed-effects model predominantly reduces the probability of bi-directional causality between firm-level responses and the tax assignment indicators, which are measured at the country level, although subsequent estimations also address the potential issues of endogeneity in the measurements.

Let K be the number of response categories of the outcome variables with $K = 0, ..., 4$. Let $J : j = 1, ..., J$ be the number of clusters or countries with each cluster consisting of $i = 1, ...n_j$ observations or firms. The following relation gives the cumulative probability of a response being in a higher category than k conditional on a set of fixed effects parameters $\mathbf{x}_{ij}$, a set of cut-points κ and a set of random effects $\mathbf{u}_j$:

$$Pr(y_{ij} > k|\mathbf{x}_{ij}, \kappa, \mathbf{u}_j) = \mathbf{\Phi}(\mathbf{x}_{ij}\beta + \mathbf{z}_{ij}\mathbf{u}_j - \kappa_k) \tag{3.1}$$

$\mathbf{\Phi}$ is the normal cumulative distribution function that represents cumulative probability. The $(1 \times p)$ row vector $\mathbf{x}_{ij}$ represents the characteristics of firm i in country j. It is the vector of covariates for the fixed effects with their respective coefficients β. The $(1 \times q)$ vector $\mathbf{z}_{ij}$ consists of covariates corresponding to the random effects and can be used to represent both the random intercepts and random coefficients which, in the former case, is simply the scalar 1. The random-effects u_j are assumed to be independently distributed across countries and independent of the covariates represented by the row vector $\mathbf{x}_{ij}$.

Equation 3.1 can alternatively be written in terms of latent responses y^*_{ij} where the error terms ϵ_{ij} follow standard normal distributions with mean 0 and variance 1, and are independent of the vector $\mathbf{x}_{ij}$ and across u_j. In all specifications, it is assumed that $\mathbf{u}_{ij}$ are independent across individual respondents and independent of the covariates, and therefore do not affect the probability of observing the individual outcome variables given the random intercept – also known as the strict exogeneity conditional on the random intercept (Rabe-Hesketh and Skrondal, 2012, Chapter 10). The fiscal burden of

the tax rates and tax administration on business operations is thus related to the latent responses via the threshold model below (Equation 3.3).

$$y_{ij}^{*} = \mathbf{x}_{ij}\beta + \mathbf{z}_{ij}\mathbf{u}_{j} + \epsilon_{ij} \tag{3.2}$$

$$y_{ij} = \begin{cases} 0 & \text{if} \quad y_{ij}^{*} \leq \kappa_0 \\ 1 & \text{if} \quad \kappa_1 < y_{ij}^{*} \leq \kappa_1 \\ \vdots & \quad \vdots \\ 4 & \text{if} \quad \kappa_3 < y_{ij}^{*} \end{cases} \tag{3.3}$$

To recall, the dependent variables are operationalized via answers to the WBES questions *"to what extent are (is) tax rates (tax administration) obstacles to current business operations?"*. Answers to these questions range from 0 to 4 (*0=no obstacle; 4=very severe obstacle*). A positive and significant coefficient thus indicates a higher probability of being in the upper categories of the responses, thus perceiving tax rates and tax administration as more severe obstacles to business operations.

One way to assess the heterogeneity of the countries in the mixed-effects econometric model is to compute the variance partition coefficient (VPC) or intra-class correlation (ICC) which indicates the proportion of total residuals (level 1 and level 2) that is attributable to between-countries variances. The intraclass correlation coefficient is given by $ICC = \frac{\sigma_u^2}{\sigma_u^2+1}$ for probit models.

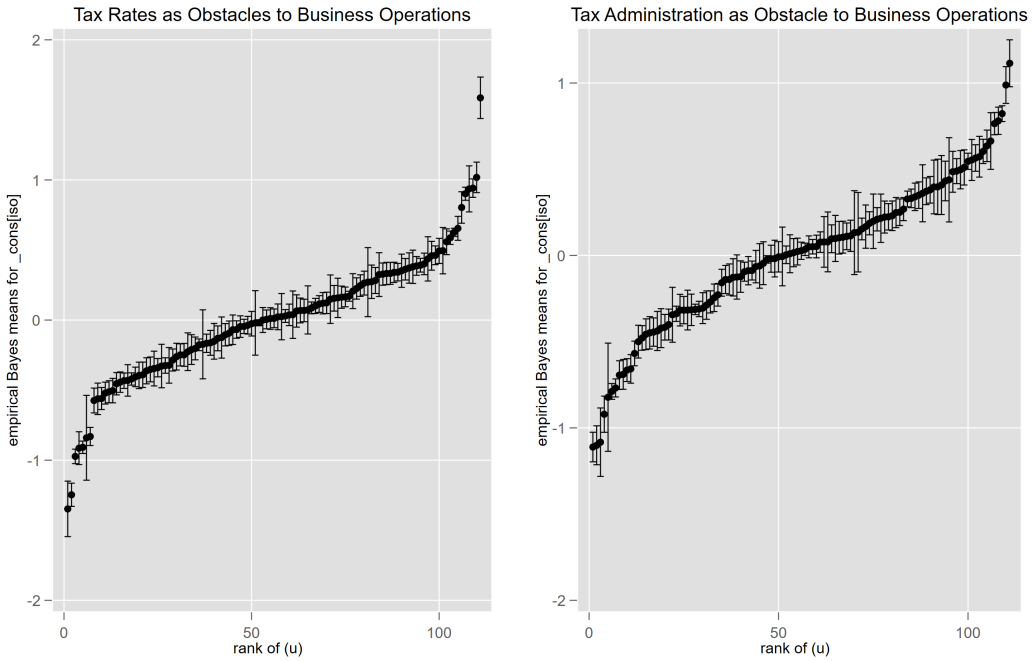
Table 3.5: Null Model

	Financial Burden		Administrative Burden	
Cut1	-0.789***	(0.048)	-0.514***	(0.050)
Cut2	-0.203***	(0.048)	0.104**	(0.046)
Cut3	0.509***	(0.048)	0.840***	(0.046)
Cut4	1.347***	(0.050)	1.593***	(0.047)
Variance(country)	0.216***	(0.038)	0.198***	(0.028)
N firms	94053		94053	
N countries	111		111	
Log-likelihood	-140791.4		-134627.3	
AIC	281592.8		269264.6	
ICC	17.8 %		16.5%	

Standard errors (in parentheses) are clustered at the country level.
Significance level: * p < 0.10, ** p < 0.05, *** p < 0.01.

The estimated between-country variance in the null model (Table 3.5) is respectively 0.216 and 0.198 for the financial and administrative burden, which implies that 17.8% and 16.5% of the variations in the answers to these questions are due to between-

Figure 3.2: Caterpillar Plot of the Country Effects (random effects)



country differences. Figure 3.2 is a graphical representation of the country effects. It is obtained by calculating the empirical Bayes predictions (a.k.a., posterior means or shrinkage estimates) of the random effects in the null model in rank order with a 95% confidence interval. The caterpillar plot shows that for many countries, the 95% confidence interval does not overlap zero, which indicates that the fiscal burden of tax rates and tax administration is significantly above or below the average (represented by the 0 line) at the 5% level for these countries. The generalized mixed-effects approach with the firms' characteristics nested in-country context is thus justified as an adequate estimation technique.

The empirical baseline estimates for the cross-sectional mixed-effects models are reported in Table 3.6 and Table 3.7, respectively. In Table 3.6, the primary indicator of interest is the tax assignment index which measures the overall taxing rights of sub-national governments. The results indicate that – all else being equal – firms in countries with a higher level of sub-national discretionary power over the tax system are more likely to report that tax rates and tax administration are obstacles to their business operations. These findings are in line with Treisman (2000) who previously hinted that there is a more significant burden of venality for firms doing business in cases where sub-national governments have a high degree of control over the fiscal space. At the firm-level, the coefficient estimates on firm ownership suggest that nationally-owned firm tend to report a greater financial burden of tax rates on their business operations than foreign enterprises, a finding which is consistent throughout

all the empirical estimations.

Sub-national Discretion over Income, Consumption and Property Taxes

In Table 3.7, I consider a variation of the main indicator of sub-national taxing rights which integrates only their discretion over the main tax instruments – income, consumption and property taxes. As argued earlier, these sources are the most prominent across countries and the most prone to affect business operations. *Tax Assignment (I,C,P)* of Table 3.7 thus reflects the discretionary power of sub-national government authorities over these instruments and across the four types of decision which, to recall, are the setting of the instruments, the definition of the taxable bases, the setting of the tax rates and tax administration (as described in chapter 2, subsection 2.4.2). The coefficient estimates are consistent with the previous table (Table 3.6) and suggest that the greater the level of discretionary power of lower-tier authorities over these main revenue instruments, the higher the probability of firms reporting that tax rates and tax administration are obstacles to their business operations.

Sub-national Discretion over Tax Rates and Tax Administration

Moving beyond the aggregated indicators, I estimate the effects of different decision dimensions by zooming into the discretionary power of sub-national authorities over tax rates and tax administration. First, I consider the sub-national discretion over tax rates and tax administration for all identified instruments. Second, I take into consideration these two dimensions but with indicators solely constructed with data for income, consumption and property tax. The results are reported in Table 3.8. They suggest that lower-tier governments decisions over tax rates and tax administration tend to negatively affect business operations.

Sensitivity Checks with alternative scoring procedures

As discussed in subsection 2.4.3, the alternative scoring procedures led to new versions for every indicator in the dataset, even though the differences are minor and only involve a relatively small number of countries. With these revised indicators, I re-estimated the models above; the results are reported in Appendix 3 (see Table A3.2, Table A3.3 and Table A3.1) and are in line with the above estimations

Table 3.6: Sub-national Governments Taxing Rights and Fiscal Burden on Business Operations: Baseline Model | Mixed-Effects Ordered Probit

	Financial Burden						Administrative Burden					
	(1.1)		(1.2)		(1.3)		(2.1)		(2.2)		(2.3)	
Country-level Variables												
Tax Assignment Index	0.717***	(0.065)	0.713***	(0.070)	0.848***	(0.073)	0.478***	(0.066)	0.399***	(0.066)	0.593***	(0.058)
Per capita GDP (ln)	-0.071***	(0.020)	-0.045***	(0.017)	-0.015	(0.029)	-0.178***	(0.022)	-0.145***	(0.021)	-0.149***	(0.022)
Ethnic Fractionalization	-0.480***	(0.062)	-0.431***	(0.055)	-0.300***	(0.055)	-0.062	(0.076)	0.032	(0.075)	-0.145***	(0.036)
WB Regulatory Quality	0.016	(0.020)	0.036**	(0.018)	-0.032	(0.022)	0.145***	(0.027)	0.119***	(0.025)	0.032	(0.019)
Firm-level Variables												
Age (ln)	0.019**	(0.007)	0.017**	(0.007)	0.015*	(0.008)	0.010	(0.008)	0.008	(0.008)	0.008	(0.008)
Exporting firm	0.021	(0.020)	0.018	(0.017)	0.003	(0.018)	0.075***	(0.015)	0.068***	(0.015)	0.070***	(0.014)
Ownership (national)	0.100***	(0.021)	0.095***	(0.022)	0.110***	(0.021)	0.086***	(0.019)	0.089***	(0.019)	0.073***	(0.020)
Branch	-0.035*	(0.018)	-0.034*	(0.019)	-0.022	(0.018)	0.008	(0.021)	0.012	(0.021)	0.010	(0.021)
Gender of Manager	0.035*	(0.018)	0.037**	(0.018)	0.037**	(0.017)	0.001	(0.016)	-0.003	(0.016)	0.013	(0.015)
City >= 1 million	0.032	(0.032)	0.030	(0.031)	0.078*	(0.041)	0.052*	(0.027)	0.046*	(0.027)	0.047*	(0.028)
Sector FE	Yes		Yes		Yes		Yes		Yes		Yes	
Size FE	Yes		Yes		Yes		Yes		Yes		Yes	
Regional FE	No		No		Yes		No		No		Yes	
Cut1	-1.424***	(0.203)	-1.180***	(0.175)	-0.046	(0.269)	-1.924***	(0.241)	-1.599***	(0.227)	-1.160***	(0.204)
Cut2	-0.838***	(0.200)	-0.593***	(0.172)	0.540**	(0.259)	-1.306***	(0.236)	-0.981***	(0.222)	-0.541**	(0.211)
Cut3	-0.126	(0.199)	0.118	(0.173)	1.252***	(0.261)	-0.570**	(0.234)	-0.245	(0.220)	0.197	(0.216)
Cut4	0.713***	(0.208)	0.955***	(0.181)	2.092***	(0.264)	0.183	(0.235)	0.508**	(0.221)	0.951***	(0.224)
σ_u^2	0.108***	(0.029)	0.127***	(0.029)	0.107***	(0.027)	0.171***	(0.028)	0.181***	(0.029)	0.102***	(0.023)
N firms	94053		94053		94053		94053		94053		94053	
N countries	111		111		111		111		111		111	
χ^2	549.3		445.7		1026.1		436.1		488.7		3483.7	
Log-likelihood	-141673.4		-141696.0		-141672.2		-135706.5		-135783.5		-135516.9	
AIC	283380.8		283430.0		283392.5		271447.0		271605.0		271081.8	

Notes: Standard errors (in parentheses) are clustered at the country level. Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Size FE refers to the size of the firm in terms of the number of employees: small (less than 20 employees), medium (between 20 and 99 employees), large (above 99 employees). Sector FE refers to the industry of operations (1: Manufacturing, 2: Services, 3: others). Regional FE refers to the world region according to the World Bank classification: East Asia and the Pacific, Europe and Central Asia, Latin America and the Caribbean, Middle East and North Africa, South Asia, Sub-Saharan Africa.

Table 3.7: Sub-national Governments Taxing Rights and Fiscal Burden on Business: Discretion over Income, Consumption and Property Taxes | Mixed-Effects Ordered Probit

	Financial Burden						Administrative Burden					
	(1.1)		(1.2)		(1.3)		(2.1)		(2.2)		(2.3)	
Country-level Variables												
Tax Assignment Index(I,C,P)	0.727***	(0.078)	1.175***	(0.086)	0.914***	(0.093)	0.450***	(0.103)	0.445***	(0.102)	0.620***	(0.073)
Per capita GDP (ln)	-0.002	(0.020)	-0.098***	(0.015)	0.039	(0.028)	-0.134***	(0.020)	-0.134***	(0.020)	-0.118***	(0.021)
Ethnic Fractionalization	-0.709***	(0.051)	-0.527***	(0.049)	-0.197***	(0.065)	0.080	(0.078)	0.079	(0.078)	-0.115***	(0.041)
WB Regulatory Quality	-0.148***	(0.023)	-0.022	(0.017)	-0.058**	(0.025)	0.109***	(0.023)	0.108***	(0.023)	0.005	(0.018)
Firm-level Variables												
Age (ln)	0.011	(0.010)	0.025***	(0.007)	0.015*	(0.008)	0.010	(0.009)	0.009	(0.008)	0.008	(0.008)
Exporting firm	0.012	(0.022)	0.020	(0.017)	0.007	(0.018)	0.068***	(0.015)	0.065***	(0.015)	0.071***	(0.013)
Ownership (national)	0.115***	(0.020)	0.102***	(0.022)	0.102***	(0.022)	0.095***	(0.019)	0.094***	(0.019)	0.075***	(0.020)
Branch	-0.037*	(0.019)	-0.029	(0.018)	-0.025	(0.019)	0.011	(0.021)	0.011	(0.021)	0.010	(0.020)
Female Manager	0.042***	(0.015)	0.037**	(0.015)	0.036**	(0.016)	-0.003	(0.015)	-0.004	(0.016)	0.011	(0.015)
City >= 1 million	0.052	(0.035)	0.007	(0.030)	0.078*	(0.041)	0.040	(0.028)	0.041	(0.028)	0.046*	(0.028)
Sector FE	Yes		Yes		Yes		Yes		Yes		Yes	
Size FE	Yes		Yes		Yes		Yes		Yes		Yes	
Regional FE	No		No		Yes		No		No		Yes	
Cut1	-1.033***	(0.187)	-1.639***	(0.158)	0.440*	(0.252)	-1.487***	(0.220)	-1.496***	(0.221)	-0.869***	(0.193)
*Cut*2	-0.446**	(0.178)	-1.053***	(0.155)	1.026***	(0.242)	-0.870***	(0.216)	-0.879***	(0.216)	-0.250	(0.198)
Cut3	0.266	(0.178)	-0.342**	(0.156)	1.738***	(0.242)	-0.134	(0.215)	-0.143	(0.215)	0.488**	(0.205)
Cut4	1.103***	(0.179)	0.497***	(0.162)	2.576***	(0.246)	0.619***	(0.217)	0.610***	(0.217)	1.241***	(0.217)
σ^2	0.139***	(0.025)	0.191***	(0.026)	0.140***	(0.037)	0.182***	(0.029)	0.182***	(0.029)	0.103***	(0.027)
N firms	94053		94053		94053		94053		94053		94053	
N countries	111		111		111		111		111		111	
χ^2	418.4		571.7		957.6		338.0		383.5		2691.2	
Log-likelihood	-142021.9		-142080.7		-141805.6		-135832.4		-135887.0		-135377.8	
AIC	284077.7		284199.3		283659.2		271698.8		271812.0		270803.6	

Notes: Standard errors (in parentheses) are clustered at the country level. Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. (I,C,P) refers to measurements that solely take into account the discretion over income, consumption and property taxes. Size FE refers to the size of the firm in terms of the number of employees: small (less than 20 employees), medium (between 20 and 99 employees), large (above 99 employees). Sector FE refers to the industry of operations (1: Manufacturing, 2: Services, 3: others). Regional FE refers to the world region according to the World Bank classification: East Asia and the Pacific, Europe and Central Asia, Latin America and the Caribbean, Middle East and North Africa, South Asia, Sub-Saharan Africa.

Table 3.8: Sub-national Governments Taxing Rights and Fiscal Burden on Business: Discretion over Tax Rates and Tax Administration | Mixed-Effects Ordered Probit

	Financial Burden				Administrative Burden			
	(1.1)		(1.2)		(2.1)		(2.2)	
Country-level Variables								
Tax Rates Assignment (TRA)	0.831***	(0.058)						
Tax Administration Assignment(TAA)					0.272***	(0.048)		
Tax Rates Assignment (TRA - I,C,P)			0.992***	(0.084)				
Tax Administration Assignment (TAA - I,C,P)							0.097**	(0.048)
Per capita GDP (ln)	-0.018	(0.023)	0.023	(0.024)	-0.126***	(0.019)	-0.088***	(0.021)
Ethnic Fractionalization	-0.370***	(0.054)	-0.308***	(0.064)	-0.234***	(0.056)	-0.223***	(0.047)
WB Regulatory Quality	-0.035	(0.023)	-0.053**	(0.021)	-0.015	(0.022)	-0.035	(0.023)
Firm-level Variables								
Age (ln)	0.019**	(0.007)	0.020**	(0.008)	0.006	(0.007)	0.007	(0.007)
Exporting Firm	0.014	(0.017)	0.012	(0.017)	0.073***	(0.013)	0.073***	(0.013)
Ownership (national)	0.109***	(0.021)	0.107***	(0.021)	0.073***	(0.020)	0.072***	(0.020)
Branch	-0.022	(0.018)	-0.024	(0.018)	0.007	(0.022)	0.007	(0.021)
Female Manager	0.036**	(0.016)	0.036**	(0.016)	0.010	(0.015)	0.009	(0.015)
City >= 1 million	0.061	(0.040)	0.046	(0.037)	0.052*	(0.029)	0.046*	(0.028)
Sector FE	Yes		Yes		Yes		Yes	
Size FE	Yes		Yes		Yes		Yes	
Regional FE	Yes		Yes		Yes		Yes	
Cut1	-0.103	(0.209)	0.215	(0.226)	-1.013***	(0.176)	-0.715***	(0.190)
Cut2	0.484**	(0.203)	0.802***	(0.222)	-0.393**	(0.179)	-0.095	(0.195)
Cut3	1.196***	(0.206)	1.514***	(0.224)	0.345*	(0.185)	0.642***	(0.203)
Cut4	2.036***	(0.212)	2.352***	(0.232)	1.097***	(0.196)	1.395***	(0.216)
σ_u^2	0.123***	(0.027)	0.129***	(0.030)	0.105***	(0.028)	0.103***	(0.030)
N firms	94053		94053		94053		94053	
N countries	111		111		111		111	
χ^2	1864.0		1942.2		2751.9		3408.0	
Log-likelihood	-141907.1		-142035.3		-135293.6		-135252.9	
AIC	283862.3		284118.6		270635.1		270553.9	

Notes: Standard errors (in parentheses) are clustered at the country level. Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. (I,C,P) refers to measurements that solely take into account the discretion over income, consumption and property taxes. Size FE refers to the size of the firm in terms of the number of employees: small (less than 20 employees), medium (between 20 and 99 employees), large (above 99 employees). Sector FE refers to the industry of operations (1: Manufacturing, 2: Services, 3: others). Regional FE refers to the world region according to the World Bank classification: East Asia and the Pacific, Europe and Central Asia, Latin America and the Caribbean, Middle East and North Africa, South Asia, Sub-Saharan Africa.

and interpretations.

3.4.2 Endogeneity and Two-Stages IV Specifications

The mixed-effects models account for omitted biases and limit bi-directional causality between macro- and micro-level variables. In other terms, individual firm responses to the survey questionnaires do not per se influence the structure of the tax system at the national level, and bi-directional causality in the main variables of interest might be, to many extents, unwarranted. Notwithstanding, institutions, including inter-governmental tax arrangements, are regarded as being endogenous in empirical research. As such, the hierarchical model might be limited in establishing causality if the salience of the fiscal burden of the tax system on business operations contributed to shaping the multi-layer tax structure.

Hence, alternatively to the generalized mixed-effects model, I address the potential endogeneity of the indicators measuring sub-national taxing rights by recurring to extended probit estimation techniques in which I instrument the indicators of interest by the number of taxing tiers and the number of second-tier government authorities.

Although both regional (or intermediate) and local governments frequently have taxing powers in federal countries, stylized facts from the dataset suggest that regional authorities in some unitary state also carry minor discretionary power especially on the setting of tax rates. Therefore, in line with the common pool problem documented in the literature (Mello, 1999; Berkowitz and Li, 2000; Keen and Kotsogiannis, 2002, 2004), it is expected that the number of government layers with discretionary powers over the tax system would impact on business operations, and such impact only takes place via the inter-governmental tax arrangements captured by the above-described indicators.

The second instrument is the number of secondary-tier (or regional) governments. Previous literature (see for e.g. Keen and Kotsogiannis, 2004) has suggested that the number of lower-level jurisdictions tends to make excessively high tax rates even higher. Unlike the number of municipalities which change from year to year due to, among others, municipality splitting and population change, the number of regions in most countries tend to be static over the years as the creation of new regions often requires substantial changes in territorial structure, making it thus a likely exogenous factor in the models. In all empirical estimations, I also test whether the results are robust to the exclusion of this instrumental variable.

The extended ordered probit model (conditional probability of being in a response category) can be written in the following form (Equation 3.4) (Gregory, 2015; StataCorp, 2019).

$$Pr\left(y_{ij} = v_h | \mathbf{x}_{ij}\right) = \mathbf{\Phi}^* \left(c_{i(h-1)}, c_{ih}, 1 - \sigma'_{1c} \sum\nolimits_c^{-1} \sigma_{1c}\right) \tag{3.4}$$

The responses given by firm i located in country j are a function of an estimated indicator of sub-national taxing rights $\mathbf{r}_{ijc}$ (the discretion over the tax system as whole or specific dimensions such as the tax rates or tax administration), and the vector of covariates $\mathbf{x}_{ij}$ (Equation 3.5). $\mathbf{r}_{ijc}$ is assumed to be endogenous and is thus instrumented by the vector of exogenous variables $\mathbf{v}_{ijc}$ described above. The coefficient estimates are calculated using maximum likelihood functions.

$$y_{ij} = v_h \qquad \text{iff} \qquad \kappa_{h-1} < \mathbf{x}_{ij}\beta + \mathbf{r}_{ijc}\theta_c + \varepsilon_{ij} \leq \kappa_h \tag{3.5}$$

$$\text{with} \quad \mathbf{r}_{ijc} = \mathbf{v}_{ijc}\alpha_c + \epsilon_{ijc}$$

Table 3.9 reports the coefficient estimates on the impact of sub-national government taxing rights on the fiscal burden of the firms. Sub-national taxing rights are captured through the overall *Tax Assignment Index* and the one built solely with information on income, consumption and property tax *(Tax Assignment Index (I,C,P))*. Both indicators result from the alternative scoring procedures described in subsection 2.4.3. Specifications (1.1) to (2.2) are estimated using the two instrumental variables, whereas specifications (1.3) to (2.4) are estimated using only one instrumental variable – the number of taxing layers.

The results indicate that the discretionary power of sub-national governments has a significant impact on the reported financial burden of the firms in the WBES (i. e. tax rates are obstacles to business operations), but does not necessarily induce an administrative hassle. The test results for the correlation of the error terms – $corr(\varepsilon_{ijc}, \varepsilon_{ij})$ – yet fail to suggest that the proxies for sub-national taxing rights are endogenous in these specifications.

As to the previous estimations (Table 3.8), I also investigate whether specific decision dimensions of the multi-layer tax arrangements impact on business operations using the two-stages IV model. Table 3.10 reports the outcomes of the models testing

Table 3.9: Sub-national Governments Taxing Rights and Fiscal Burden on Business Operations: Extended Ordered Probit (with IV)

	Financial (1.1)	Administrative (2.1)	Financial (1.2)	Administrative (2.2)	Financial (1.3)	Administrative (2.3)	Financial (1.4)	Administrative (2.4)
TAI (*)	0.733** (0.368)	0.279 (0.292)			0.728** (0.365)	0.275 (0.293)		
TAI (*I,C,P)			0.875* (0.515)	0.252 (0.366)			0.880* (0.509)	0.256 (0.363)
Country-level variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-level variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Size FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Regional FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First-Stage								
Number of Second-tier	-0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)	0.000 (0.000)				
Number of taxing layers	0.168*** (0.044)	0.168*** (0.044)	0.121*** (0.028)	0.121*** (0.028)	0.168*** (0.044)	0.168*** (0.044)	0.121*** (0.029)	0.121*** (0.029)
Constant	-0.202** (0.081)	-0.202** (0.081)	-0.146*** (0.052)	-0.147*** (0.052)	-0.204*** (0.077)	-0.204*** (0.077)	-0.145*** (0.050)	-0.145*** (0.050)
Cut1	0.158 (0.601)	-0.754 (0.526)	0.413 (0.613)	-0.501 (0.563)	0.155 (0.600)	-0.753 (0.525)	0.414 (0.613)	-0.502 (0.564)
Cut2	0.715 (0.591)	-0.162 (0.529)	0.969 (0.604)	0.091 (0.564)	0.713 (0.591)	-0.161 (0.528)	0.970 (0.604)	0.090 (0.565)
Cut3	1.388** (0.594)	0.541 (0.533)	1.641*** (0.606)	0.794 (0.568)	1.386** (0.593)	0.542 (0.532)	1.642*** (0.606)	0.793 (0.569)
Cut4	2.182*** (0.597)	1.259** (0.537)	2.434*** (0.610)	1.512*** (0.575)	2.180*** (0.596)	1.260** (0.536)	2.435*** (0.610)	1.512*** (0.575)
corr(ε_{ijc},ε_{ij})	-0.006 (0.057)	0.058 (0.042)	-0.041 (0.056)	0.030 (0.045)	-0.004 (0.057)	0.059 (0.042)	-0.042 (0.056)	0.029 (0.044)
N firms	94053	94053	94053	94053	94053	94053	94053	94053
N countries	111	111	111	111	111	111	111	118
χ^2	178.1	152.7	178.8	154.5	178.6	151.9	178.6	153.9
Log-likelihood	-79266.4	-72161.3	-49322.4	-42202.0	-79283.3	-72176.5	-49329.8	-42211.1
AIC	158588.7	144378.5	98700.8	84459.9	158620.6	144407.1	98713.7	84476.3

Notes: Standard errors (in parentheses) are clustered at the country level. Significance level: * p < 0.10, ** p < 0.05, *** p < 0.01. TAI: Tax Assignment Index. (*) implies that the indicator has been revised to account for the relevance of the intermediate level of governments in joint decisions with central and local authorities; (I,C,P) refers to measurements that solely take into account the discretion over income, consumption and property taxes. Size FE refers to the size of the firm in terms of the number of employees: small (less than 20 employees), medium (between 20 and 99 employees), large (above 99 employees). Sector FE refers to the industry of operations (1: Manufacturing, 2: Services, 3: others). Regional FE refers to the world region according to the World Bank classification: East Asia and the Pacific, Europe and Central Asia, Latin America and the Caribbean, Middle East and North Africa, South Asia, Sub-Saharan Africa. Control variables include the age of operations, export status, ownership(nationally owned), branch, gender of manager, size of the location (city >= 1 million inhabitants), per capita GDP, ethnic fractionalization and the WB regulatory quality index. Specifications (1.1), (2.1), (1.2) and (2.2) are estimated using the two instrumental variables, whereas specifications (1.3), (2.3), (1.4), and (2.4) are estimated using only one instrumental variable (the number of taxing layers).

Table 3.10: Sub-national Governments Taxing Rights and Fiscal Burden on Business Operations: Discretion over Tax Rates and Tax Administration | Extended Ordered Probit (with IV)

	Financial (1.1)	Administrative (2.1)	Financial (1.2)	Administrative (2.2)	Financial (1.3)	Administrative (2.3)	Financial (1.4)	Administrative (2.4)
TRA (*)	0.724** (0.314)		0.716** (0.313)					
TAA (*)		0.126 (0.210)		0.122 (0.209)				
TRA (*,I,C,P)					0.792** (0.368)		0.801** (0.361)	
TAA (*I,C,P)						0.141 (0.273)		0.140 (0.272)
Country-level variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-level variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Size FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Regional FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First-Stage								
Number of taxing layers	0.185*** (0.054)	0.215*** (0.033)	0.184*** (0.054)	0.215*** (0.033)	0.151*** (0.045)	0.164*** (0.034)	0.151*** (0.046)	0.164*** (0.034)
Number of Second-tier	-0.000 (0.000)	-0.000 (0.001)			0.000 (0.000)	-0.000 (0.000)		
Constant	-0.221** (0.100)	-0.176*** (0.067)	-0.226** (0.096)	-0.181*** (0.064)	-0.199** (0.082)	-0.131** (0.065)	-0.196** (0.079)	-0.132** (0.062)
Cut1	-0.080 (0.537)	-0.392 (0.577)	-0.081 (0.534)	-0.391 (0.577)	0.102 (0.594)	-0.331 (0.565)	0.103 (0.596)	-0.330 (0.565)
Cut2	0.478 (0.530)	0.200 (0.579)	0.477 (0.527)	0.200 (0.578)	0.659 (0.587)	0.261 (0.566)	0.660 (0.588)	0.261 (0.566)
Cut3	1.153** (0.532)	0.902 (0.583)	1.152** (0.530)	0.903 (0.582)	1.334** (0.589)	0.963* (0.570)	1.335** (0.590)	0.964* (0.570)
Cut4	1.949*** (0.535)	1.621*** (0.589)	1.948*** (0.533)	1.621*** (0.588)	2.128*** (0.593)	1.682*** (0.576)	2.129*** (0.595)	1.682*** (0.576)
corr(ε_{ijc},ε_{ij})	0.012 (0.051)	0.008 (0.044)	0.015 (0.051)	0.009 (0.044)	-0.002 (0.058)	-0.004 (0.055)	-0.004 (0.058)	-0.003 (0.055)
N firms	94053	94053	94053	94053	94053	94053	94053	94053
N countries	111	111	111	111	111	111	111	111
χ^2	185.8	135.7	186.6	135.7	185.0	140.5	183.5	140.4
Log-likelihood	-98597.3	-85848.5	-98654.4	-85897.9	-81047.6	-86197.3	-81074.9	-86198.6
AIC	197250.6	171753.0	197362.8	171849.7	162151.1	172450.7	162203.7	172451.3

Notes: Standard errors (in parentheses) are clustered at the country level. Significance level: * p < 0.10, ** p < 0.05, *** p < 0.01. TRA: Tax Rates Assignment; TAA; Tax Administration Assignment; (*) implies that the indicator has been revised to account for the relevance of the intermediate level of governments in joint decisions with central and local authorities; (I,C,P) refers to measurements that solely take into account the discretion over income, consumption and property taxes. Size FE refers to the size of the firm in terms of the number of employees: small (less than 20 employees), medium (between 20 and 99 employees), large (above 99 employees). Sector FE refers to the industry of operations (1: Manufacturing, 2: Services, 3: others). Regional FE refers to the world region according to the World Bank classification: East Asia and the Pacific, Europe and Central Asia, Latin America and the Caribbean, Middle East and North Africa, South Asia, Sub-Saharan Africa. Control variables include the age of operations, export status, ownership(nationally owned), branch, gender of manager, size of the location (city >= 1 million inhabitants), per capita GDP, ethnic fractionalization and the WB regulatory quality index. Specifications (1.1), (2.1), (1.2) and (2.2) are estimated using the two instrumental variables, whereas specifications (1.3), (2.3), (1.4), and (2.4) are estimated using only one instrumental variable (the number of taxing layers).

whether the ability of lower-tier governments to set the tax rates and to administer the tax revenues have an impact on how tax rates and tax administration affect business operations. Similar to Table 3.9, I use the scores on tax rates and tax administration that are constructed through the alternative scoring procedures. I also consider two instrumental variables in specifications (1.1) and (2.1) and one instrument in specifications (1.2) to (2.3). In addition, I estimate the models using the indicators constructed precisely for the main tax instruments - income, consumption and property taxes. The results are robust and in line with previous tables. The coefficient estimates indicate that the sub-national governments' discretion over the tax rates harms business operations, whereas their discretion over tax administration is less of a concern.

3.4.3 Alternative Outcome Variables

In an attempt to better understand the interactions between fiscal institutions and the firms, I consider alternative outcome variables to the financial and administrative burden of the tax system on business operations as reported by the firms in the WBES. Are included the average amount of time that management spends dealing with government regulations, a binary indicator that equals 1 if a firm was audited in the 12 months before the survey, and lastly a binary indicator if a firm was asked for a bribe by tax officials at the time of the audit. These variables are a reflection of the business climate, and it is expected that the interaction of the firms with tax and regulatory authorities would have influenced their answers to the survey questionnaires.

Using the instrumental variables' strategy, I estimate the extent to which sub-national taxing rights impact on these alternative outcome variables. A positive and statistically significant coefficient implies that the time loads spent on government regulations are greater, and that the probability of being audited and reporting that tax officials requested bribe during audits are much higher, the greater the sub-national discretionary power over the tax system. Given the differing structure of these variables, I use different estimation approaches summarized in Table 3.11.

Table 3.11: Alternative Outcomes - Estimation Techniques

Outcome Variable	Type	Estimation Techniques
Time spent dealing with government regulations	Continuous	IV-GMM
Audit in the 12 months preceding the survey	Binary	Extended Probit with IV
Bribe request by tax officials	Binary	Extended Probit with IV

Time Spent Dealing with Government Regulations

In the WBES, the average time that firms' managers spend dealing with government regulations is expressed in percentage and thus a continuous variable. I, therefore, estimate an IV model with General Methods of Moments (IV-GMM). As suggested by Baum et al. (2003), the IV-GMM holds the advantage of producing more accurate statistical inferences than the traditional 2SLS-IV approach if the error term is heteroscedastic and of unknown form.

Table 3.12 reports the coefficient estimates from the IV-GMM model, in which the same previously described instrumental variables are used. I explore the impact of three different measurements of sub-national governments taxing rights: the overall discretion over the tax system as proxied by the *Tax Assignment Index*, the overall discretion over tax administration, and the discretion over tax administration concerning income, consumption and property taxes.

The results indicate that the overall discretion over the tax system increases the time loads that management spends on regulations by approximately 16 percentage points. Sub-national discretion over tax administration more specifically increases the time loads by 11 percentage points. Management time loads also increase by approximately 14 percentage points for every basis point increase in sub-national authorities' administrative oversight over income, consumption and property taxes. The Sargan test and the LM statistic test for under-identification confirm the validity of the instruments. The results are also robust to the use of one instrument and the inclusion of additional control variables on the status of the firms, access to financial services and the level of sales in the fiscal year prior to the survey.

Audit Probability and Corruption of Tax Officials

The outcome variables on whether a firm was audited or requested bribe by tax officials at the time of the audit are binary. I, therefore, estimate extended probit models with the instrumental variables described above. The conditional probability of having been audited or requested bribe by tax officials is obtained as follows (3.6).

$$\Pr\left(y_{ij}=1|\mathbf{r}_{ijc},\mathbf{x}_{ij},\mathbf{v}_{ijc}\right)=\Pr\left(\mathbf{x}_{ij}\beta+r_{ijc}\theta_c+\varepsilon_{ij}>0|\mathbf{r}_{ijc},\mathbf{x}_{ij},\mathbf{v}_{ijc}\right) \tag{3.6}$$

The responses of firm i in country j are modelled as a function of an indicator of sub-

Table 3.12: Sub-national Governments Taxing Rights and Fiscal Burden on Business Operations: Time spent dealing with government regulations | IV-GMM

Dependent Variable: *Time spent dealing with government regulations (%)*	(1)		(2)		(3)		(4)		(5)		(6)	
TAI (*)	16.140***	(4.809)					15.778***	(4.876)				
TAA (*)			11.449***	(3.252)					11.159***	(3.324)		
TAA (*,I,C,P)					14.155***	(4.191)					13.620***	(4.272)
Constant	15.366**	(7.363)	9.450	(7.054)	5.888	(7.296)	15.072**	(7.415)	9.266	(7.068)	5.749	(7.268)
Country-level variables	Yes		Yes		Yes		Yes		Yes		Yes	
Firm-level covariates	Yes		Yes		Yes		Yes		Yes		Yes	
Sector FE	Yes		Yes		Yes		Yes		Yes		Yes	
Size FE	Yes		Yes		Yes		Yes		Yes		Yes	
Regional FE	No		No		Yes		No		No		Yes	
First-stage												
Number of taxing layers	0.137	(0.017)	0.194	(0.019)	0.160	(0.019)	0.137	(0.017)	0.193	(0.018)	0.158	(0.019)
Number of second-tier	0.000	(0.000)	0.000	(0.000)	0.000	0.000	No		No		No	
Adjusted-R^2(second-stage)	0.300		0.301		0.299		0.300		0.301		0.299	
N firms	86067		86067		86067		86067		86067		86067	
N countries	111		111		111		111		111		111	
Log-likelihood	-374794.7		-374755.5		-374873.7		-374788.5		-374749.9		-374854.6	
AIC	749629.3		749551.0		749787.3		749617.0		749539.8		749749.2	
Sargan-J	0.686		0.665		0.589							
Sargan(*p-value*)	0.408		0.415		0.443							
LM test (under-identification) (*p-value*)	0.000		0.000		0.000		0.000		0.000		0.000	

Notes: Standard errors (in parentheses) are clustered at the country level. Significance level: * p < 0.10, ** p < 0.05, *** p < 0.01. TAI: Tax Assignment Index; TAA; Tax Administration Assignment. (*) implies that the indicator has been revised to account for the relevance of the intermediate level of governments in joint decisions with central and local authorities; (I,C,P) refers to measurements that solely take into account the discretion over income, consumption and property taxes. Size FE refers to the size of the firm in terms of the number of employees: small (less than 20 employees), medium (between 20 and 99 employees), large (above 99 employees). Sector FE refers to the industry of operations (1: Manufacturing, 2: Services, 3: others). Regional FE refers to the world region according to the World Bank classification: East Asia and the Pacific, Europe and Central Asia, Latin America and the Caribbean, Middle East and North Africa, South Asia, Sub-Saharan Africa. Control variables include the age of operations, export status, ownership(nationally owned), branch, gender of manager, size of the location (city >= 1 million inhabitants), per capita GDP, ethnic fractionalization and the WB regulatory quality index. Specifications (1) to (3) are estimated using the two instrumental variables, whereas specifications (4) to (6) are estimated using only one instrumental variable (the number of taxing layers).

national discretionary power over the tax system $\mathbf{r}_{ijc}$ and a vector of co-variates $\mathbf{x}_{ij}$. $\mathbf{r}_{ijc}$ is instrumented by the vector $\mathbf{v}_{ijc}$.

$$y_{ij} = 1\left(\mathbf{x}_{ij}\beta + r_{ijc}\theta_c + \varepsilon_{ij} > 0\right) \tag{3.7}$$

$$\text{with} \quad r_{ijc} = \mathbf{v}_{ijc}\alpha_c + \epsilon_{ijc}$$

The coefficient estimates of the extended probit model for the likelihood of audit in the 12 months before the survey are reported in Table 3.13. Similar to Table 3.12, I consider two instruments in specifications (1) to (3) and one in specifications (4) to (6). The main variables of interest are respectively the tax assignment index, the discretion over tax administration, and the discretion on tax administration yet concerning income, consumption and property taxes.

The results indicate that the probability of audit is greater the higher the discretionary power of sub-national governments over the tax system and tax administration in particular. The test results for the correlation of the error terms – $corr(\varepsilon_{ijc}, \varepsilon_{ij})$ – suggests that the proxies of sub-national government taxing rights are endogenous in these models. It is unsurprising given the needs for tax enforcement and audits could have contributed to shaping the assignment of taxing powers to sub-national authorities in a given country.

Table 3.14 reports on the impact of sub-national taxing rights on the probability of tax officials requesting bribes at the time of the audit. As for the previous estimations, I use two instrumental variables in specifications (1) to (3) and one in specifications (4) to (6). The results suggest that the likelihood of bribe request by tax officials also increases the more extended the taxing rights of sub-national authorities more broadly, and the more oversight they have over tax administration as well as the administration of income, consumption and property taxes. While these alternative outcomes do not expressly point to the interactions of the firms with sub-national tax authorities, the findings consistently indicate that the multi-layer tax structure contributes to a hostile business climate in the country sample.

Table 3.13: Sub-national Governments Taxing Rights and Fiscal Burden on Business Operations: Audit Probability | Extended Probit with IV

Dependent Variable: *Firm was audited in the 12 months preceding the survey*	(1)		(2)		(3)		(4)		(5)		(6)	
TAI (*)	0.364***	(0.049)					0.358***	(0.049)				
TAA (*)			0.243***	(0.038)					0.237***	(0.038)		
TAA (*,I,C,P)					0.331***	(0.048)					0.325***	(0.048)
Constant	2.937***	(0.108)	2.814***	(0.103)	2.841***	(0.103)	2.939***	(0.108)	2.818***	(0.103)	2.840***	(0.104)
Country-level variables	Yes		Yes		Yes		Yes		Yes		Yes	
Firm-level variables	Yes		Yes		Yes		Yes		Yes		Yes	
Sector FE	Yes		Yes		Yes		Yes		Yes		Yes	
Size FE	Yes		Yes		Yes		Yes		Yes		Yes	
Regional FE	No		No		Yes		No		No		Yes	
First Stage												
Number of taxing layers	0.173***	(0.001)	0.220***	(0.001)	0.172***	(0.001)	0.173***	(0.001)	0.220***	(0.001)	0.171***	(0.001)
Number of Second-tier	-0.000***	(0.000)	-0.000***	(0.000)	-0.000***	(0.000)						
Constant	-0.208***	(0.002)	-0.179***	(0.002)	-0.142***	(0.002)	-0.211***	(0.002)	-0.185***	(0.002)	-0.145***	(0.001)
corr(ε_{ijc},ε_{ij})	-0.025***	(0.008)	-0.057***	(0.007)	-0.050***	(0.008)	-0.023***	(0.008)	-0.055***	(0.007)	-0.049***	(0.008)
N firms	77492		77492		77492		77492		77492		77492	
N countries	111		111		111		111		111		111	
Log-likelihood	1597.2		-6517.1		-6485.2		1578.9		-6592.4		-6500.3	
AIC	-3132.5		13096.1		13032.4		-3097.7		13244.9		13060.6	

Notes: Standard errors (in parentheses) are clustered at the country level. Significance level: * p $<$ 0.10, ** p $<$ 0.05, *** p $<$ 0.01. TAI: Tax Assignment Index; TAA; Tax Administration Assignment. (*) implies that the indicator has been revised to account for the relevance of the intermediate level of governments in joint decisions with central and local authorities; (I,C,P) refers to measurements that solely take into account the discretion over income, consumption and property taxes. Size FE refers to the size of the firm in terms of the number of employees: small (less than 20 employees), medium (between 20 and 99 employees), large (above 99 employees). Sector FE refers to the industry of operations (1: Manufacturing, 2: Services, 3: others). Regional FE refers to the world region according to the World Bank classification: East Asia and the Pacific, Europe and Central Asia, Latin America and the Caribbean, Middle East and North Africa, South Asia, Sub-Saharan Africa. Control variables include the age of operations, export status, ownership(nationally owned), branch, gender of manager, size of the location (city $>=$ 1 million inhabitants), per capita GDP, ethnic fractionalization and the WB regulatory quality index. In addition, we also control for the status of the firm (1: shareholding with traded shares; 2: shareholding with non-traded shares; 3: sole partnership; 4: partnership), the sales level in preceding fiscal year and whether the firm has a bank account. Specifications (1) to (3) are estimated using the two instrumental variables, whereas specifications (4) to (6) are estimated using only one instrumental variable (the number of taxing layers).

Table 3.14: Taxing Rights and Fiscal Burden on Business Operations:
Bribe Request by Tax Officials | Extended Probit with IV

Dependent Variable: *Bribe Request by Tax Officials*	(1)		(2)		(3)		(4)		(5)		(6)	
TAI (*)	0.307***	(0.088)					0.306***	(0.088)				
TAA (*)			0.172**	(0.067)					0.170**	(0.067)		
TAA (*,I,C,P)					0.240***	(0.085)					0.238***	(0.085)
Country-level variables	Yes		Yes		Yes		Yes		Yes		Yes	
Firm-level variables	Yes		Yes		Yes		Yes		Yes		Yes	
Sector FE	Yes		Yes		Yes		Yes		Yes		Yes	
Size FE	Yes		Yes		Yes		Yes		Yes		Yes	
Regional FE	No		No		Yes		No		No		Yes	
First Stage												
Number of taxing layers	0.182***	(0.001)	0.229***	(0.001)	0.177***	(0.001)	0.182***	(0.001)	0.228***	(0.001)	0.177***	(0.001)
Number of Second-tier	-0.000***	(0.000)	-0.000***	(0.000)	-0.000***	(0.000)						
Constant	-0.232***	(0.002)	-0.203***	(0.002)	-0.156***	(0.002)	-0.235***	(0.002)	-0.208***	(0.002)	-0.159***	(0.002)
corr(ε_{ijc},ε_{ij})	0.003	(0.012)	-0.028**	(0.012)	-0.014	(0.013)	0.004	(0.012)	-0.028**	(0.012)	-0.014	(0.013)
N firms	42693		42693		42693		42693		42693		42693	
N countries	111		111		111		111		111		111	
Log-likelihood	15479.8		7277.8		9472.2		15465.4		7238.8		9463.7	
AIC	-30897.7		-14493.6		-18882.3		-30870.8		-14417.7		-18867.4	

Notes: Standard errors (in parentheses) are clustered at the country level. Significance level: * p $<$ 0.10, ** p $<$ 0.05, *** p $<$ 0.01. TAI: Tax Assignment Index; TAA; Tax Administration Assignment. (*) implies that the indicator has been revised to account for the relevance of the intermediate level of governments in joint decisions with central and local authorities; (I,C,P) refers to measurements that solely take into account the discretion over income, consumption and property taxes. Size FE refers to the size of the firm in terms of the number of employees: small (less than 20 employees), medium (between 20 and 99 employees), large (above 99 employees). Sector FE refers to the industry of operations (1: Manufacturing, 2: Services, 3: others). Regional FE refers to the world region according to the World Bank classification: East Asia and the Pacific, Europe and Central Asia, Latin America and the Caribbean, Middle East and North Africa, South Asia, Sub-Saharan Africa. Control variables include the age of operations, export status, ownership(nationally owned), branch, gender of manager, size of the location (city $>=$ 1 million inhabitants), per capita GDP, ethnic fractionalization and the WB regulatory quality index. In addition, we also control for the status of the firm (1: shareholding with traded shares; 2: shareholding with non-traded shares; 3: sole partnership; 4: partnership), the sales level in preceding fiscal year and whether the firm has a bank account. Specifications (1) to (3) are estimated using the two instrumental variables, whereas specifications (4) to (6) are estimated using only one instrumental variable (the number of taxing layers).

3.4.4 Beyond the Taxing Tights: Tax Autonomy

While sub-national governments' involvement in the governance of the fiscal space might be comparable across countries, it is expected that the incentivizing effects of inter-governmental tax arrangements would be more significant the more extensive the monetary size of the revenue that is under the control of sub-national authorities.

Thus, beyond the taxing rights, I test whether the share of revenue upon which sub-national authorities have a certain level of discretion does matter in this analysis. I do so by following the conceptual approach to the measurement of tax autonomy put forward by Stegarescu (2005) and the OECD tax autonomy database (OECD, 1999, 2013, 2020). I thereby multiply the ratio of sub-national government tax revenue (*SNGT*) in consolidated general government tax revenue (*GGT*) to account for the monetary autonomy of sub-central governments over the fiscal space.

I create two separate indicators. The first one considers the ratio of $^{SNGT}/_{GGT}$ for the total tax revenue, which is then multiplied by the overall *Tax Assignment Index*. The second one is a similar ratio but which only considers the tax revenues from income, consumption and property taxes whose impacts on business operations are expected to be the most significant (i=income; c= consumption; p= property) (Equation 3.9). Both composite indicators point to the relative share of sub-national tax revenues that can be influenced by sub-national governments' policies in a given year. The ratios on tax revenue are computed with data from the IMF Government Finance Statistics.

$$TA = TAI \times \frac{SNGT}{GGT} \tag{3.8}$$

$$TA_{i,c,p} = TAI_{i,c,p} \times \frac{SNGT_{i,c,p}}{GGT_{i,c,p}} \tag{3.9}$$

With this new approach, I introduce a time dimension in a three-level hierarchical model. A sub-sample of the WBES panel data points to the firms that have been surveyed in more than one rounds. Given that the budgetary ratios on tax revenue are available for multiple years (although for a small sample of countries), I could pair the indicators above (Equation 3.8 and Equation 3.9) for multiple years with the longitudinal micro-level firm data from the WBES.

I thereby assess whether the financial and administrative burdens of the tax system on business operations, as reported by each firm, have changed in-between two-

survey rounds. As to the baseline model (Equation 3.1), I estimate a mixed-effect regression model in which I control for firms and country characteristics, with the enterprises' details being nested in country contexts. The time dimension induces a three-level hierarchical model in which the occasions (responses given in a particular year) become the lowest level in the hierarchy.

Following Liu and Hedeker (2006) and Rabe-Hesketh and Skrondal (2012), I denote t the number of occasions that each firm i in country j was surveyed. The three-level model for the underlying latent variable with longitudinal data can be written in terms of y^*_{jit}, where $\mathbf{x}'_{jit}$ is the vector of covariates, β the vector of fixed effects coefficients, $\mathbf{z}'_{jit}$ the covariates corresponding to the random subjects effects (country-level) and $\mathbf{u}_j$ the level-3 random subject effects which follow a multivariate normal distribution. d'_{jit} is the $m \times 1$ indicator vector for the repeated items, and $T_{(2)}$ is the random-effects standard deviation vector from the level-2 subject-availability θ_{ji} which itself follows a standard normal distribution (Liu and Hedeker, 2006, p. 262-263).

$$y^*_{jit} = \mathbf{x}'_{jit}\beta + \mathbf{z}'_{jit}\mathbf{u}_j + d'_{jit}T_{(2)}\theta_{ji} + \epsilon_{jit} \tag{3.10}$$

Given that not all firms have the same number of occasions (some with two, others with three), it is convenient to represent the random subjects in a standardized form. As in Liu and Hedeker (2006, p. 262), let $\mathbf{u}_j = T_{(3)}\theta_i$ where $T_{(3)}T'_{(3)} = \sum_{(3)}$ is the Cholesky decomposition the $r \times r$ matrix $\sum_{(3)}$ and θ_i is the vector of standardized level-3 random effects. The standardized form can thus be written as follows:

$$y^*_{jit} = \mathbf{x}'_{jit}\beta + \mathbf{z}'_{jit}T_{(3)}\theta_j + d'_{jit}T_{(2)}\theta_{ji} + \epsilon_{jit} \tag{3.11}$$

The coefficient estimates are reported in Table 3.15. In specifications (1.1) and (1.2) of Table 3.15, tax autonomy is proxied by the composite indicators in Equation 3.8 with the ratio on total tax revenue along with the overall tax assignment index; whereas in specifications (1.2) and (2.2), I consider the composite indicator in Equation 3.9 with the tax revenue ratio on income, consumption and property taxes along with the corresponding tax assignment index based on income, consumption and property taxes.

The results from these columns suggest that the higher the degree of tax autonomy, the higher the financial and administrative burden of the tax system on business operations. It is worth noting that the sample is reduced due to limited number

Table 3.15: Sub-national Governments Taxing Rights and Fiscal Burden on Business Operations: Longitudinal Analysis

	Financial (1.1)		Administrative (2.1)		Financial (1.2)		Administrative (2.2)		Financial (1.3)		Administrative (2.3)	
Tax Autonomy	12.252***	(1.123)	7.026***	(1.393)								
Tax Autonomy (I,C,P)					11.197***	(1.949)	3.319*	(1.979)				
Tax Autonomy (Rates)									7.542***	(1.257)		
Tax Autonomy (Administrations)											3.494***	(0.791)
Country-level covariates	Yes		Yes		Yes		Yes		Yes		Yes	
Firm-level covariates	Yes		Yes		Yes		Yes		Yes		Yes	
Sector FE	Yes		Yes		Yes		Yes		Yes		Yes	
Size FE	Yes		Yes		Yes		Yes		Yes		Yes	
Regional FE	No		No		Yes		No		No		Yes	
Cut1	-2.350	(1.609)	-3.868***	(1.234)	-3.248***	(0.863)	-4.250***	(1.002)	-3.624***	(0.686)	-1.775*	(1.049)
Cut2	-1.825	(1.616)	-3.318***	(1.243)	-2.739***	(0.862)	-3.707***	(1.003)	-3.098***	(0.689)	-1.227	(1.060)
Cut3	-1.048	(1.637)	-2.540**	(1.272)	-1.975**	(0.881)	-2.927***	(1.033)	-2.322***	(0.707)	-0.450	(1.084)
Cut4	-0.246	(1.650)	-1.810	(1.291)	-1.167	(0.890)	-2.183**	(1.053)	-1.520**	(0.719)	0.280	(1.105)
$\sigma^2_{countries}$	0.111***	(0.112)	0.162***	(0.195)	0.118***	(0.075)	0.173***	(0.106)	0.091***	(0.088)	0.148***	(0.110)
σ^2_{firms}	0.048***	(0.309)	0.064***	(0.251)	0.062***	(0.284)	0.107***	(0.186)	0.048***	(0.306)	0.062***	(0.266)
N firms	8583		8583		7886		7886		8583		8583	
N countries	35		35		35		35		35		35	
χ^2	267.6		93.1		197.9		84.3		69.5		278.5	
Log-likelihood	-12911.4		-12215.6		-11810.7		-11103.2		-12897.6		-12267.6	
AIC	25848.8		24457.3		23647.4		22232.3		25821.2		24561.3	

Notes: Standard errors (in parentheses) are clustered at the country level. Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. (I,C,P) refers to measurements that solely take into account the discretion over income, consumption and property taxes. (*) implies that the indicator has been revised to account for the relevance of the intermediate level of governments in joint decisions with central and local authorities; (I,C,P) refers to measurements that solely take into account the discretion over income, consumption and property taxes. Size FE refers to the size of the firm in terms of the number of employees: small (less than 20 employees), medium (between 20 and 99 employees), large (above 99 employees). Sector FE refers to the industry of operations (1: Manufacturing, 2: Services, 3: others). Regional FE refers to the world region according to the World Bank classification: East Asia and the Pacific, Europe and Central Asia, Latin America and the Caribbean, Middle East and North Africa, South Asia, Sub-Saharan Africa. In addition to previous firm-level control variables, I also control for the legal status of the firms, the sales level in the year preceding the survey and the access to a bank account.

of observations in the longitudinal datasets on firms in the WBES, and the limited time-series data on sub-national government tax revenues for most developing and emerging countries.

3.5 Conclusion

This chapter proposed to fill the existing empirical gap related to the public choice view on tax assignment in multi-layer governments, and which has been emphasized in recent developments of the fiscal federalism literature. According to this framework, lower-tier governments are inclined to support private sector development when they control the revenues generated within their jurisdictions. Given the lack of data on the multi-layer tax structure across countries, the empirical evidence has, for very long, been scarce and based on case-studies involving countries like China or Russia.

In this chapter, I go beyond the country case-study approach and overcome the lack of comparative data on inter-governmental tax arrangements by relying on a new dataset on countries' multi-tax structure which covers many developing and emerging economies. The dataset, described in chapter 2, informs on the discretionary power of all government tiers over important tax instruments and across four types of decisions: the introduction or alteration of new instruments, the definition of the tax base, the settings of tax rates and tax administration.

Using the new indicators, this chapter thus estimates whether assigning greater taxing rights to sub-national governments translates into a more or lesser burden of the tax system on business activities. The new indicators are matched with micro-data on more than 94,000 private firms across 111 countries provided through the World Bank Enterprise Surveys (WBES). This latter data source informs on the extent to which the tax system in each given country negatively affects business operations. The dependent variables are thus operationalized from answers provided by managers and firms' owners to the survey questions. With the combined data, I estimate the impact of sub-national government taxing rights, and by extension, their rights over the setting of tax rates and tax administration, on the financial and administrative burden of the tax system on business activities, all the while controlling for the heterogeneous characteristics of both firms and countries.

The results indicate that, all things being equal, firms in countries with a higher sub-national discretionary power over the fiscal space tend to report a higher burden of tax rates and tax administration on their business operations. Zooming into the different

decision dimensions, the findings indicate that sub-national government legal ability to set tax rates are harmful to the private sector whereas their level of discretion over tax administration is of lesser concern once I address the potential endogeneity of the leading indicators of interest.

Alternatively to the reported burden of tax rates and tax administration on business operations, I consider dependent variables that convey the interactions of the firms with their respective state authorities. Are considered the time that management spends dealing with government regulations, the probability of audits, and the probability of tax officials requesting bribe at the time of an audit. It is assumed that such interactions may have shaped the answers provided by the firms on their perceived fiscal burden. The coefficient estimates indicate that the probability of being audited, the likelihood of tax officials requesting bribe during the audits, and the average time that managers spend dealing with government regulations are all significantly impacted by the level of taxing rights granted to sub-national authorities. For instance, the percentage of time that management spends dealing with government regulations increases by 16 percentage points for every basis point increase in the overall measurement of sub-national taxing rights, and by 11 percentage points when I consider the sub-national discretion over tax administration. The likelihoods of being audited and of tax officials requesting bribes increase with sub-national discretionary powers over the tax system more broadly, and tax administration in particular.

Beyond the taxing rights, I also test whether the share of revenue upon which sub-national authorities have a certain level of discretion do matter in this analysis. I do so by drawing insights from the existing literature on measuring tax autonomy (Stegarescu, 2005; OECD, 1999). I multiply the sub-national taxing rights indicators by the ratio of sub-national in consolidated general government tax revenue. I also introduced a time dimension by linking the composite indicators to longitudinal firm-level data from the WBES. In doing so, I investigate whether any change in the relative share of tax revenues which can be influenced by sub-national governments is reflected in the responses of a given firm at two or more survey rounds. The results bound in a similar direction, indicating that greater tax autonomy in monetary terms hurts business operations in developing and emerging economies.

The findings from all the different specifications thus highly contrast with the positive view of tax assignment in multi-layer governments. They indicate the advent of a hostile business climate as a result of sub-national authorities' involvement in the governance of the tax system. Thus, while the arguments linking China's fiscal contract in the 1980s to the country's economic prosperity might, to some extent, be valid, a similar structure could well be harmful elsewhere, especially in developing and

emerging economies where under-developed fiscal institutions could well generate perverse incentives. These insights call for further comparative research on inter-governmental tax structure across countries as well as in-depth investigations of the ramifications of multi-layer tax arrangements, and a greater understanding of observed cross-country variations. Future research projects could also consider the use of administrative and firm-level data on tax payments (instead of surveys) and within-country information to capture the variation in sub-national fiscal policies.

Bibliography

Alesina, A., A. Devleeschauwer, W. Easterly, S. Kurlat, and R. Wacziarg (2003). Fractionalization. *Journal of Economic Growth 8*(2), 155–194.

Arzaghi, M. and J. V. Henderson (2005). Why countries are fiscally decentralizing. *Journal of Public Economics 89*(7), 1157–1189.

Baum, C. F., M. E. Schaffer, and S. Stillman (2003). Instrumental variables and GMM: Estimation and testing. *The Stata Journal 3*(1), 1–31.

Berkowitz, D. and W. Li (2000). Tax rights in transition economies: a tragedy of the commons? *Journal of Public Economics 76*(3), 369–397.

Besley, T. and S. Coate (2003). Centralized versus Decentralized Provision of Local Public Goods: A Political Economy Analysis. *Journal of Public Economics 87*(12), 2611–2637.

Brennan, H. G. and J. M. Buchanan (1980). *The power to tax: Analytical foundations of a fiscal constitution* (2006 ed.). Cambridge: Cambridge University Press.

Brülhart, M. and M. Jametti (2006). Vertical versus horizontal tax externalities: An empirical test. *Journal of Public Economics 90*(10-11), 2027–2062.

Cai, H. and D. Treisman (2006). Did Government Decentralization Cause China's Economic Miracle? *World Politics 58*(04), 505–535.

Campbell, H. F. (2003). Are Culturally Diverse Countries More Fiscally Decentralized? In H. Bloch (Ed.), *Growth and Development in the Global Economy*. Edward Elgar Publishing.

Chow, G. C. (1997). Challenges of China's Economic System for Economic Theory. *The American Economic Review 87*(2), 321–327.

Djankov, S., R. La Porta, F. Lopez-de Silanes, and A. Shleifer (2002). The Regulation of Entry. *The Quarterly Journal of Economics 117*(1), 1–37.

Dziobek, C., C. Gutierrez Mangas, and P. Kufa (2011). Measuring Fiscal Decentralization: Exploring the IMF's Databases. Washington D.C, USA.

Emery, J. J., M. T. Spence, JR, L. T. Wells, JR., and T. S. Buehrer (2000). Administrative Barriers to Foreign Investment: Reducing Red Tape in Africa.

Fjeldstad, O.-H. and J. Semboja (1999). Local government taxation and tax administration in Tanzania. Bergen, Norway.

Frye, T. and A. Shleifer (1997). The Invisible Hand and the Grabbing Hand. *American Economic Review Papers and Proceedings 87*(2), 354–358.

Garzarelli, G. (2004). Old and new theories of fiscal federalism, organizational design problems, and tiebout. *Journal of Public Finance and Public Choice 22*(1-2), 91–104.

Goedhuys, M. and M. Srholec (2010). Understanding multilevel interactions in economic development.

Gregory, C. A. (2015). Estimating Treatment Effects for Ordered Outcomes Using Maximum Simulated Likelihood. *The Stata Journal: Promoting communications on statistics and Stata 15*(3), 756–774.

Guasch, J. L. and R. W. Hahn (1999). The Costs and Benefits of Regulation: Implications for Developing Countries.

Hayek, F. A. (1948). *Individualism and economic order*. Chicago, USA: University of chicago Press.

Hindriks, J. and G. D. Myles (2013). *Intermediate Public Economics, 2nd Edition*. MIT Press.

Hopkin, J. and A. Rodriguez Pose (2007). Grabbing Hand or Helping Hand? Corruption and the Economic Role of the State. *Governance 20*(2), 187–208.

Jacobs, S. and J. Coolidge (Eds.) (2006). *Reducing administrative barriers to investment: Lessons learned*, Volume 17 of *Occasional paper / Foreign Investment Advisory Service*. Washington, DC: World Bank.

Jin, H., Y. Qian, and B. R. Weingast (2005). Regional decentralization and fiscal incentives: Federalism, Chinese style. *Journal of Public Economics 89*(9-10), 1719–1742.

Keen, M. J. and C. Kotsogiannis (2002). Does Federalism Lead to Excessively High Taxes? *American Economic Review 92*(1), 363–370.

Keen, M. J. and C. Kotsogiannis (2004). Tax competition in federations and the welfare consequences of decentralization. *Journal of Urban Economics 56*(3), 397–407.

Lin, J. Y. and Z. Liu (2000). Fiscal Decentralization and Economic Growth in China. *Economic Development and Cultural Change 49*(1), 1–21.

Liu, L. C. and D. Hedeker (2006). A Mixed-Effects Regression Model for Longitudinal Multivariate Ordinal Data. *Biometrics 62*(1), 261–268.

Lockwood, B. (2005). Fiscal Decentralization: A Political Economy Perspective.

McChesney, F. S. (1988). Rent Extraction and Rent Creation in the Economic Theory of Regulation. In C. K. Rowley, R. D. Tollison, and G. Tullock (Eds.), *The Political Economy of Rent-Seeking*, pp. 179–196. Boston, MA: Springer US.

Mello, L. R. (1999). Intergovernmental Fiscal Relations: Coordination Failures and Fiscal Outcomes. *Public Budgeting & Finance 19*(1), 3–25.

Montinola, G., Y. Qian, and B. R. Weingast (1995). Federalism, Chinese Style: The Political Basis for Economic Success in China. *World Politics 48*(01), 50–81.

Musgrave, R. A. (1983). Who should tax, where, and what? In C. E. McLure (Ed.), *Tax assignment in federal countries*, pp. 2–19. Canberra and Canberra and New York: Centre for Research on Federal Financial Relations, Australian National University, in association with the International Seminar in Public Economics and Distributed by ANU Press.

North, D. (1994). Economic Performance through Time. *American Economic Review 84*(3), 359–368.

Oates, W. E. (1972). *Fiscal federalism*. The Harbrace series in business and economics. New York: Harcourt Brace Jovanovich.

Oates, W. E. (1977). *The Political economy of fiscal federalism*. Lexington, Mass.: Lexington Books.

Oates, W. E. (2005). Toward a second-generation theory of fiscal federalism. *International Tax and Public Finance 12*(4), 349–373.

Oates, W. E. (2008). On The Evolution of Fiscal Federalism: Theory and Institutions. *National tax journal 61*(2), 313–334.

OECD (1999). *Taxing Powers of State and Local Government*, Volume 1 of *OECD Tax Policy Studies*. OECD Publishing.

OECD (2013). *Measuring Fiscal Decentralisation*. OECD Fiscal Federalism Studies. Paris, France: Organisation for Economic Co-operation and Development.

OECD (2020). Tax Autonomy.

OECD and UCLG (2019). World Observatory on Sub-national Finance and Investment.

Oi, J. C. (1992). Fiscal Reform and the Economic Foundations of Local State Corporatism in China. *World Politics 45*(1), 99–126.

Peltzman, S. (1976). Toward a More General Theory of Regulation. *The Journal of Law and Economics 19*(2), 211–240.

Qian, Y. and B. R. Weingast (1996). China's Transition to Markets: Market-Preserving Federalism, Chinese style. *The Journal of Policy Reform 1*(2), 149–185.

Qian, Y. and B. R. Weingast (1997). Federalism as a Commitment to Reserving Market Incentives. *Journal of Economic Perspectives 11*(4), 83–92.

Rabe-Hesketh, S. and A. Skrondal (2012). *Multilevel and longitudinal modeling using Stata* (3rd ed. ed.). College Station, Tex.: Stata.

Raudenbush, S. W. and A. S. Bryk (2002). *Hierarchical linear models: Applications and data analysis methods* (2nd ed.). Advanced quantitative techniques in the social sciences. Thousand Oaks: Sage Publications.

Rodden, J. (2006). *Hamilton's paradox: The promise and peril of fiscal federalism*. Cambridge University Press.

Rodden, J. and S. Rose-Ackerman (1997). Does Federalism Preserve Markets? *Virginia Law Review 83*(7), 1521.

Rowley, C. K., R. D. Tollison, and G. Tullock (Eds.) (1988). *The Political Economy of Rent-Seeking*. Boston, MA: Springer US.

Seabright, P. (1996). Accountability and decentralisation in government: An incomplete contracts model. *European Economic Review 40*(1), 61–89.

Shleifer, A. and R. W. Vishny (1993). Corruption. *Quarterly Journal of Economics 108*(3), 599–617.

Shleifer, A. and R. W. Vishny (1994). Politicians and Firms. *The Quarterly Journal of Economics 109*(4), 995–1025.

Shleifer, A. and R. W. Vishny (1998). *The grabbing hand: Government pathologies and their cures*. Cambridge, Mass.: Harvard University Press.

StataCorp (2019). Stata Statistical Software: Release 16.

Stegarescu, D. (2005). Public Sector Decentralisation: Measurement Concepts and Recent International Trends*. *Fiscal Studies 26*(3), 301–333.

Stigler, G. J. (1971). The Theory of Economic Regulation. *The Bell Journal of Economics and Management Science 2*(1), 3.

Tiebout, C. M. (1956). A Pure Theory of Local Expenditures. *Journal of Political Economy 64*(5), 416–424.

Tiebout, C. M. (1961). An economic theory of fiscal decentralization. In National Bureau for Economic Research (Ed.), *Public finances: Needs, sources, and utilization*, pp. 79–96. Princeton University Press.

Treisman, D. (2000). Decentralization and the Quality of Government. Washington D.C., USA.

Vo, D. (2014). The Economics of Measuring Fiscal Decentralisation: Part II: New Fiscal Decentralisation Indices.

Vo, D. H. (2010). The Economics of Fiscal Decentralization. *Journal of Economic Surveys 24*(4), 657–679.

Walder, A. G. (1995). China's Transitional Economy: Interpreting Its Significance. *The China Quarterly Dec. 1995*(144), 963–979.

Weingast, B. (1995). The Economic Role of Political Institutions: Market-Preserving Federalism and Economic Development. *Journal of Law, Economics and Organization 11*(1), 1–31.

Weingast, B. R. (2009). Second generation fiscal federalism: The implications of fiscal incentives. *Journal of Urban Economics 65*(3), 279–293.

Weingast, B. R. (2014). Second Generation Fiscal Federalism: Political Aspects of Decentralization and Economic Development. *World Development 53*, 14–25.

Wilson, J. D. (1995). Mobile Labor, Multiple Tax Instruments, and Tax Competition. *Journal of Urban Economics 38*(3), 333–356.

Wilson, J. D. (1999). Theories of Tax Competition. *National tax journal 52*(2), 269–304.

Yang, Z. (2016). Tax reform, fiscal decentralization, and regional economic growth: New evidence from China. *Economic Modelling 59*, 520–528.

Zhang, T. and H.-f. Zou (1998). Fiscal decentralization, public spending, and economic growth in China. *Journal of Public Economics 67*(2), 221–240.

Zhuravskaya, E. (2000). Incentives to provide local public goods: fiscal federalism, Russian style. *Journal of Public Economics 76*(3), 337–368.

APPENDIX: CHAPTER 3

Table A3.1: Sub-national Governments Taxing Rights and Fiscal Burden on Business: Discretion over Tax Rates and Tax Administration (alternative scoring) | Mixed-Effects Ordered Probit

	Financial Burden				Administrative Burden			
	(1.1)		(1.2)		(2.1)		(2.2)	
Country-level Variables								
TRA (*)	0.848***	(0.058)						
TAA (*)					0.263***	(0.048)		
TRA (*I,C,P)			0.928***	(0.073)				
TAA (*I,C,P)							0.106**	(0.048)
Per capita GDP (ln)	-0.019	(0.024)	0.024	(0.024)	-0.123***	(0.019)	-0.090***	(0.021)
Ethnic Fractionalization	-0.381***	(0.056)	-0.351***	(0.067)	-0.215***	(0.054)	-0.215***	(0.048)
WB Regulatory Quality	-0.038*	(0.022)	-0.055***	(0.020)	-0.020	(0.022)	-0.038*	(0.023)
Firm-level Variables								
Age (ln)	0.019**	(0.007)	0.020**	(0.008)	0.006	(0.007)	0.007	(0.007)
Exporting Firm	0.016	(0.017)	0.012	(0.017)	0.073***	(0.013)	0.074***	(0.013)
Ownership (national)	0.109***	(0.021)	0.108***	(0.021)	0.073***	(0.020)	0.071***	(0.020)
Branch	-0.023	(0.018)	-0.023	(0.018)	0.005	(0.021)	0.007	(0.021)
Female Manager	0.037**	(0.016)	0.036**	(0.016)	0.009	(0.015)	0.009	(0.015)
City >= million	0.063	(0.040)	0.052	(0.038)	0.052*	(0.029)	0.046*	(0.028)
Cut1	-0.111	(0.210)	0.210	(0.233)	-0.975***	(0.176)	-0.723***	(0.188)
Cut2	0.475**	(0.204)	0.796***	(0.229)	-0.355**	(0.180)	-0.104	(0.193)
Cut3	1.188***	(0.207)	1.509***	(0.231)	0.383**	(0.186)	0.634***	(0.201)
Cut4	2.027***	(0.213)	2.347***	(0.238)	1.135***	(0.198)	1.387***	(0.214)
σ_u^2	0.127***	(0.027)	0.128***	(0.029)	0.106***	(0.027)	0.103***	(0.029)
N firms	94053		94053		94053		94053	
N countries	111		111		111		111	
χ^2	2022.3		2022.5		2676.3		3633.4	
Log-likelihood	-141942.7		-142032.0		-135327.6		-135252.0	
AIC	283933.4		284112.0		270703.3		270551.9	

Notes: Standard errors (in parentheses) are clustered at the country level. Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. TRA: Tax Rates Assignment; TAA; Tax Administration Assignment. (*) implies that the indicator has been revised to account for the relevance of the intermediate level of governments in joint decisions with central and local authorities. (I,C,P) refers to measurements that solely take into account the discretion over income, consumption and property taxes. Size FE refers to the size of the firm in terms of the number of employees: small (less than 20 employees), medium (between 20 and 99 employees), large (above 99 employees). Sector FE refers to the industry of operations (1: Manufacturing, 2: Services, 3: others). Regional FE refers to the world region according to the World Bank classification: East Asia and the Pacific, Europe and Central Asia, Latin America and the Caribbean, Middle East and North Africa, South Asia, Sub-Saharan Africa.

Table A3.2: Sub-national Governments Taxing Rights and Fiscal Burden on Business Operations: Baseline Model with revised indicators | Mixed-Effects Ordered Probit

	Financial Burden						Administrative Burden					
	(1.1)		(1.2)		(1.3)		(2.1)		(2.2)		(2.3)	
Country-level Variables												
Tax Assignment Index (*)	0.904***	(0.041)	0.926***	(0.058)	0.845***	(0.073)	0.480***	(0.066)	0.421***	(0.065)	0.581***	(0.059)
Per capita GDP (ln)	-0.119***	(0.015)	-0.079***	(0.017)	-0.017	(0.029)	-0.179***	(0.022)	-0.154***	(0.021)	-0.146***	(0.021)
Ethnic Fractionalization	-0.549***	(0.044)	-0.515***	(0.048)	-0.290***	(0.055)	-0.062	(0.076)	0.003	(0.074)	-0.160***	(0.039)
WB Regulatory Quality	0.007	(0.022)	0.065***	(0.024)	-0.035	(0.022)	0.146***	(0.027)	0.128***	(0.025)	0.034*	(0.019)
Firm-level Variables												
Age (ln)	0.020**	(0.008)	0.018**	(0.008)	0.015*	(0.008)	0.010	(0.008)	0.008	(0.008)	0.008	(0.008)
Exporting firm	0.013	(0.020)	0.017	(0.018)	0.003	(0.018)	0.075***	(0.015)	0.067***	(0.015)	0.070***	(0.014)
Ownership (national)	0.097***	(0.023)	0.094***	(0.023)	0.110***	(0.021)	0.086***	(0.019)	0.086***	(0.019)	0.073***	(0.020)
Branch	-0.017	(0.017)	-0.023	(0.018)	-0.022	(0.018)	0.008	(0.021)	0.009	(0.021)	0.009	(0.021)
Gender of Manager	0.037**	(0.016)	0.035**	(0.017)	0.037**	(0.017)	0.001	(0.016)	-0.003	(0.016)	0.013	(0.015)
City >= 1 million	0.041	(0.034)	0.042	(0.034)	0.078*	(0.041)	0.051*	(0.027)	0.046*	(0.027)	0.048*	(0.028)
Sector FE	Yes		Yes		Yes		Yes		Yes		Yes	
Size FE	Yes		Yes		Yes		Yes		Yes		Yes	
Regional FE	No		No		Yes		No		No		Yes	
Cut1	-1.790***	(0.152)	-1.434***	(0.177)	-0.051	(0.267)	-1.932***	(0.241)	-1.695***	(0.226)	-1.139***	(0.203)
Cut2	-1.204***	(0.151)	-0.848***	(0.177)	0.535**	(0.258)	-1.314***	(0.236)	-1.078***	(0.221)	-0.519**	(0.210)
Cut3	-0.493***	(0.152)	-0.136	(0.180)	1.247***	(0.260)	-0.578**	(0.234)	-0.341	(0.220)	0.219	(0.215)
Cut4	0.345**	(0.153)	0.703***	(0.182)	2.087***	(0.263)	0.175	(0.236)	0.411*	(0.220)	0.972***	(0.223)
σ_u^2	0.184***	(0.029)	0.172***	(0.028)	0.107***	(0.027)	0.171***	(0.028)	0.177***	(0.029)	0.107***	(0.023)
N firms	94053		94053		94053		94053		94053		94053	
N countries	111		111		111		111		111		111	
χ^2	834.3		768.0		1032.5		442.8		511.6		3484.9	
Loglikelihood	-142050.2		-141790.6		-141619.3		-135674.3		-135764.7		-135518.9	
AIC	284134.5		283619.2		283286.5		271382.5		271567.4		271085.7	

Notes: Standard errors (in parentheses) are clustered at the country level. Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. (*) implies that the indicator has been revised to account for the relevance of the intermediate level of governments in joint decisions with central and local authorities. Size FE refers to the size of the firm in terms of the number of employees: small (less than 20 employees), medium (between 20 and 99 employees), large (above 99 employees). Sector FE refers to the industry of operations (1: Manufacturing, 2: Services, 3: others). Regional FE refers to the world region according to the World Bank classification: East Asia and the Pacific, Europe and Central Asia, Latin America and the Caribbean, Middle East and North Africa, South Asia, Sub-Saharan Africa.

Table A3.3: Sub-national Governments Taxing Rights and Fiscal Burden on Business:
Discretion over Income, Consumption and Property Taxes (alternative scoring) | Mixed-Effects Ordered Probit

	Financial Burden						Administrative Burden					
	(1.1)		(1.2)		(1.3)		(2.1)		(2.2)		(2.3)	
Country-level Variables												
Tax Assignment Index(*,I,C,P)	0.721***	(0.078)	1.164***	(0.082)	0.907***	(0.094)	0.464***	(0.100)	0.460***	(0.100)	0.622***	(0.074)
Per capita GDP (ln)	-0.001	(0.020)	-0.099***	(0.015)	0.039	(0.028)	-0.134***	(0.020)	-0.134***	(0.020)	-0.115***	(0.020)
Ethnic Fractionalization	-0.704***	(0.051)	-0.518***	(0.048)	-0.198***	(0.065)	0.082	(0.078)	0.082	(0.078)	-0.123***	(0.041)
WB Regulatory Quality	-0.147***	(0.023)	-0.025	(0.017)	-0.058**	(0.024)	0.109***	(0.023)	0.108***	(0.023)	0.010	(0.018)
Firm-level Variables												
Age (ln)	0.012	(0.010)	0.023***	(0.008)	0.015*	(0.008)	0.011	(0.009)	0.009	(0.008)	0.008	(0.008)
Exporting Firm	0.013	(0.022)	0.019	(0.017)	0.007	(0.018)	0.069***	(0.015)	0.067***	(0.015)	0.071***	(0.013)
Ownership (national)	0.115***	(0.020)	0.103***	(0.022)	0.102***	(0.022)	0.094***	(0.019)	0.093***	(0.019)	0.076***	(0.020)
Branch	-0.037*	(0.019)	-0.028	(0.018)	-0.025	(0.019)	0.010	(0.021)	0.010	(0.021)	0.010	(0.020)
Female Manager	0.040***	(0.015)	0.037**	(0.015)	0.036**	(0.016)	-0.003	(0.015)	-0.005	(0.016)	0.011	(0.015)
City $>= 1$ million	0.055	(0.035)	0.005	(0.029)	0.078*	(0.041)	0.037	(0.027)	0.038	(0.027)	0.048*	(0.028)
Sector FE	Yes		Yes		Yes		Yes		Yes		Yes	
Size FE	Yes		Yes		Yes		Yes		Yes		Yes	
Regional FE	No		No		Yes		No		No		Yes	
Cut 1	-1.024***	(0.185)	-1.643***	(0.156)	0.440*	(0.250)	-1.485***	(0.220)	-1.493***	(0.221)	-0.852***	(0.188)
Cut 2	-0.438**	(0.177)	-1.057***	(0.154)	1.025***	(0.240)	-0.868***	(0.216)	-0.876***	(0.217)	-0.233	(0.192)
Cut 3	0.275	(0.176)	-0.345**	(0.155)	1.737***	(0.240)	-0.132	(0.216)	-0.140	(0.216)	0.505**	(0.199)
Cut 4	1.112***	(0.178)	0.493***	(0.160)	2.576***	(0.244)	0.621***	(0.218)	0.613***	(0.218)	1.258***	(0.211)
σ_u^2	0.140***	(0.025)	0.190***	(0.026)	0.140***	(0.037)	0.182***	(0.029)	0.182***	(0.029)	0.104***	(0.027)
N firms	94053		94053		94053		94053		94053		94053	
N countries	111		111		111		111		111		111	
χ^2	419.7		591.1		959.2		354.1		406.8		2667.1	
Log-likelihood	-142187.1		-142305.5		-141755.8		-135888.0		-135948.2		-135511.2	
AIC	284408.3		284648.9		283559.6		271809.9		271934.3		271070.4	

Notes: Standard errors (in parentheses) are clustered at the country level. Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. (*) implies that the indicator has been revised to account for the relevance of the intermediate level of governments in joint decisions with central and local authorities; (I,C,P) refers to measurements that solely take into account the discretion over income, consumption and property taxes. Size FE refers to the size of the firm in terms of the number of employees: small (less than 20 employees), medium (between 20 and 99 employees), large (above 99 employees). Sector FE refers to the industry of operations (1: Manufacturing, 2: Services, 3: others). Regional FE refers to the world region according to the World Bank classification: East Asia and the Pacific, Europe and Central Asia, Latin America and the Caribbean, Middle East and North Africa, South Asia, Sub-Saharan Africa.

Chapter 4

Tax Compliance in Multi-Layer Tax Structure: An Empirical Enquiry

Abstract

This chapter investigates the influence of multi-layer tax arrangements on tax compliance of residents in 49 countries in Latin-America and Africa. Existing research on tax compliance generally considers the government-taxpayer relationship as a bilateral one. In practice, however, governments consist of many layers, and taxpayers have multiple payment obligations and often towards more than one layers. In this chapter, I argue for the consideration of the multi-layer structure of tax institutions in empirical enquiries on the potential drivers of tax compliance. I explore the different channels through which such an effect might take place and provide robust empirical evidence that corroborates the hypotheses that are therefrom derived. The chapter draws from micro-data on citizens' socio-economic characteristics and attitudes towards tax payments which are paired with new indicators on multi-layer tax arrangements and sub-national governments' involvement in tax-related decisions. The findings indicate that subnational governments' discretion over the tax system more broadly and tax administration, in particular, lead to lower tax compliance. The chapter also finds strong evidence that the scarcity of tax knowledge exacerbates the adverse effects of sub-national taxing rights or tax administration on tax compliance. However, the marginal effects of lower-tier governments' discretion over tax matters and tax administration are positive in low-income countries, thereby suggesting some benefits to having lower-tier authorities involved in the governance of the fiscal space in those countries. The results are robust to numerous specifications and estimation strategies.

Keywords: Tax Compliance; Tax Institutions; Tax Structure; Fiscal Federalism; Developing Countries
JEL Codes: H77; H26; O1

4.1 Introduction

The ability of a state to raise revenues from citizens in exchange for public goods and services is fundamental for economic progress and development. As such, understanding the drivers of tax compliance and finding the optimal design for tax institutions have long been of significant concern to policy-makers and academics alike. Still, to date, non-compliance with tax payments remains one of the most pressing public policy challenges, especially in developing economies where tax avoidance persistently undermines the ability of state authorities to provide goods and services in poverty-sensitive areas such as education and healthcare.

In 2019, the International Monetary Fund estimated that in order to reach the Sustainable Development Goals by 2030, low-income countries need to gather revenues and fiscal resources approximating 15.4% of their GDP (see for e.g. Gaspar et al., 2019). Yet, as of 2017, the tax-to-GDP of low and middle-income countries stood at 11.93% (World Bank, 2018) compared to 34% for OECD countries (OECD, 2019). Weak institutions, lack of enforcement capacity, profit shifting of corporations, and low accountability in the provision of public services are cited among other rationales for the low collection rate in developing economies (Clemens Fuest and Nadine Riedel, 2010; Besley and Persson, 2014; Ali et al., 2014; Janský and Palanský, 2019). The erosion of tax bases also triggers the dependency of developing countries on external donors, which further undermines the *"governance dividend of taxation"* (Moore, 2004, p.310) and disincentivizes citizens to comply with their due payments, thus perpetuating a vicious cycle.

In attempts to understand the drivers of tax compliance, early theoretical works drew insights from the economics of crime and portfolio choice literature (see for e.g. Allingham and Sandmo, 1972; Yitzhaki, 1974). Taxpayers are depicted as money-maximizing individuals who gamble on whether to pay their full-liability or under-report their gross income given a set of parameters such as tax rates and audit probability. In recent years, the focus of the literature has shifted to non-expected utility models as researchers argue that taxpayers make their decisions under ambiguity rather than risk (see for e.g. Dhami and al Nowaihi, 2007). Recent publications also predominantly fall at the cross-section of economics and psychology as scholars dig into the intrinsic, neurological and social factors that influence citizens' willingness to pay (Cummings et al., 2001; Alm and Torgler, 2006; Traxler, 2010; Hokamp, 2014; Chetty et al., 2014; Besley et al., 2019).

To date, empirical evidence within both strands abounds. Notwithstanding, an

overview of existing works suggests that they are mostly built upon frameworks that consider the taxpayer-government relationship as a bilateral one. In practice, however, governments consist of many layers, and taxpayers often have payment obligations towards more than one layers. As argued by Hindriks and Myles (2013, p. 585), the setting of tax instruments, including the probability of being caught and the fines associated with each tax instrument may not be set by the same layer or tax agencies, and even less in a cohesive manner. In some countries, regional or local governments are permitted to have their own tax enforcement institutions or procedures independently of central or federal ones. Despite a wide range of publications on fiscal federalism, on the one hand, and tax compliance, on the other, empirical evidence linking the multi-layer structure of taxation to tax compliance is exceptionally scarce. There is also a conspicuous lack of theoretical frameworks on how multi-layered tax institutions could influence tax behaviours of firms and residents.

In this chapter, I argue for the consideration of intergovernmental tax arrangements in attempts to understand tax compliance. The chapter provides empirical evidence on how the level of sub-national governments discretion over the tax system influences compliance behaviours of citizens in approximately 49 Latin-American and African countries. The chapter relies on renowned public opinion survey data (Afrobarometer, 2016; Latinóbarometro, 2015) that capture individual attitudes towards tax payments. It overcomes the lack of comparative data on intergovernmental tax arrangements by drawing on the new dataset on multi-layer tax structure described in chapter 2. For each country, the dataset identifies the vertical decision structure on tax matters more broadly, and on specific dimensions such as tax administration or the setting of tax rates. The main contributions of this chapter are threefold.

First, I explore the mechanisms through which the multi-tier structure of taxation could impact on individual tax compliance, using existing frameworks within the public finance and political economy literature. Considering tax compliance as the ultimate goal for the state, the analytical framework builds upon the pro and con arguments for having decentralized tax institutions or sub-national governments' involvement in tax matters. On the one hand, it hypothesizes that the proximity induced by decentralized tax institutions could positively drive compliance given that local institutions and policies are bound to community preferences (see for e.g. Güth et al., 2005). Assigning taxing rights to lower-tier authorities could also bring more visibility and accountability to local officials (Rodden, 2002; Lockwood, 2005). Under the premise that tax institutions are designed according to citizens' preferences, I postulate sub-national governments' discretion over the tax system would increase the

likelihood of citizens complying with their tax payments. On the other hand, a multi-layer tax system could significantly raise compliance costs (Coolidge, 2012; Ali, 2018), especially for taxpayers with payment obligations in several jurisdictions and which are bound to interact with several tax authorities. Such hurdles could lead a taxpayer to undermine his returns to tax payments, and thereby dampen his willingness to pay. Furthermore, knowledge of tax procedures is likely to become more crucial for tax compliance in a complex tax system (Eriksen and Fallan, 1996; Saad, 2014), and the scarcity of such knowledge can considerably increase the compliance cost of individual taxpayers.

Second, this chapter is the first to assess how various features of intergovernmental tax arrangements could influence compliance. The dataset on the multi-layer tax structure, described in chapter 2, suggests that countries differ quite significantly in the types of decisions assigned to different government tiers. It is, therefore, worth investigating whether governments' discretion over different dimensions of the tax system would yield different effects on tax compliance. In line with the accountability argument, the ability of sub-national governments to set tax rates, for instance, would provide a transparent framework for households and businesses in choosing their preferred jurisdictions and could thus be expected to increase accountability and compliance. On the other hand, the geographical proximity of local tax administration offices could increase observability and facilitate the tracking down of non-compliant residents and firms. Compliance might also be enhanced if local tax institutions are efficient in ensuring fiscal coordination and bottom-up information sharing with central authorities. The chapter provides empirical estimates into how these different dimensions drive compliance.

Third, following the arguments in favour of centralized tax systems, the chapter assesses the extent to which contextual factors increase or undermine the effects of granting taxing rights to sub-national authorities on tax compliance. Following Bird (2015) and others on the inefficiency of tax institutions in developing countries, I test whether, for any given level of sub-national taxing rights, taxpayers in low-income economies are less compliant. In addition, I empirically test whether, for any given level of sub-national taxing rights, the scarcity of tax knowledge plays a mitigating role in how the design of inter-governmental tax institutions influences tax compliance.

The empirical results corroborate the hypothesis that the multi-layer structure of taxation matters for the understanding of tax compliance. The findings indicate that the higher the level of taxing rights of sub-national authorities, the lower the likelihood of citizens fully complying with their tax payments. It is also revealed that sub-national discretion over tax administration reduces tax compliance, whereas

sub-national discretion over the setting of tax rates is not statistically significant in the empirical estimations. It is thereby inferred that decentralizing tax administration might negatively affect revenue mobilization across the board.

Exploring the contextual factors that may explain the above results, the chapter finds that the marginal effects of sub-national taxing rights and sub-national tax administration are positive in low-income countries. It, therefore, appears that there might be some added-value to having lower-tier authorities being involved in the governance of the tax system in low-income economies. Notwithstanding, the empirical results point to strong evidence that the lack of tax knowledge exacerbates the negative effects of sub-national taxing rights or discretion over tax administration on tax compliance.

Aside from the main variables of interest, the models indicate that trust in public institutions and support for democracy increase tax compliance, whereas political involvement, and a positive view of the redistribution system lower tax compliance. This latter finding is counter-intuitive and would suggest that African and Latin-American citizens who positively appraise their governments' work in improving the livelihoods of the most impoverished strata of the population are more prone to evade taxes. At the country-level, it is also noted that residents of wealthier nations are less compliant.

Lastly, I question whether the adverse effects evidenced by the empirical results are due to the institutional design of tax institutions (or the multi-layer tax arrangements) or higher compliance costs in the context in which the taxpayers evolve. In other terms, I investigate whether indicators that capture the compliance costs to each taxpayer at the country level trump the relevance of the indicators that proxy sub-national taxing rights or discretion over tax administration. I do so by relying on the World Bank Doing Business Index Surveys which provide country-level estimates on the total number of hours per year it takes to prepare, file, and pay taxes and the total number of taxes paid by businesses in each given country. The results suggest that neither of these variables trumps the relevance of the institutional design per se in the sample of 49 countries. Hence, it appears the negative effects are not due to the average compliance costs at the country level per se but instead to other parameters such as the lack of knowledge of regulatory features or other factors that result from or are embedded in the multi-layer design of tax institutions.

Overall, the chapter contributes to the scholarly discussion on how complex tax structure affects revenue mobilization in developing and emerging economies. By exploring the different channels and using the novelly constructed indicators, it adds

to the literature on how incentives embedded in intergovernmental fiscal institutions could extend to and drive taxpayers' behaviours. In what follows, Section 4.2 provides an overview of the background literature. Section 4.3 presents the analytical framework and lays out testable hypotheses. Section 4.4 details the empirical framework, the variables and data sources, and the primary estimation strategy. Section 4.5 presents and discusses the results while concluding remarks are provided in Section 4.6.

4.2 Brief Overview of the Literature

Understanding why people pay taxes has long been a central topic in the public finance literature. Early theoretical works drew insights from the economics of crime and portfolio choice literature. Allingham and Sandmo (1972) and Yitzhaki (1974), for instance, count among the initial attempts to model a taxpayer's decision to evade. In their framework, taxpayers are assumed to be homogeneous, money maximizing and gamble on whether to pay their full liability or under-report their gross income given a set of parameters – namely the tax rates, the fines, and the likelihood of being caught. Predictions that are therefrom derived are relatively straightforward: tax evasion decreases with tax rates, fines rates and the audit probability.

Publications that followed questioned the simplicity of these predictions. Critics argued that such models abstract from the complex reality in which taxpayers operate (Alm et al., 1992; Slemrod, 2002; Snow and Warren, 2005; Blackwell, 2007; Hashimzade et al., 2012). Snow and Warren (2005) and Hashimzade et al. (2012), for instance, argue that the probability of audit is not common knowledge; therefore, ambiguity-adverse taxpayers would comply in any case, and independently of such probability. Contributions by Slemrod (2002) and Blackwell (2007) further point out that higher tax rates might induce less compliance. Refinements of the early theoretical models also depart from the sole private utility assumption to include the returns to tax payments – in the form of tax-financed public goods and services – as potential drivers of tax compliance (Cowell and Gordon, 1988; Bordignon, 1993; Dell'Anno, 2009; Blackwell, 2007; Bodea and LeBas, 2016).

The more recent literature on tax compliance and tax evasion is predominantly centred around non-expected utility modelling. Contributors to that new strand argue that taxpayers make their choices under ambiguity (uncertainty with unknown probability) rather than risk (uncertainty with known probability) (see for e.g. Dhami and al Nowaihi, 2007). Non-expected utility theories can thus offer better predictions

for those who overweight the audit and detection probabilities (Hashimzade et al., 2012).

Recent publications also mostly fall at the cross-section of economics and psychology as scholars dig into the intrinsic, neurological and social factors that influence the willingness to pay or compliance with tax payments (Cummings et al., 2001; Alm and Torgler, 2006; Traxler, 2010; Hokamp, 2014; Chetty et al., 2014; Besley et al., 2019). The ever-growing literature puts a greater emphasis on experimental methodologies, either as a mean to circumvent the unavailability of administrative tax data for many countries or to reach causal estimates and thereby limit biased conclusions (Andreoni et al., 1998; Weber et al., 2014; Alm, 2012; Weber et al., 2014). As surveyed by Mascagni (2018), this strand has also expanded to developing economies, such as in Sub-Saharan Africa, where there is a growing number of tax experiments.

Empirical evidence within both the classical and new literature strands abounds. While the added-value of each contribution differs, the findings point to fairness (Bordignon, 1993; Falkinger, 1995; Fortin et al., 2007), trust in tax authorities (Feld and Frey, 2002, 2007), prestige and social norms (Cowell, 1990; Bobek et al., 2007; Fortin et al., 2007; Traxler, 2010; Hokamp, 2014; Chetty et al., 2014; Besley et al., 2019), culture (Cummings et al., 2001; Alm and Torgler, 2006), higher institutional quality and the perception of government and its accountability (Alm et al., 1992; Frey and Torgler, 2007; Cummings et al., 2009; Cullen et al., 2018), as key explanatory factors of tax compliance behaviours. Findings on government accountability as a driver of compliance sustain the inclusion of public utility in theoretical models (see for e.g. Bordignon, 1993; Cowell and Gordon, 1988).

Nonetheless, a review of the literature suggests that the existing empirical and experimental findings rely on frameworks that consider the taxpayer-government relationship as a bilateral one. Tax authorities are depicted as a single unit in charge of monitoring and collecting tax payments. In practice, however, a government consists of many layers. In many countries (both federal and unitary), taxpayers have multiple payment obligations and towards more than one tiers of government. As described in chapter 2, sub-national authorities may, by-laws, be entitled to decision-making on various tax matters such as the setting of tax rates or granting tax reliefs. Hindriks and Myles (2013, p. 585), among others, argue that in a multi-layer tax structure, the setting of tax instruments, including the probability of being caught and the fines associated with each tax revenue instrument may not be set by the same layer and even less in a cohesive manner. In Argentina, for instance, the provincial authorities may have their independent tax agencies, and the procedures on audit and collection may operate under different modalities from one jurisdiction or province to another (Besfamille

et al., 2017).

Despite a wide range of publications on fiscal federalism, on the one hand, and tax compliance, on the other, contributions linking the multi-layer structure of tax systems to tax compliance behaviours are exceptionally scarce, alongside a continuing lack of clear theoretical frameworks. There are, however, many rationales for investigating this further. In a nutshell, enforcement agencies across layers might differ in their audit schedule, monitoring and detection capabilities to persuade or dissuade compliance. Vertical mis-coordination could induce unwanted consequences such as higher tax rates in a non-cooperative equilibrium (Keen and Kotsogiannis, 2003, 2004) or higher compliance costs for taxpayers who undertake different transactions across jurisdictions. Reversely, the geographical proximity of local tax offices to the taxpayers might increase observability and facilitate the tracking down of non-compliant residents and firms. Proximity could also bring more visibility and accountability to local officials. While I am unable to explore all the possible channels in this chapter, the following section makes the case for considering inter-governmental tax arrangements in the search to understand tax compliance behaviours.

4.3 Analytical Framework

Despite the theoretical discussions on tax assignment in the fiscal federalism literature (see for e.g. chapter 1), there remains minimal cross-country empirical evidence on its ramifications for various socio-economic and behavioural outcomes. Most notably, empirical research on the effects of multi-layer tax arrangements on taxpayers' behaviours – be they firms or individuals – is highly scarce. Until recently, the academic and policy discourse on tax revenue mobilization was mostly centred on national tax institutions. Yet, with the prominence of decentralization reforms since the 1990s and the rapid urbanization rate, many countries have granted (or are granting) their local and regional governments public responsibilities in various areas, including in tax and revenue matters. The legal frameworks in each country, often specified through the tax codes, the local government acts or local taxation acts, describe the extent to which sub-national authorities are involved in or entitled to making fiscal and tax-related decisions.

As described in chapter 2, such discretion comes in different shapes and varies significantly across countries. For instance, sub-national governments may be assigned revenues from a specific tax instrument while having no discretion regarding the administration of revenues from said instrument. Countries that have a highly

centralized tax administration may grant some discretionary power to lower-tier authorities in setting the tax rates on property taxes, for instance. There are also cases where provincial authorities administer their own enforcement agencies, and sporadically, are in charge of collecting national taxes on behalf of the central governments.

Hence, it is of utmost relevance to understand how the structure of tax institutions across government layers influences taxpayers' attitudes towards compliance, as for other socio-economic and political outcomes. While recent developments in the fiscal federalism literature emphasize the behavioural responses of stakeholders to inter-governmental political and fiscal institutions (Dixit, 2002; Oates, 2005; Weingast, 2009, 2014), there remain very few insights into how taxpayers respond to such arrangements. Given the lack of existing theoretical framework on the matter, exploring the linkages between multi-layer tax arrangements and tax compliance requires an in-depth discussion of the factors that – given the final aim which is to increase compliance – may incite the establishment of a more centralized or decentralized tax system. I regroup these factors under two broader strands which reflect the pro- and con-arguments of having both upper and lower-tier authorities involved in tax matters.

4.3.1 Public Accountability, Fiscal Exchange and Enforcement

By bringing political decision-making closer to the citizens, decentralization is argued to reduce information asymmetries and improve the adequacy of public policies. As local public goods are closer to community-bound preferences, a taxpayer is expected to be more tax compliant when his social or group identity interests align with regional public provisions. Evidence of such is provided by Güth et al. (2005) who show that voluntary provision rates for locally provided public goods are usually higher than for global (or national) ones.

From a practical perspective, the decentralization of the tax system can also bring more visibility and accountability to local officials. In a democratic electoral process, it is expected that local authorities would have an incentive to spend according to public demands as their constituents closely monitor them. The fiscal federalism literature has also long argued for tying local expenditure to revenue generation as a mean of restraining local authorities from confiscatory demands and bringing about public accountability (Rodden, 2002, 2006; Lockwood, 2005). Empirical findings by Pommerehne and Weck-Hannemann (1996) suggest that tax evasion is lower in Swiss

cantons with a high degree of direct political control. Although the demands for monitoring and the decision to comply with one's tax payments can be regarded as two independent choices, the literature on mental accounting suggests that individuals' aversion that government would waste their tax payments increases their incentives to monitor their governments (Tversky and Kahneman, 1991) – a level of monitoring which is more feasible in a reduced-size environment. Furthermore, the intensive interactions between taxpayers and local bureaucrats in a small structure could also promote trust – a factor which has been established as an essential determinant of tax compliance (Feld and Frey, 2002; Wahl et al., 2010; Kouamé, 2015).

Notwithstanding, it is worth acknowledging that the ultimate effect of sub-national taxing rights on tax compliance attitudes is ambiguous. Whether an increase in tax compliance at the lower-tier implies compliance across the board (with taxes collected by central authorities, for instance) is yet to be addressed by the theoretical and empirical literature. It is undeniable that such predictions would be complicated in cases where the tax climate, including trust and accountability, differs across government tiers.

While investigating these questions is beyond the scope of this chapter, I assume that the level of taxing rights granted to lower-tier governments is set according to residents' preferences and demands for such institutions. Hence, it can be expected that inter-governmental tax arrangements are set in a way that increases the fiscal exchange between local authorities and their constituencies, and by extension tax compliance. Empirical evidence by Torgler et al. (2010) suggests a positive relationship between local autonomy and tax morale in the context of Switzerland, with local autonomy measured through a self-assessment by local authorities. Torgler and Werner (2005) also evidence that higher tax autonomy, measured by the ratio of sub-national own-tax in federal tax revenues, is associated with higher tax morale in Germany. Considering that tax morale is an essential driver of compliance, as discussed in Torgler (2011), I conjecture that the higher the discretionary power of subnational governments on tax matters, the higher the likelihood of tax compliance.

Besides the overall taxing rights of sub-national authorities, I argue that their discretion over tax administration and the setting of tax rates could also increase compliance. The geographical proximity to taxpayers might enhance local tax administration's ability to effectively track-down and punish non-compliant. Expanding tax administration beyond the central level might also be beneficial across the board if local agencies are efficient in sharing information with upper tiers. As fraud detection – or the perception of such – becomes recurrent, it would be expected that taxpayers would comply more with their due payments.

Compared to the decentralization of tax administration, which requires extensive facilities and investment, discretionary powers of sub-national governments in the setting of tax rates, single-handedly or in coordination with upper-tier governments, are more common across countries. As described in chapter 2, sub-central authorities are often assigned legal powers on defining the rates of certain tax instruments, especially property taxes, even though central authorities may impose a ceiling on the final rates. The discretion of sub-central authorities to set tax rates can further enhance the fiscal exchange between residents and local authorities. On the one hand, setting the tax rates has a direct impact on the raising revenue ability of government authorities; on the other, it provides a transparent framework for households and businesses in choosing their preferred jurisdictions (Tiebout, 1956; Wilson, 1999; Keen and Kotsogiannis, 2004). As a result, residents are able to assess the rates they pay *vis-à-vis* the packages of tax-financed public services that they receive. To date, measurements of tax autonomy, such as in the OECD tax autonomy database (OECD, 1999) and the Regional Authority Index (Marks et al., 2008; Hooghe et al., 2016), integrate the tax rate-setting ability as an essential component of sub-national fiscal autonomy. Thus, in line with the above, I also postulate that the ability of lower-tier authorities to set tax rates would increase tax compliance by enhancing accountability between the authorities and the taxpayers.

4.3.2 Transaction Costs and Externalities of a Multi-Layer Tax System

There are several challenges associated with a multi-layer tax structure. The fiscal federalism literature has pointed to potential threats of decentralizing the tax system, including disintegrated economic space and fiscal erosion (Prud'Homme, 1995; Rodden, 2002, 2006). Considerations for such risks appear to have guided the design of intergovernmental tax relations in many countries, given the limited discretionary power granted to intermediate and local authorities, especially in developing and emerging economies (see chapter 2, section 2.5). The negative externalities of a multi-layer tax structure can be explored through different angles.

First, one of the most unwanted consequences of a complex tax system is the rise in compliance costs for taxpayers who may have payment obligations in several jurisdictions or are bound to interact with several tax authorities. Such hurdles might lead an individual to under-estimate his returns to tax-payments (or his received share of tax-financed public goods) which could further dampen his willingness to pay and thus decrease the likelihood of tax compliance. If such transactions costs are a result of a multi-layer tax system, countries might be motivated to have more centralized

fiscal institutions: fewer offices to visit, less information to process, far less regulatory procedures.

Second, assumed benefits of a centralized tax structure include economies of scale in enforcement capacities, more efficient uses of tax-related capitals and technology. Although the literature on the optimal size of tax administration is limited, Mayshar (1991) and Keen and Slemrod (2017), among others, suggest that it might still be undesirable to expand tax administration even when there is a positive correlation between the expansion and the marginal collected tax revenues. Given the cost of the expansion, it is generally not optimal to take enforcement up to the point at which tax revenue, net of administration costs, is maximized (unless the marginal social value of additional revenue is infinitely large) (Keen and Slemrod, 2017, p. 135).

In low-income countries, more particularly, a multi-layered tax administration does not only imply a new organizational structure but also a partition of already scarce public resources into multiple units. Bird (2015), among others, suggests that developing countries generally have inefficient tax administrations, often associated with corruption leading to higher compliance costs for the taxpayers. Such a split could result in an expansion of corrupt behaviours, or else, in one or more enforcement agencies being less efficient in detecting fraudulent behaviours, conducting frequent and thorough audits and punishing the evaders, all the while forsaking the benefits of economies of scale. Any disparities in administrative capacities could also alter the perception of coercive powers of tax officials which is argued to be an essential driver of tax compliance (Wahl et al., 2010; Hartl et al., 2015).

Furthermore, as resources are scarce, excessive monitoring by local (or the closest) authorities could erode trust and create a hostile tax climate, and thus crowds-out the incentives to pay. As argued by Feld and Frey (2002) and Ferrin et al. (2007), excessive monitoring can also be seen as a sign of distrust, and excessive regulations crowd-out intrinsic motivation in relevant circumstances. A few case studies on developing economies suggest that higher tax discretion to lower-tier authorities results in inefficient forms of taxation (Alm et al., 2004; Rodden, 2006; Bird, 2015; Carnahan, 2015). It can, therefore, be expected that granting taxing rights to lower-tier governments in low-income countries might result in inefficient tax institutions and thus less compliance.

Third, it is undeniable that tax knowledge is crucial to tax compliance (Eriksen and Fallan, 1996; Saad, 2014) and even more so in a system with multiple enforcement stakeholders. Tax laws are often criticized for being too complicated. In a multi-layered tax structure, the scarcity of tax knowledge – especially on the tax rates, tax

reliefs and regulatory procedures – can considerably increase the compliance costs to the taxpayers. It can therefore be expected that given the structure of the tax system, the lack of tax knowledge would lessen any positive marginal effects of sub-national taxing rights on tax compliance.

There remain several other channels through which multi-layer tax arrangements could influence taxpayers' behaviours. Such channels are not explored in this chapter, either due to un-established theoretical frameworks or a lack of data. The following section details how the above arguments are captured in the empirical framework.

4.4 Empirical Framework

The empirical analysis utilizes public survey data on individuals' tax compliance attitudes, alongside their socio-demographic characteristics, social and political attitudes. The survey data are paired with proxies measuring the extent to which sub-national governments are involved in decision-making over different dimensions of the tax system in respective countries in Latin-America and Africa. The merged data are then complemented by additional variables from the World Bank Governance Indicators, World Development Indicators and the Quality of Government datasets that further capture the heterogeneity of countries and contexts in which the individual taxpayers operate.

4.4.1 Measuring Tax Compliance

A persistent challenge in empirical work on tax compliance is the absence or lack of reliable administrative information on tax payments by individuals in most countries. Effectively measuring tax compliance requires access to large scale administrative tax data which are often not readily available. In this chapter, I compensate for the limited availability of tax compliance information by following the existing literature and relying on survey data from the Afrobarometer and Latinobarómetro (Afrobarometer, 2016; Latinóbarometro, 2015).

Survey data have been widely used in measuring tax morale and tax compliance both in cross-sectional (Torgler, 2004, 2005a; Alm and Torgler, 2006; Torgler and Schneider, 2007; Cummings et al., 2009) and time-series studies (Torgler, 2005a; Martinez-Vazquez and Timofeev, 2009). While it may be argued that respondents are not truthful in their answers, the use of survey data remains widespread, and Reinikka and

Svensson (2006), among others, have argued that the appropriate survey methods can significantly reduce the issues of biased and misleading responses in surveys. Tripp (1997) also suggests that there is a high degree of truthfulness in survey responses on tax payments, as the refusal to pay taxes can be seen as a form of opposition towards the state, contrarily to the predominant view that non-compliance with tax payments should bring a sentiment of shame.

Compared to the above-cited works, this chapter moves beyond the moral sentiments on whether paying taxes is right or wrong – the most common way of measuring tax morale – to operationalize tax compliance as a respondent's deliberate refusal or failure to pay taxes and fees to his government. The outcome variable – *Tax Compliance* – is derived as follows, respectively in the Afrobarometer and the Latinobarómetro. The two survey data sources are chosen to increase the variation in the main variable of interest, as well as increasing the reliability of the coefficient estimates. The operationalization of *Tax Compliance* and the selection of covariates are made with careful assessment of the questionnaires to ensure the comparability of information across the two data sources (see Table A4.1 in Appendix 4).

Afrobarometer Round 6

Tax Compliance is operationalized through question Q27D formulated as follows:

> ***Question:*** Here is a list of actions that people sometimes take as citizens when they are dissatisfied with government performance. For each of these, please tell me whether you, personally, have done any of these things during the past year. If not, would you do this if you had the chance: ***Refused to pay a tax or fee to government***
> ***Answers:*** 0=No, would never do this, 1=No, but would do if had the chance, 2=Yes, once or twice, 3=Yes, several times, 4=Yes, often, 9=Don't know, 98=Refused to answer, -1=Missing

Two outcome variables are derived from answers to this question: a binary indicator and an ordinal variable. The binary indicator refers to the fully compliant individuals or those that stated to have never refused to pay taxes and fees to their respective governments; hence: *1="No, would never do this", "0=Yes, have done"*. To avoid any ambiguity, observations from the second category *"No, but would do if had the chance"* are discarded from empirical estimations with the binary outcome on tax compliance. It is unclear whether the answer conveys full compliance or whether that was used as a subterfuge to avoid the question. These observations are, however, reinstated in sensitivity analyses in which I use the ordinal tax compliance variable as the outcome, and which is coded as follows: *1="Have done" 2="Could do" 3="Have done"*. The ordinal

variable conveys different extents of tax compliance attitudes of the individuals in the survey data.

Latinobarómetro 2015

In the Latinobarómetro, *Tax Compliance* is derived from question Q21STGBS.F on each respondent's refusal to pay taxes.

> ***Question:*** *Q21STM.* Now I want you to look at this card. I am going to read out a variety of political activities that people can undertake, and I would like you to tell me if you have ever done any of them (1), if you would ever do any of them (2), or if you would never do any of them (3).
> *Q21STGBS.F*: ***Refused to pay taxes or fees to the government***
> ***Answers:*** 1 = Have done, 2=Could do, 3 = Never, under any circumstances

Similar to the Afrobarometer survey, a binary indicator is derived to identify the fully compliant individuals – those that stated to have never refused to pay taxes and fees to the governments (*1=Never, under any circumstances; 0=Have done*). Observations with *"could do"* as an answer are discarded from the primary estimations, and reinstated in sensitivity analyses in which the ordinal variable is used as the outcome and includes all the above possible answers.

4.4.2 Dimensions of the Multi-Layer Tax Structure and Hypotheses

To date, the most notable proxy of tax decentralization remains the ratio of subnational tax revenues in total public tax revenues. Such an indicator does, however, not suit the empirical analysis of this chapter as it fails to inform on the vertical decision structure or the involvement of different governments tiers in the governance of the tax system which, as argued above, is crucial for the understanding of the linkages between tax institutions and tax compliance. Beyond the conventional budgetary ratios, existing data on tax autonomy, such as from the OECD tax autonomy database or the Regional Authority Index, are often limited in scope or are not disaggregated enough on different dimensions of the tax system, especially for this group of countries.

This chapter overcomes the data limitation by relying on the new dataset described in chapter 2 and which identifies, for each included country, the vertical decision structure on tax matters, and more specifically on different tax instruments and decision dimensions – such as tax administration or the setting of tax rates. To recall, the database was built through desk research and in-depth review of legal and policy

documents which inform on the legal assignment of tax responsibilities to different tiers of authorities – including the constitution, the tax codes, the local government acts, and reports on territorial and public finance reforms, all of which are triangulated with archives from the international bureau of fiscal documentation (IBFD, 2017). Indicators that are therefrom derived, and which are also described in chapter 2, convey the level of taxing rights of sub-national authorities more broadly, and the extent to which they are involved in the setting of tax rates and tax administration, in particular.

Following the discussion in section 4.3, I conjecture that the higher the discretionary power of sub-national governments on tax matters, the higher the likelihood of tax compliance. Hence, the empirical estimations test the following hypothesis, using the *"Tax Assignment Index"* as a proxy for the level of sub-national taxing rights (see chapter 2, subsection 2.4.3).

Hypothesis a_1: *The higher the level of sub-national taxing rights, the higher the likelihood of tax compliance.*

In subsection 4.3.2, I also argue that the geographical proximity of local tax administration might grant local authorities the ability to monitor and punish non-compliant residents. In addition, I postulate that the discretion of sub-national authorities over the setting of tax rates would enhance the fiscal exchange between residents and local authorities, as such structure provides a framework for them to choose their preferred jurisdictions. These postulates are reflected in the hypotheses below.

Hypothesis a_2: *The greater the sub-national involvement in tax administration, the higher the likelihood of tax compliance.*

Hypothesis a_3: *The greater the sub-national involvement in the setting of tax rates, the higher the likelihood of tax compliance.*

In the empirical settings, sub-central authorities' decision-making power over tax administration and the setting of tax rates are proxied by the indicators of *"Tax Administration Assignment"* which refers to the level of subnational governments' discretion over tax administration, and the *"Tax Rate Assignment"* which conveys the extent to which sub-national governments are involved in the setting of tax rates on the range of tax instruments. A greater value of these indicators indicates that sub-central authorities have, by law, the rights to influence the corresponding dimensions.

By using these indicators, this chapter differentiates itself from previous works. For

instance, Güth et al. (2005)'s lab experiment indicates that the willingness to pay is higher in a decentralized structure compared to a centralized one; the paper, however, does not address the complexity of a combined system where upper and lower-tier authorities may both have some degrees of discretion. Torgler et al. (2010) operationalized local autonomy through a survey in which local administrators are asked to report their perception of local autonomy. Similar to Güth et al. (2005), their empirical strategy does not address the structure of tax payments in the context of Switzerland – a country where sub-federal authorities hold considerable decision-making power over the tax institutions. Lago-Peñas and Lago-Peñas (2010) considered a binary indicator for federal governments in their empirical estimations; yet, as highlighted numerously in the literature, subnational authorities in federal countries do not necessarily hold significant taxing powers. Federal countries such as Malaysia and Austria stand as staggering examples (see chapter 2, section 2.5). This chapter is also the first to provide concrete empirical evidence on the influence of sub-national discretion over tax rates and tax administration on tax compliance.

Besides testing the relevance of sub-national taxing rights for tax compliance, the empirical framework also aims at examining how the above postulates might yield different outcomes in different socio-economic settings. In the analytical framework, I listed a few counter-arguments which convey the inconvenience of a multi-layer tax structure and which may incite countries to opt for centralized tax institutions. One of these counter-arguments relates to the inefficiency and diseconomies of scale in enforcement capacity that might result from having a tax system split across tiers of governments.

In low-income countries, more particularly, a multi-layered tax system is expected to result in a partition of already scarce public resources into multiple units, which might further lead to loopholes which can be exploited by dishonest taxpayers. A complex tax administration overseen by multiple stakeholders might also result in tax officials being unable to detect fraudulent behaviours and punish evaders, alongside higher compliance costs for firms and residents that must pay taxes in different regions or jurisdictions. The disparities in enforcement agencies could also alter the perception of coercive powers of tax officials which is argued to be an essential driver of tax compliance. Previous contributions have shown that higher discretion to lower-tier authorities in tax matters in developing economies result in inefficient forms of taxation (Alm et al., 2004; Rodden, 2006; Bird, 2015; Carnahan, 2015). Hence, I postulate that the positive effects of sub-national taxing rights on tax compliance would be diminished in low-income countries.

Hypothesis b_{11}: *The marginal effects of sub-national taxing rights on tax compliance are*

negative in low-income countries.

Hypothesis b_{12}: *The marginal effects of sub-national control over tax administration on tax compliance are negative in low-income countries.*

To test the above hypotheses, I interact the variables of interest – *Tax Assignment Index (TAI)* and *Tax Administration Assignment (TAA)* – with a binary indicator which equals 1 if a respondent lives in a low-income country. The income status of countries is withdrawn from the World Development Indicators for respective fiscal years.

In the analytical framework, I also argued that the availability and access to tax knowledge are essential for residents' tax compliance (Eriksen and Fallan, 1996; Saad, 2014) and even more so in a complex system with multiple stakeholders and enforcement agencies. In a multi-layered tax structure or tax administration, the scarcity of tax knowledge can significantly increase compliance costs and can create hurdles that dampen the taxpayers' willingness to pay. It is therefore expected that the lack of tax knowledge would play a mitigating role and curtail the (hypothesized) positive marginal effects of sub-national taxing rights on tax compliance.

Hypothesis b_{21}: *Scarcity of tax knowledge reduces the positive marginal effects of subnational taxing rights on tax compliance*.

Hypothesis b_{22}: *Scarcity of tax knowledge reduces the positive marginal effects of sub-national tax administration on tax compliance*.

The proxy capturing the scarcity of tax knowledge is computed with data from the Afrobarometer surveys, and more specifically question ***Q70a*** on the respondents' difficulty to find out what taxes and fees to pay. The indicator is constructed in two stages. First, a binary indicator is derived from the answers to the above question; it equals 1 if the respondent finds it difficult to know which taxes and fees to pay. Second, the binary indicator is averaged at the primary sampling unit or the enumeration area (EA) within each country. By using this approach, the variable thus conveys the broader scarcity of tax knowledge within the residential location of each individual, accounts for the regional disparities in tax knowledge (for instance in urban versus rural areas) and reduces the bi-directionality with individual answers.

As described in subsection 2.4.3, intermediate or regional-level governments in many countries carry discretionary power over the tax system. Thus, bidding the local and regional governments into "sub-national governments" would undermine the relevance of regional authorities in the vertical decision-making process. Therefore, for each primary indicator in the new database, an alternative proxy is derived in which

Table 4.1: Variables of Interest and Correlation with Tax Compliance

		PANEL A.	
HYPOTHESES	PROXIES	DESCRIPTION	CORRELATION
a_1	Tax Assignment Index (TAI)	Sub-national government taxing rights (overall)	-0.1058***
	Tax Assignment Index (TAI*)	Sub-national government taxing rights (overall)	-0.1067***
a_2	Tax Administration Assignment (TAA)	Sub-national government discretion over tax administration	-0.0966***
	Tax Administration Assignment (TAA*)	Sub-national government discretion over tax administration	-0.0982***
a_3	Tax Rate Assignment (TRA)	Sub-national government discretion over the setting of tax rates	-0.0623***
	Tax Rate Assignment (TRA*)	Sub-national government discretion over the setting of tax rates	-0.0644***
		PANEL B.	
HYPOTHESIS	PROXIES	Data Sources	
b_{11}	TAI $\times$ Low-income countries	Authors; World Development Indicators	
b_{12}	TAA $\times$ Low-income countries	Authors; World Development Indicators	
b_{21}	TAI $\times$ Scarcity of Tax Knowledge	Author's; Afrobarometer	
b_{22}	TAA $\times$ Scarcity of Tax Knowledge	Author's; Afrobarometer	

Notes: Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. (*) implies that the indicator has been revised to account for the relevance of the intermediate level of governments in joint decisions with central and local authorities.

I account for the involvement of intermediate-level governments in joint decision-making (with central and local authorities) on tax matters. The indicators from the alternative scoring procedures are identified as such in Table 4.1 and are used in the empirical analysis to test the robustness of the results (see Panel A.).

Table 4.1 links the hypotheses to the variables of interest (Panel A and B). It also points to a statistically significant and negative correlation between the binary outcome variable on tax compliance and the indicators capturing sub-national taxing rights and their discretion over tax rates and tax administration. To convey the robustness of the results, the empirical estimations also consider the proxies for sub-national taxing rights that are solely constructed with respect to income, consumption and property taxes – as these are the most common instruments and the most important revenue sources across countries.

4.4.3 Additional Covariates

The empirical specifications control for an array of variables that capture the socio-demographic characteristics, political and social attitudes of each respondent and the country context. The set of individual-level covariates is provided through the Afrobarometer (2016) and the Latinóbarometro (2015) respectively, alongside the questions and answers on tax compliance. The vector of country characteristics is provided through secondary data sources in addition to the indicators on multi-layer tax arrangements.

Socio-economic and demographic characteristics

- *Gender* is a binary variable indicating whether the respondent is a man (1) or a woman (0). I expect tax compliance to be much lower for men (Torgler, 2005b; Torgler and Schaltegger, 2006; Alm and Torgler, 2006),
- *Age* is a continuous variable indicating the age of the survey respondent. Tax compliance is expected to increase with age (Alm and Torgler, 2006; Torgler and Schaltegger, 2006; Cummings et al., 2009).
- *Education* is a re-coded ordinal variable which ranges from *0=no formal education; 1=primary education; 2=secondary education; 3=post-secondary education*. Following Torgler and Schaltegger (2006), I postulate that higher education would negatively affect tax compliance.

- *Employment status* is a binary variable indicating whether the respondent was employed at the time of the survey. Due to the disparities across the survey questionnaires, I am unable to disentangle different employment categories. Employed individuals are expected to be more tax compliant (Torgler, 2004; Alm and Torgler, 2006).

Political Attitude

- *Trust in Institutions* is a composite indicator which measures a respondent's overall trust in public and political institutions, including the presidential office or the national government, the parliament or congress, the judiciary or the courts, and electoral institutions. The variable is constructed through factor analyses using polychoric correlations of ordinal variables related to trust in the above-listed institutions (see for e.g. Lee et al., 1995; Holgado-Tello et al., 2008). I postulate that trust in institutions would positively align with tax compliance (Frey and Torgler, 2007; Torgler and Schneider, 2007; Torgler et al., 2010).

- *Pro-democracy* refers to whether a respondent supports or has a favourable opinion of democracy. It is evidenced that a pro-democratic attitude increases tax morale and tax compliance (Torgler, 2005b; Torgler and Schneider, 2007).

- *Political Involvement* is a composite indicator pointing to a respondent's political endeavours. It is constructed through factor analyses using polychoric correlations of binary indicators that indicate whether a respondent is close to a political party, frequently discusses politics, participates in political protest, and attends or raises an issue at community meetings. As for the pro-democratic attitude, it is expected that political involvement or awareness would positively align with tax compliance (Wahl et al., 2010; Ma et al., 2020).

Social Attitude

- *Religiosity* is a binary variable for a respondent's adherence to a particular religion or religious assembly. Religious beliefs and commitments and the virtues that stem from religious teachings are expected to provide an internal constraint on cheating (Anderson, 1988; Hull and Bold, 2007). Following Torgler and Schaltegger (2006) and Benk et al. (2016), it is expected that religiosity would increase tax compliance.

- *Perception of redistribution* indicates whether a respondent thinks that the current income redistribution is fair, and the narrowing of the income gap is appropriately

handled by the government. It is expected that a positive appraisal of the redistribution system would increase tax compliance (Bordignon, 1993; Falkinger, 1995; Verboon and Goslinga, 2009; Congdon et al., 2011).

Country-level covariates

The vector $\mathbf{w}_j$ refers to country-level characteristics which are withdrawn from standard databases on countries' socio-economic and political features (Teorell et al., 2017; Scartascini et al., 2018; World Bank, 2018).

- *Per capita GDP (ln)* is a proxy for the level of development in selected countries. Tax compliance is expected to be weaker in rich countries (Lago-Peñas and Lago-Peñas, 2010). For each country in the sample, per capita GDP is averaged over three years – the year of the data collection and two years preceding the survey in each country. Such an approach helps to capture the broader level of development rather than a year-based estimate. Alternatively to the per capita GDP, hypotheses b_{11} and b_{12} are tested using the income classification of the World Bank for respective fiscal years, with a binary variable referring to low-income economies.
- *WGI Government Effectiveness* is a composite variable from the World Governance Indicators (WGI) which captures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies. It is expected that government effectiveness would positively impact on compliance (Frey and Torgler, 2007; Cummings et al., 2009). WGI Government Effectiveness is also averaged over three years even though the data display minimal year-to-year variation for included countries.
- *Ethnic fractionalization* is defined as the probability that two randomly selected individuals will be from different ethnic groups. As in Lago-Peñas and Lago-Peñas (2010) and Alesina et al. (2003), this chapter argues that trust and consensus over public policies and institutions might be lower in ethnically fragmented societies. As such, it is expected that ethnic fragmentation would negatively influence tax compliance.

4.4.4 Estimation Strategy

The empirical estimates are computed through a generalized linear mixed model (GLMM) with probit estimation techniques – also known as mixed-effects probit model – in which individual data and responses are nested in country context (Raudenbush and Bryk, 2002; Rabe-Hesketh and Skrondal, 2012). This estimation technique has also previously been used by Lago-Peñas and Lago-Peñas (2010) in empirical enquiries regarding the drivers of tax morale.

As the proxy for tax compliance is binary, the probability of falling into that category is given as follows, where the likelihood of tax compliance of individual i in country j is a function of the $1 \times q$ row vector $\mathbf{x}_{ij}$ of individual characteristics, $1 \times p$ vector $\mathbf{w}_j$ of institutional and socio-economic factors of the country in which (i) lives, and random effects $\mathbf{u}_j$. $\Phi(.)$ is the standard normal cumulative distribution function. $\mathbf{z}_{ij}$ is the $1 \times n$ vector of covariates corresponding to the random effects and can be used to represent both random intercepts and random coefficients, and which is the scalar 1 in the random intercept model.

$$P(y_{ij} = 1|\mathbf{x}_{ij}, \mathbf{w}_j, \mathbf{u}_j) = \mathbf{\Phi}(\mathbf{x}_{ij}\beta + \mathbf{w}_j\delta + \mathbf{z}_{ij}\mathbf{u}_j) \tag{4.1}$$

Equation (4.1) can also be written in a latent linear form where the binary responses y_{ij} are determined by the latent continuous responses via the threshold model as in (4.3). The error terms ϵ_{ij} and $\mathbf{u}_{ij}$ follow the standard normal distribution with mean 0 and variance 1. ϵ_{ij} is also assumed to be independent across countries and individuals, and independent of $\mathbf{u}_{ij}$.

$$y^*_{ij} = \mathbf{x}_{ij}\beta + \mathbf{w}_j\delta + \mathbf{u}_j + \epsilon_{ij} \tag{4.2}$$

$$\text{with} \qquad i = 1...I,\ j = 1...J$$

$$\text{and} \qquad y_{ij} = \begin{cases} 1 & \text{if} \quad y^*_{ij} > 0 \\ 0 & \quad otherwise \end{cases} \tag{4.3}$$

The random effects are not directly estimated as model parameters but are instead

summarized according to the variance components. The random intercept can be seen as the combined effects of omitted country covariates that induce some respondents to be more compliant than others. In all specifications, it is assumed that $\mathbf{u}_{ij}$ are independent across individual respondents and independent of the covariates, and thus do not affect the probability of observing the individual outcome variables given the random intercept – strict exogeneity conditional on the random intercept (Rabe-Hesketh and Skrondal, 2012, Chapter 10).

To assess the level of correlation within clusters or countries, it can be derived the intra-class correlation or the variance partition coefficient. ρ is understood as the proportion of the variation that is explained by the hierarchical structure or country-context. σ^2 is the variance of the random component $\mathbf{u}_j$ and θ^2 the variance of the individual error term, which equals 1 in standard probit models. The ICC, calculated as follows, is reported for each estimation.

$$ICC = \rho = \frac{\sigma^2}{\sigma^2 + \theta^2} \tag{4.4}$$

Figure 4.1 is a graphical representation of the country effects. It is obtained by calculating the empirical Bayes predictions of the random effects in the null model with the main variables of interests on rank order with a 95% confidence interval. The caterpillar plots show that for a large number of countries, the 95% confidence interval does not overlap zero, which indicates that the likelihood of tax compliance is significantly above or below the average in these countries. Therefore, a nested model with consideration for both individual and country-level parameters appears to be an adequate estimation technique.

4.5 Empirical Results and Discussion

Table 4.2 reports the coefficient estimates of the baseline model testing the first and main hypothesis (a_1) in which I argue that the higher the level of sub-national taxing rights, the higher the likelihood of tax compliance of respondents in respective countries. Sub-national taxing rights are proxied by the *Tax Assignment Index*, constructed as per details in chapter 2. A positive and significant coefficient for that proxy suggests, on average, a positive effect on tax compliance or a greater probability that the respondents state to have never refused to pay taxes or fees to their respective governments.

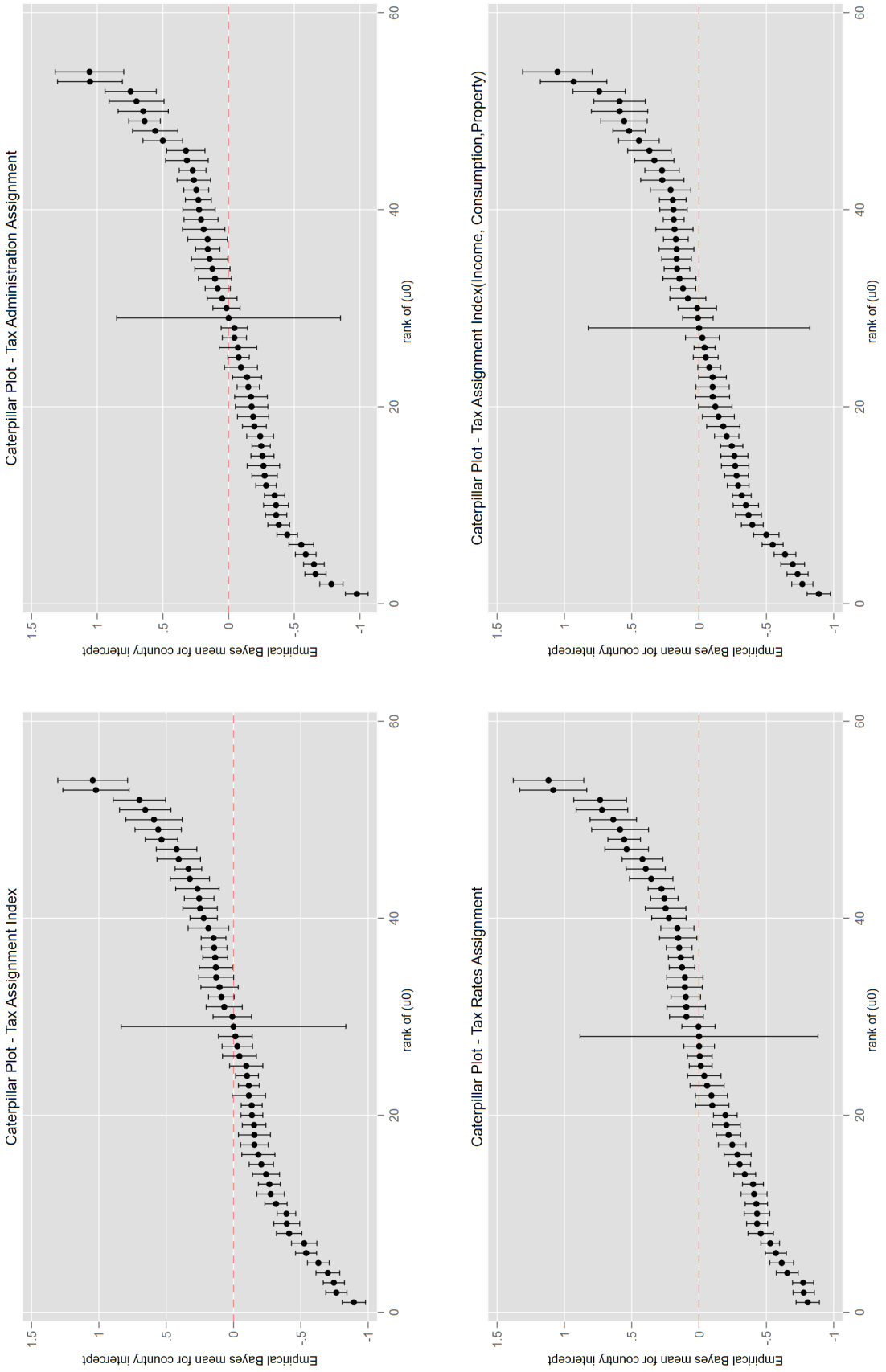


Figure 4.1: Caterpillar Plots of the country (random) effects

The estimation results in Table 4.2 indicate a negative relationship between sub-national taxing rights and tax compliance, a finding which contrasts with the hypothesis. In columns (4) to (6), I substitute the *Tax Assignment Index*, based on all tax instruments, with the one constructed with income, consumption and property taxes only. The coefficient estimates in columns (4) to (6) are consistent with the findings of columns (1) to (3). The intra-class coefficients (ICC) suggest that, at the baseline (columns (1) and (3)), more than 15% of the variation in the outcome is due to cross-country differences.

At the individual level, trust in institutions and support for democracy appear, as expected, to be positive drivers of tax compliance. Political involvement and awareness, on the other hand, weakens the likelihood of citizens complying with their due payments. Counter-intuitively, the more positive the citizens' appraisal of the redistributive system, the lower the tendency towards compliance. This finding is consistent throughout all estimations in this chapter and suggests that, contrarily to conventional beliefs, residents in Latin-America and Sub-Saharan Africa are less prone to pay their taxes when they believe that the government is already doing enough to help the most impoverished strata of the population. At the country-level, it is indicated that tax compliance is much lower in wealthier countries, as indicated by the coefficient estimate on per capita GDP – a finding that is in line with Lago-Peñas and Lago-Peñas (2010).

To test the sensitivity of these results, the specifications of Table 4.2 are re-estimated using the indicators of sub-national taxing rights that are derived from the alternative scoring procedures described in chapter 2 (see subsection 2.4.3). In these indicators, I take into account the relevance of the intermediate level of governments in joint decisions with central and local authorities. The results are reported in Table A4.3 in Appendix 4 and are consistent with the estimates reported in Table 4.2.

Sub-National Discretion Over Tax Administration and Tax Rates

With hypotheses a_2 and a_3, I zoom into specific dimensions of the tax system, most notably the involvement of sub-national authorities in tax administration and the setting of tax rates. These hypotheses respectively postulate that the greater the sub-national authorities' involvement in these decisions, the higher the likelihood of tax compliance. Sub-national governments' discretion over tax administration and tax rates are respectively captured by the defined *"Tax Administration Assignment"* and *"Tax Rate Assignment"* indicators whose constructions are described in chapter 2

Table 4.2: Tax Compliance in Multi-Layer Tax Structure: Baseline Model

	MIXED-EFFECTS PROBIT					
	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable: Tax Compliance (binary)						
COUNTRY-LEVEL						
Tax Assignment Index	-1.176***	-1.514***	-0.827**			
	(0.254)	(0.275)	(0.349)			
Tax Assignment Index(I,C,P)				-1.503***	-1.781***	-1.138***
				(0.299)	(0.412)	(0.378)
Per Capita GDP (ln)			-0.322***			-0.325***
			(0.108)			(0.100)
WGI Government Effectiveness			0.242			0.260*
			(0.161)			(0.152)
Ethnic Fractionalization			0.043			0.051
			(0.317)			(0.312)
INDIVIDUAL-LEVEL						
Age (ln)		0.057**	0.059**		0.057**	0.059**
		(0.028)	(0.028)		(0.028)	(0.028)
Gender (male)		-0.023	-0.024		-0.023	-0.024
		(0.020)	(0.020)		(0.020)	(0.020)
Education (base= post-secondary)						
No formal education		-0.173***	-0.177***		-0.172***	-0.177***
		(0.049)	(0.049)		(0.049)	(0.049)
Primary education		-0.068*	-0.071*		-0.068*	-0.070*
		(0.039)	(0.039)		(0.039)	(0.039)
Secondary Education		-0.065***	-0.066***		-0.065***	-0.066***
		(0.024)	(0.024)		(0.024)	(0.024)
Employment Status (yes=1)		-0.025	-0.024		-0.025	-0.024
		(0.029)	(0.029)		(0.029)	(0.029)
Religiosity		-0.029	-0.030		-0.029	-0.030
		(0.033)	(0.033)		(0.033)	(0.033)
Perception of Redistribution		-0.076*	-0.075*		-0.076*	-0.075*
		(0.039)	(0.039)		(0.039)	(0.039)
Trust in Institutions		0.078***	0.079***		0.078***	0.079***
		(0.013)	(0.013)		(0.013)	(0.013)
Pro-Democracy		0.209***	0.209***		0.209***	0.208***
		(0.025)	(0.025)		(0.025)	(0.025)
Political Involvement		-0.803***	-0.805***		-0.803***	-0.804***
		(0.069)	(0.069)		(0.069)	(0.069)
Constant	1.539***	1.625***	4.379***	1.535***	1.607***	4.420***
	(0.085)	(0.142)	(1.078)	(0.082)	(0.146)	(1.018)
σ_2^2	0.181***	0.235***	0.180***	0.176***	0.232***	0.174***
	(0.039)	(0.051)	(0.035)	(0.037)	(0.047)	(0.033)
N Respondents	56340	39556	39556	56340	39556	39556
N Countries	53	49	49	53	49	49
χ^2	21.397	265.178	319.586	25.288	268.191	325.899
Log-likelihood	-17999.338	-11853.012	-11846.747	-17998.628	-11852.730	-11845.913
AIC	36004.675	23734.024	23727.493	36003.256	23733.461	23725.825
ICC	0.153	0.190	0.153	0.150	0.188	0.148

Notes: Standard errors (in parentheses) are clustered at the country level. Significance level * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. (I,C,P) refers to the indicators that account solely for income, consumption and property taxes. Trust in Institutions and Political involvement are composite indicators that capture the respondents' trust in major political institutions and their involvement in political discussion and political life. ICC refers to the intra-class correlation or the proportion of the total variance that is due to between-country differences. σ_2^2 refers to the variance of the random components (country-level).

(subsection 2.4.3).

Table 4.3 reports the empirical results testing these postulates. The coefficient estimates of columns (1) and (2) suggest that the higher the lower-tier involvement in tax administration, the lower the tax compliance, or the probability of citizens stating that they have always complied with their taxes and fees. As in Table 4.2, the specification in column (2) is estimated with the *Tax Administration Assignment* index on Income, Consumption and Property Taxes, and the results bound in a similar direction. It must be noted that no country has a fully decentralized tax administration, even federal ones such as Argentina or Brazil. A high score on the *Tax Administration Assignment* does not imply the non-existence of a central and federal tax administration. The negative and statistically significant coefficient on the main variable of interest thus hints that granting a greater discretionary power on tax administration to lower-tier authorities might be detrimental to tax revenue mobilization.

In specifications (3) and (4), I report the empirical results on a_3 on the relevance of sub-national governments' involvement in the setting of tax rates, thus measured by the *Tax Rate Assignment* indices. While the coefficient estimates point to a negative correlation, there is no statistically significant evidence that lower-tier governments' involvements in the setting of tax rates, more broadly or specifically on income, consumption and property taxes, matter to tax compliance in Latin-America and Africa.

Like in Table 4.2, the intra-class coefficients (ICC) suggest that more than 15% of the variation in the outcome is due to cross-country differences. The coefficients on trust in institutions and support for democracy are consistent with previous reports, suggesting that they are positive and significant drivers of tax compliance. In contrast, respondents that are involved in politics are less compliant. A positive appraisal of the current redistribution system still yields a negative sign, corroborating the previous findings that respondents in included countries tend to cheat more when they believe that the government is already improving the lives of the poorest strata of the population. At the country level, it remains consistent that tax compliance is lower in wealthier countries – as indicated by the coefficient estimates on per capita GDP.

As for hypothesis a_1, I test the sensitivity of the results by re-estimating the specifications of Table 4.3 using the indicators constructed through the alternative scoring procedures and which take into account the relevance of intermediate levels of governments in joint decisions with central and local authorities on tax administration and tax rates. The results are consistent with these above estimates (see Table A4.4 in Appendix 4).

Table 4.3: Tax Compliance in Multi-Layer Tax Structure:
Sub-national Discretion over Tax Administration and Tax Rates

	MIXED-EFFECTS PROBIT			
	(1)	(2)	(3)	(4)
Dependent Variable: Tax Compliance (binary)				
COUNTRY-LEVEL				
Tax Administration Assignment	-0.638*			
	(0.329)			
Tax Administration Assignment(I,C,P)		-0.791***		
		(0.295)		
Tax Rate Assignment			-0.297	
			(0.402)	
Tax Rate Assignment(I,C,P)				-0.674
				(0.427)
Per Capita GDP (ln)	-0.348***	-0.359***	-0.366***	-0.353***
	(0.098)	(0.092)	(0.112)	(0.107)
WGI Government Effectiveness	0.246	0.271*	0.273*	0.280*
	(0.160)	(0.156)	(0.163)	(0.156)
Ethnic Fractionalization	-0.039	-0.054	0.038	0.084
	(0.315)	(0.307)	(0.340)	(0.338)
INDIVIDUAL-LEVEL				
Perception of Redistribution	-0.075*	-0.075*	-0.075*	-0.075*
	(0.040)	(0.039)	(0.039)	(0.039)
Trust in Institutions	0.079***	0.079***	0.078***	0.078***
	(0.013)	(0.013)	(0.014)	(0.014)
Pro-Democracy	0.208***	0.208***	0.209***	0.209***
	(0.025)	(0.025)	(0.025)	(0.025)
Political Involvement	-0.805***	-0.805***	-0.805***	-0.805***
	(0.069)	(0.069)	(0.069)	(0.069)
Constant	4.723***	4.846***	4.697***	4.588***
	(0.984)	(0.957)	(1.133)	(1.087)
σ_2^2	0.180***	0.174***	0.190***	0.186***
	(0.036)	(0.034)	(0.035)	(0.034)
N Respondents	39556	39556	39556	39556
N Countries	49	49	49	49
χ^2	333.330	358.816	338.493	360.014
Log-likelihood	-11846.751	-11845.832	-11848.021	-11847.479
AIC	23727.503	23725.665	23730.041	23728.958
ICC	0.153	0.148	0.160	0.157

Notes: Standard errors (in parentheses) are clustered at the country level. Significance level * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. (I,C,P) refers to the indicators that account solely for income, consumption and property taxes. Trust in Institutions and Political involvement are composite indicators that capture the respondents' trust in major political institutions and their involvement in political discussion and political life. Age (ln), Gender, Education, Employment Status, and Religiosity are included in all specifications but not reported. The coefficient estimates on age are positive and statistically significant, thus implying that tax compliance increases with age. Respondents with no formal education or secondary education tend to be less compliant than those with post-secondary level education. ICC refers to the intra-class correlation or the proportion of the total variance that is due to between-country differences. σ_2^2 refers to the variance of the random components (country-level).

4.5.1 Tax Compliance in Low-Income Countries

In previous sections, I argued that a multi-layered tax system is likely to be less efficient in low-income countries, where the multiplicity of tax institutions, mis-coordination across tiers, and the absence of economies of scale in enforcement capacities might create loopholes to be exploited by dishonest taxpayers. While the existing data do not allow for testing the quality of tax institutions in the country sample, I interact the *Tax Assignment Index* and *Tax Administration Assignment* with a binary indicator pointing to low-income economies as a mean of testing for hypotheses b_{11} and b_{12} (see Panel B. of Table 4.1). By doing so, I check whether, for any given level of sub-national taxing rights or discretion over tax administration, living in a low-income country results in a lower tendency towards tax compliance.

The coefficient estimates on the interactions terms capture the reinforcing or moderating effects of residing in a low-income country on tax compliance given the level of taxing rights and discretion on tax administration granted to lower-tier authorities. The results, reported in Table 4.4, indicate that the marginal effects of sub-national taxing rights and their involvement in tax administration are positive in low-income countries. Such finding, therefore, hints that involving lower-tier governments in the governance of the tax system might yield some benefits for tax compliance in low-income economies.

Figure 4.2: Effects of Sub-national Governments' Taxing Rights on Tax Compliance in Low-Income Countries

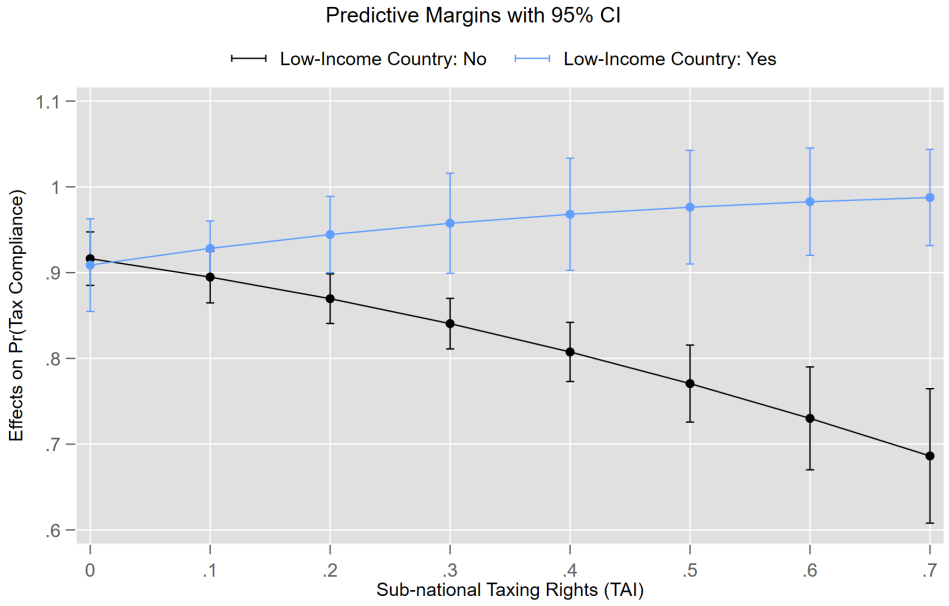


Table 4.4: Tax Compliance in Multi-Layer Tax Structure: Compliance in Low-Income Countries

	MIXED-EFFECTS PROBIT			
	(1)	(2)	(3)	(4)
Dependent Variable: Tax Compliance (binary)				
COUNTRY-LEVEL				
Tax Assignment Index	-1.463***			
	(0.295)			
Tax Administration Assignment		-1.211***		
		(0.376)		
Tax Assignment Index(*)			-1.449***	
			(0.291)	
Tax Administration Assignment(*)				-1.210***
				(0.369)
Tax Assignment Index × LCI	2.964*			
	(1.655)			
Tax Administration Assignment × LCI		1.588*		
		(0.857)		
Tax Assignment Index(*) × LCI			2.919*	
			(1.652)	
Tax Administration Assignment(*) × LCI				1.566*
				(0.849)
Low-Income Countries (LIC)	-0.055	-0.173	-0.053	-0.173
	(0.230)	(0.274)	(0.230)	(0.273)
INDIVIDUAL-LEVEL				
Perception of Redistribution	-0.075*	-0.075*	-0.075*	-0.075*
	(0.039)	(0.040)	(0.039)	(0.040)
Trust in Institutions	0.079***	0.079***	0.079***	0.079***
	(0.013)	(0.013)	(0.013)	(0.013)
Pro-Democracy	0.209***	0.209***	0.209***	0.209***
	(0.025)	(0.025)	(0.025)	(0.025)
Political Involvement	-0.804***	-0.804***	-0.804***	-0.804***
	(0.069)	(0.069)	(0.069)	(0.069)
Constant	1.368***	1.537***	1.367***	1.540***
	(0.243)	(0.275)	(0.243)	(0.275)
σ_2^2	0.206***	0.215***	0.206***	0.214***
	(0.043)	(0.046)	(0.043)	(0.046)
N Respondents	39556	39556	39556	39556
N Countries	49	49	49	49
χ^2	282.897	286.137	282.829	285.755
Log-likelihood	-11849.998	-11850.995	-11849.930	-11850.869
AIC	23735.995	23737.990	23735.860	23737.737
ICC	0.171	0.177	0.171	0.176

Notes: Standard errors (in parentheses) are clustered at the country level. Significance level * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. (*) implies that the indicator has been revised to account for the relevance of intermediate level of governments in joint decisions with central and local authorities. LIC refers to low-income countries according to the World Bank Classification for the fiscal year of 2016. Per capita GDP is excluded from the estimations to avoid multi-collinearity with the low-income status of countries. Age (ln), Gender, Education, Employment Status, and Religiosity are included in all specifications but not reported. The coefficient estimates on age are positive and statistically significant, thus implying that tax compliance increases with age. Respondents with no formal education or secondary education tend to be less compliant than those with post-secondary level education. Trust in Institutions and Political involvement are composite indicators that capture the respondents' trust in major political institutions and their involvement in political discussion and political life. ICC refers to the intra-class correlation or the proportion of the total variance that is due to between-country differences. σ_2^2 refers to the variance of the random components (country-level).

Such a reinforcing effect is more appearing in Figure 4.2, where for any given value of the Tax Assignment Index, for instance, the likelihood of tax compliance is higher in low-income countries. The coefficient estimates on other variables such as the perception of redistribution, trust in institutions, pro-democracy and political involvement are robustly consistent with previous reports in Table 4.2 and Table 4.3.

4.5.2 The Relevance of Tax Knowledge

With hypotheses b_{21} and b_{22}, I argue that the scarcity of tax knowledge would lessen the positive marginal effects of sub-national taxing powers or involvement in tax administration on tax compliance behaviours. Questions on the scarcity of tax knowledge are only available in the Afrobarometer survey data. Scarcity of tax knowledge is measured by the regional average number of individuals who have difficulties finding out which taxes and fees to pay. The regional average allows me to capture the broader lack of tax knowledge within the residential location area of each individual.

The results are reported in Table 4.5. The coefficient estimates indicate that the marginal effects of sub-national taxing rights on tax compliance turn negative the higher the scarcity of tax knowledge. It is noted that the main variables of interest lose their statistical significance which suggests the quality of tax knowledge in a multi-layer tax structure matters significantly in how such structure influences tax compliance.

The moderating effects of scarcity of tax knowledge are depicted in Figure 4.3. All else equal, a greater lack of tax knowledge combined with a higher sub-national discretion over the tax system, more broadly, and tax administration, in particular, leads to the worse cases scenarios or lowest probability of tax compliance. The coefficient estimates on other variables such as the positive perception of redistribution, trust in institutions, pro-democracy and political involvement are also consistent with previous estimates.

4.5.3 Institutional Design versus Compliance Costs

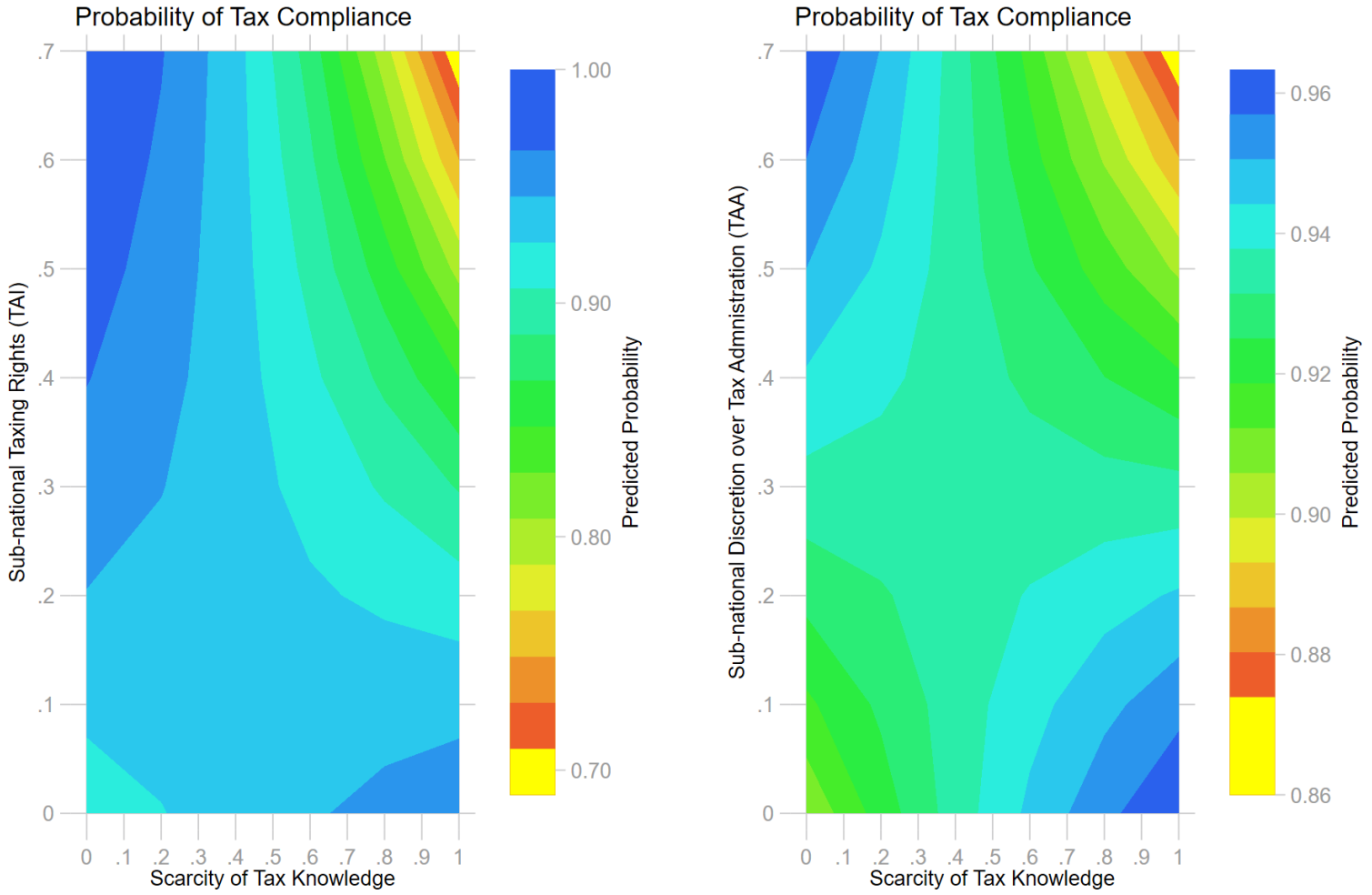
As previously described, one of the most unwanted consequences of a complex tax structure is the increase in compliance costs. The fulfilment of tax obligations in several jurisdictions or towards more than one tier of authorities might significantly increase the compliance cost for individual taxpayers and firms. The multiplicity

Table 4.5: Tax Compliance in Multi-Layer Tax Structure:
The Relevance of Tax Knowledge

	MIXED-EFFECTS PROBIT			
	(1)	(2)	(3)	(4)
Dependent Variable: Tax Compliance (binary)				
COUNTRY-LEVEL				
Tax Assignment Index	1.274			
	(1.272)			
Tax Administration Assignment		0.734		
		(0.486)		
Tax Assignment Index (*)			1.268	
			(1.263)	
Tax Administration Assignment (*)				0.726
				(0.484)
Tax Assignment Index × STK	-3.247*			
	(1.878)			
Tax Administration Assignment × STK		-1.798***		
		(0.638)		
Tax Administration Assignment(*) × STK			-3.220*	
			(1.882)	
Tax Administration Assignment(*) × STK				-1.793***
				(0.636)
Scarcity of Tax Knowledge (STK)	0.403	0.518*	0.400	0.519*
	(0.298)	(0.282)	(0.299)	(0.282)
INDIVIDUAL-LEVEL				
Perception of Redistribution	-0.122**	-0.122**	-0.122**	-0.122**
	(0.055)	(0.056)	(0.055)	(0.056)
Trust in Institutions	0.093***	0.093***	0.093***	0.093***
	(0.016)	(0.016)	(0.016)	(0.016)
Pro-Democracy	0.209***	0.208***	0.209***	0.208***
	(0.046)	(0.046)	(0.046)	(0.046)
Political Involvement	-0.877***	-0.875***	-0.877***	-0.874***
	(0.132)	(0.132)	(0.132)	(0.132)
Constant	3.147***	3.156***	3.147***	3.157***
	(1.093)	(1.130)	(1.092)	(1.127)
σ_2^2	0.129***	0.129***	0.129***	0.129***
	(0.043)	(0.042)	(0.043)	(0.042)
N Respondents	25996	25996	25996	25996
N Countries	31	31	31	31
χ^2	164.621	146.191	166.166	146.080
Log-likelihood	-5643.243	-5640.685	-5643.280	-5640.682
AIC	11324.485	11319.370	11324.559	11319.365
ICC	0.115	0.114	0.115	0.114

Notes: Standard errors (in parentheses) are clustered at the country level. Significance level * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. STK: Scarcity of tax knowledge (regional average of the binary variable indicating whether a respondent has difficulty to find information on which taxes and fees to pay to the government. (*) implies that the indicator has been revised to account for the relevance of intermediate level of governments in joint decisions with central and local authorities. Age (ln), Gender, Education, Employment Status, Religiosity, Per capita GDP, WGI Government Effectiveness and Ethnic Fragmentation are included in all specifications but not reported. The coefficient estimates on age are positive and statistically significant, thus implying that tax compliance increases with age. Respondents with no formal education or secondary education tend to be less compliant than those with post-secondary level education. Trust in Institutions and Political involvement are composite indicators that capture the respondents' trust in major political institutions and their involvement in political discussion and political life. ICC refers to the intra-class correlation or the proportion of the total variance that is due to between-country differences. σ_2^2 refers to the variance of the random components (country-level).

Figure 4.3: Sub-national Governments' Taxing Rights and Scarcity of Tax Knowledge: Joint Effect on Tax Compliance



of regulatory forms to be filled, the number of hours dedicated to abiding by the rules of different tax authorities could induce hurdles that undermine any taxpayer's voluntary compliance.

Previous results (e. g. Table 4.2, Table 4.3) suggest a negative effect of sub-national governments' taxing rights on tax compliance. They also suggest that granting a higher discretion over tax administration to lower-tiers of governments results in a lower probability of citizens complying with their due payments. Given the arguments above, it is worth questioning whether the adverse effects evidenced in the previous result tables are, in fact, due to the institutional design of the multi-layer tax structure, or due to higher compliance costs.

Empirically, I investigate whether indicators that capture compliance costs at the country level trump the relevance of the indicators that proxy sub-national taxing rights or their discretion over tax administration. I do so by relying on the World Bank Doing Business Index Surveys which provide country-level estimates on the total number of hours per year it takes to prepare, file, and pay (or withhold) three major types of taxes (corporate income tax, value-added tax and the labour tax), and the total number of taxes paid by businesses including electronic filling. Although these variables are issued from survey data collection where the unit of analysis is firm, they convey the broader challenges towards paying taxes in respective countries. As for other country-level parameters, these variables averaged over three years – the year of the data collection and two years preceding the survey in each country. While there is very limited variation in the Doing Business Index indicators for each country, the three-year average allows me to capture the trend in compliance costs at the country-level and not a year-based estimate.

The results are reported in Table 4.6 and Table 4.7, respectively. In Table 4.6, I control for the estimated total number of hours spent per year in preparing, filing and paying or withholding the three major taxes in a country (corporate income tax, value-added tax and labour taxes). The coefficient estimates suggest that the time loads on tax payments do not trump the relevance of the design per se. Sub-national taxing rights more broadly, and sub-national discretion over tax administration remains strongly negative in their effect on tax compliance of residents in the 49 countries in the sample. In Table 4.7, I control for the estimated number of taxes paid by businesses, including electronic filling, for each country. As for Table 4.6, there is no evidence that the estimated number of tax payments trumps the relevance of the multi-layer structure of the tax system and tax administration.

Hence, it appears that the adverse and significant effects evidenced by these results

Table 4.6: Tax Compliance in Multi-Layer Tax Structure:
Institutional Design versus Compliance Costs (Hours to Pay Taxes)

	MIXED-EFFECTS PROBIT			
	(1)	(2)	(3)	(4)
Dependent Variable: Tax Compliance (binary)				
	COUNTRY-LEVEL			
Tax Assignment Index	-0.913**			
	(0.405)			
Tax Administration Assignment		-0.634*		
		(0.328)		
Tax Assignment Index (*)			-0.928**	
			(0.403)	
Tax Administration Assignment (*)				-0.647**
				(0.323)
Hours to Pay Taxes (ln)	0.056	-0.008	0.063	-0.002
	(0.149)	(0.137)	(0.149)	(0.136)
	INDIVIDUAL-LEVEL			
Perception of Redistribution	-0.075*	-0.075*	-0.075*	-0.075*
	(0.039)	(0.040)	(0.039)	(0.040)
Trust in Institutions	0.079***	0.079***	0.079***	0.079***
	(0.014)	(0.014)	(0.014)	(0.014)
Pro-Democracy	0.209***	0.208***	0.209***	0.208***
	(0.025)	(0.025)	(0.025)	(0.025)
Political Involvement	-0.805***	-0.805***	-0.805***	-0.805***
	(0.069)	(0.069)	(0.069)	(0.069)
	INDIVIDUAL-LEVEL			
Constant	4.225***	4.739***	4.191***	4.715***
	(1.061)	(0.952)	(1.057)	(0.948)
σ_2^2	0.180***	0.180***	0.179***	0.179***
	(0.034)	(0.037)	(0.034)	(0.037)
N Respondents	39556	39556	39556	39556
N Countries	49	49	49	49
χ^2	319.651	333.671	319.275	332.698
Log-likelihood	-11846.675	-11846.750	-11846.585	-11846.650
AIC	23729.351	23729.499	23729.171	23729.300
ICC	0.152	0.153	0.152	0.152

Notes: Standard errors (in parentheses) are clustered at the country level. Significance level * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. (*) implies that the indicator has been revised to account for the relevance of intermediate level of governments in joint decisions with central and local authorities. Age (ln), Gender, Education, Employment Status, Religiosity, Per capita GDP, WGI Government Effectiveness and Ethnic Fragmentation are included in all specifications but not reported. The coefficient estimates on age are positive and statistically significant, thus implying that tax compliance increases with age. Respondents with no formal education or secondary education tend to be less compliant than those with post-secondary level education. Trust in Institutions and Political involvement are composite indicators that capture the respondents' trust in major political institutions and their involvement in political discussion and political life. ICC refers to the intra-class correlation or the proportion of the total variance that is due to between-country differences. σ_2^2 refers to the variance of the random components (country-level).

Table 4.7: Tax Compliance in Multi-Layer Tax Structure:
Institutional Design versus Compliance Costs (Number of Tax Payments)

	MIXED-EFFECTS PROBIT			
	(1)	(2)	(3)	(4)
Dependent Variable: Tax Compliance (binary)				
COUNTRY-LEVEL				
Tax Assignment Index	-0.723**			
	(0.362)			
Tax Administration Assignment		-0.576*		
		(0.328)		
Tax Assignment Index (*)			-0.731**	
			(0.357)	
Tax Administration Assignment (*)				-0.589*
				(0.323)
Number of Tax Payments	0.006	0.006	0.006	0.006
	(0.004)	(0.004)	(0.004)	(0.004)
INDIVIDUAL-LEVEL				
Perception of Redistribution	-0.076*	-0.075*	-0.076*	-0.075*
	(0.039)	(0.040)	(0.039)	(0.040)
Trust in Institutions	0.078***	0.079***	0.078***	0.079***
	(0.013)	(0.013)	(0.013)	(0.013)
Pro-Democracy	0.208***	0.208***	0.208***	0.208***
	(0.025)	(0.025)	(0.025)	(0.025)
Political Involvement	-0.804***	-0.804***	-0.804***	-0.804***
	(0.069)	(0.069)	(0.069)	(0.069)
Constant	4.124***	4.407***	4.109***	4.395***
	(1.042)	(0.953)	(1.039)	(0.949)
σ_2^2	0.173***	0.172***	0.172***	0.171***
	(0.035)	(0.036)	(0.035)	(0.036)
N Respondents	39556	39556	39556	39556
N Countries	49	49	49	49
χ^2	339.299	352.292	338.286	350.808
Log-likelihood	-11845.819	-11845.731	-11845.743	-11845.624
AIC	23727.638	23727.463	23727.486	23727.248
ICC	0.147	0.147	0.147	0.146

Notes: Standard errors (in parentheses) are clustered at the country level. Significance level * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. (*) implies that the indicator has been revised to account for the relevance of intermediate level of governments in joint decisions with central and local authorities. Age (ln), Gender, Education, Employment Status, Religiosity, Per capita GDP, WGI Government Effectiveness and Ethnic Fragmentation are included in all specifications but not reported. The coefficient estimates on age are positive and statistically significant, thus implying that tax compliance increases with age. Respondents with no formal education or secondary education tend to be less compliant than those with post-secondary level education. Trust in Institutions and Political involvement are composite indicators that capture the respondents' trust in major political institutions and their involvement in political discussion and political life. ICC refers to the intra-class correlation or the proportion of the total variance that is due to between-country differences. σ_2^2 refers to the variance of the random components (country-level).

are not primarily due to the average compliance costs at the country level – which I attempt to capture by the above variables from the Doing Business Index survey data – but rather the design in itself or other parameters such as the scarcity of tax knowledge as evidenced in the previous sub-section. As these variables are issued from different surveys and administrative data, I acknowledge the limitations in matching them with the Afrobarometer and the Latinobarómetro. Notwithstanding, at the individual level, both sets of results are consistent with previous findings, meaning that trust in institutions and support for democracy are, as expected, positive drivers of tax compliance. In contrast, and consistently, political awareness and a positive appraisal of the redistributive system tend to lower the tendency towards compliance.

4.5.4 Further Sensitivity Analyses

Several robustness checks are performed on the above results. First, I consider a three-level hierarchical mixed-effects model to account for regional disparities within countries. Individual responses are thus nested within regions (or enumeration areas) and then within countries.

In addition, I transform the vector of variables on political attitudes by taking their regional averages. I do so to reduce the likelihood of bi-directional causality between these variables and individual answers on tax compliance. The results of the three-tiered specifications are reported in Table 4.8, in which it is corroborated that the higher the sub-national discretion over the tax system, the lower the likelihood of tax compliance. At the regional level, the salience of trust in institutions is no longer relevant. Conversely, the aggregate perception of redistribution and the salience of political involvement at the regional level are in line with previous estimates, meaning that they reduce the tendency to comply with tax payments. Consistently with previous findings, the regional support for democracy also appears to drive compliance upwards.

Second, I estimate the models using the ordered outcome variable on tax compliance. As discussed in subsection 4.4.1, the ordered variable carries the following values *"1=Have done; 2 Could do; 3=Never"* and reflects different attitudes towards paying taxes and fees to the governments. Let K be the number of response categories of the outcome variables with $K = 0, ..., 3$. Let $J : j = 1, ..., J$ be the number of clusters or countries with each cluster consisting of $i = 1, ..., n_j$ observations or respondents. The cumulative probability of an individual response being in a higher category than k conditional on a set of fixed effects parameters $\mathbf{x}_{ij}$ and $\mathbf{w}_j$, a set of cut-points κ and a

Table 4.8: Tax Compliance in Multi-Layer Tax Structure:
3-level Hierarchical Model

	MIXED-EFFECTS PROBIT			
	(1)	(2)	(3)	(4)
Dependent Variable: Tax Compliance (binary)				
COUNTRY-LEVEL				
Tax Assignment Index	-0.686*			
	(0.353)			
Tax Assignment Index (I,C,P)		-0.995***		
		(0.342)		
Tax Assignment Index (*)			-0.693**	
			(0.348)	
Tax Assignment Index (*I,C,P)				-1.001***
				(0.342)
Per Capita GDP (ln)	-0.258**	-0.258***	-0.257**	-0.257***
	(0.104)	(0.097)	(0.104)	(0.097)
WGI Government Effectiveness	0.176	0.189	0.176	0.189
	(0.153)	(0.146)	(0.153)	(0.145)
Ethnic Fractionalization	-0.039	-0.029	-0.036	-0.027
	(0.324)	(0.318)	(0.324)	(0.318)
REGIONAL-LEVEL				
Perception of Redistribution$^{\overline{r}}$	-0.076**	-0.076**	-0.076**	-0.076**
	(0.035)	(0.035)	(0.035)	(0.035)
Trust in Institutions$^{\overline{r}}$	0.062	0.063	0.062	0.063
	(0.075)	(0.075)	(0.075)	(0.075)
Pro-Democracy$^{\overline{r}}$	0.891***	0.885***	0.891***	0.885***
	(0.158)	(0.157)	(0.158)	(0.156)
Political Involvement$^{\overline{r}}$	-0.961***	-0.951***	-0.961***	-0.951***
	(0.229)	(0.230)	(0.229)	(0.230)
Constant	3.424***	3.431***	3.411***	3.428***
	(1.063)	(0.993)	(1.061)	(0.992)
σ_3^2	0.149***	0.144***	0.149***	0.144***
	(0.039)	(0.038)	(0.039)	(0.038)
σ_2^2	0.115***	0.115***	0.115***	0.115***
	(0.015)	(0.015)	(0.015)	(0.015)
N Respondents	48239	48239	48239	48239
N Countries	49	49	49	49
χ^2	150.085	158.885	149.846	158.658
Log-likelihood	-14507.768	-14506.898	-14507.701	-14506.862
AIC	29051.536	29049.795	29051.403	29049.724
ICC_3	0.118	0.114	0.118	0.114
ICC_2	0.209	0.206	0.209	0.205

Notes: Standard errors (in parentheses) are clustered at the country level. Significance level * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. (I,C,P) refers to the indicators that account solely for income, consumption and property taxes. (*) implies that the indicator has been revised to account for the relevance of intermediate level of governments in joint decisions with central and local authorities. $^{\overline{r}}$ implies that these variables are averaged at the regional level (or enumeration areas). Age (ln), Gender, Education, Employment Status, and Religiosity are included in all specifications but not reported. The coefficient estimates on age are positive and statistically significant, thus implying that tax compliance increases with age. Respondents with no formal tend to be less compliant than those with post-secondary level education. Trust in Institutions and Political involvement are composite indicators that capture the respondents' trust in major political institutions and their involvement in political discussion and political life. ICC refers to the intra-class correlation at level 3 (country) and level 2(regions) respectively. σ_3^2 and σ_2^2 refer to the variance of the random components at the country (3) and regional (2) levels. (country-level).

set of random effects $\mathbf{u}_j$, is given by the following relation:

$$Pr(y_{ij} > k|\mathbf{x}_{ij}, \mathbf{w}_j, \kappa, \mathbf{u}_j) = \mathbf{\Phi}(\mathbf{x}_{ij}\beta + \mathbf{w}_j\delta + \mathbf{z}_{ij}\mathbf{u}_j - \kappa_k) \tag{4.5}$$

$\mathbf{\Phi}$ is the normal cumulative distribution function that represents cumulative probability. The $1 \times p$ row vector $\mathbf{x}_{ij}$ and $\mathbf{w}_j$ represent the covariates for the fixed effects with their respective coefficients β. The $1 \times q$ vector $\mathbf{z}_{ij}$ consists of covariates corresponding to the random effects and can be used to represent both the random intercepts and random coefficients which, in the former case, is simply the scalar 1. The random-effects $\mathbf{u}_j$ are assumed to be independently distributed across countries.

Equation 4.5 can alternatively be written in terms of latent responses y^*_{ij} where the error terms ϵ_{ij} follow standard normal distributions with mean 0 and variance 1, and independent of $\mathbf{u}_j$ and the vectors of fixed-effects variables.

$$y^*_{ij} = \mathbf{x}_{ij}\beta + \mathbf{w}_j\delta + \mathbf{z}_{ij}\mathbf{u}_j + \epsilon_{ij} \tag{4.6}$$

$$y_{ij} = \begin{cases} 0 & \text{if} \quad y^*_{ij} \leq \kappa_0 \\ 1 & \text{if} \quad \kappa_1 < y^*_{ij} \leq \kappa_1 \\ \vdots & \quad \vdots \\ 3 & \text{if} \quad \kappa_2 < y^*_{ij} \end{cases} \tag{4.7}$$

A positive and statistically significant coefficient indicates a higher probability of being in the upper category of the answers on tax compliance. The results, which are reported in Table 4.9, are in line with previous findings. The higher the level of sub-national taxing rights, the lower the likelihood of citizens stating that they have always complied with paying their taxes and fees to their respective governments.

Lastly, I substitute the hierarchical mixed-effects (ordered) probit models with extended ordered probit regressions with instrumental variables. While any bi-directional causality in the main variables of interest is to many extents unwarranted, I acknowledge that the hierarchical model might be limited in establishing causality as the salience of individual non-compliance may have fostered changes in the multi-layer structure of taxation in recent decades.

I, therefore, address the concern of endogeneity by instrumenting the indicators on sub-national taxing rights with the number of taxing rights and the number of second-

Table 4.9: Tax Compliance in Multi-Layer Tax Structure:
Estimations with Ordered Outcome

	MIXED-EFFECTS ORDERED PROBIT			
	(1)	(2)	(3)	(4)
Dependent Variable: Tax Compliance (ordered categorical)				
COUNTRY-LEVEL				
Tax Assignment Index	-0.294*			
	(0.168)			
Tax Assignment Index(I,C,P)		-0.511***		
		(0.173)		
Tax Assignment Index(*)			-0.291*	
			(0.164)	
Tax Assignment Index(*I,C,P)				-0.513***
				(0.173)
Per Capita GDP (ln)	-0.107*	-0.103*	-0.107*	-0.103*
	(0.056)	(0.053)	(0.056)	(0.053)
WGI Government Effectiveness	0.025	0.029	0.025	0.029
	(0.088)	(0.086)	(0.088)	(0.086)
Ethnic Fractionalization	-0.260**	-0.251**	-0.259**	-0.251**
	(0.124)	(0.121)	(0.124)	(0.121)
INDIVIDUAL-LEVEL				
Perception of Redistribution	-0.068**	-0.068**	-0.068**	-0.068**
	(0.030)	(0.030)	(0.030)	(0.030)
Trust in Institutions	0.089***	0.089***	0.089***	0.089***
	(0.013)	(0.013)	(0.013)	(0.013)
Pro-Democracy	0.168***	0.168***	0.168***	0.168***
	(0.019)	(0.019)	(0.019)	(0.019)
Political Involvement	-0.468***	-0.468***	-0.468***	-0.468***
	(0.069)	(0.069)	(0.069)	(0.069)
Cut1	-2.122***	-2.095***	-2.120***	-2.094***
	(0.542)	(0.518)	(0.543)	(0.518)
Cut2	-1.425***	-1.398***	-1.423***	-1.397***
	(0.548)	(0.524)	(0.548)	(0.524)
σ_2^2	0.050***	0.048***	0.050***	0.048***
	(0.015)	(0.014)	(0.015)	(0.014)
N Respondents	47120	47120	47120	47120
N Countries	49	49	49	49
χ^2	267.340	280.091	267.535	280.567
Log-likelihood	-33164.263	-33163.257	-33164.250	-33163.230
AIC	66364.526	66362.513	66364.500	66362.460
ICC	0.048	0.046	0.048	0.046

Notes: Standard errors (in parentheses) are clustered at the country level. Significance level * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. (I,C,P) refers to the indicators that account solely for income, consumption and property taxes. (*) implies that the indicator has been revised to account for the relevance of intermediate level of governments in joint decisions with central and local authorities. Age (ln), Gender, Education, Employment Status, and Religiosity are included in all specifications but not reported. The coefficient estimate on age is positive and statistically significant, thus implying that tax compliance increases with age. Compared to post-secondary education level, respondents with lower education level tend to be less compliant. Trust in Institutions and Political involvement are composite indicators that capture the respondents' trust in major political institutions and their involvement in political discussion and political life. ICC refers to the intra-class correlation or the proportion of the total variance that is due to between-country differences. σ_2^2 refers to the variance of the random components (country-level).

tier government authorities, as in chapter 3. Regional governments in some unitary countries are also legally able to intervene in specific decisions structure such as the setting of tax rates or tax administration. It is thus expected that the number of government layers with a discretionary power over the tax system would impact on tax compliance through them having discretion over tax matters. The second instrument is the number of secondary-tier (or regional) governments. While the number of municipalities may frequently vary as a result of changes in population size, the number of regions in most countries tend to be static over the years given that the creation of new regions requires substantial changes in territorial structure. The findings again are in line with previous tables. They suggest that sub-national government discretion on tax matters reduces the likelihood of citizens complying with their due tax payments (see Table A4.5 and Table A4.6 in Appendix 4).

4.6 Conclusion

This chapter provides empirical evidence on how the multi-layer structure of taxation and tax institutions influences tax compliance. It does so by aligning micro-survey data on individual tax compliance behaviours to new indicators that capture the degree to which sub-national governments are involved in a range of tax-related decisions. The empirical estimations are conducted on a sample of 49 developing and emerging economies located in Latin-America and Africa and where tax non-compliance remains a significant policy challenge, and undermines governments' ability to provide essential public goods and services.

The chapter bridges the fiscal federalism and tax compliance literature and argues for the consideration of inter-governmental tax arrangements in attempts to understand tax compliance. To date, both theoretical and empirical research projects in this field are built upon frameworks that often consider the taxpayer-government relationship as a bilateral one. In practice, however, taxpayers operate in a much more complex environment, and taxpayers often have multiple payment obligations and towards more than one layers of government. Thus, as any other form of institutional arrangements, it is expected that inter-governmental tax arrangements and the assignment of taxing rights to lower-tier authorities would influence tax compliance behaviours by, among other explanations, enhancing the fiscal exchange between the state and residents, enhancing the monitoring and tracking down of dishonest taxpayers or, reversely, increasing compliance costs for taxpayers who deal with multiple procedures.

The contributions of the chapter are threefold. First, it identifies some channels through which multi-layer tax arrangements could influence tax compliance. Considering tax compliance as the ultimate aim, the analytical framework builds upon the pro- and con-arguments for having decentralized tax institutions. From these arguments are thus derived testable hypotheses. Second, the chapter assesses how different dimensions of the multi-layer tax structure – such as sub-national authorities' discretion over tax rates and tax administration – or sub-national taxing rights more broadly influence the likelihood of citizens complying with their tax payments. Third, the chapter investigates some contextual factors which, if combined with a multi-layer design of tax institutions, are likely to increase the compliance cost for individual taxpayers and thus resulting in lower compliance.

The empirical results confirm the overarching hypothesis that inter-governmental tax arrangements matter for the understanding of the potential drivers of tax compliance. More specifically, the findings indicate that the higher the level of taxing rights of sub-national authorities, the lower the likelihood of citizens complying with their tax payments. In addition, sub-national discretion over tax administration reduces tax compliance, whereas sub-national discretion over tax rates matters to a lesser extent. The coefficient estimates thus indicate that decentralizing tax administration might be detrimental to tax revenue mobilization and lead to a hostile tax climate.

Exploring further the different contextual parameters which may increase the compliance costs in a multi-layer structure, the chapter finds strong evidence that the scarcity of tax knowledge exacerbates the negative effects of sub-national taxing rights or discretion over tax administration on tax compliance. Notwithstanding, the empirical findings indicate that the marginal effects of sub-national taxing rights and sub-national government involvement in tax administration are positive in low-income countries. It, therefore, appears that there might be some added-value to having lower-tier authorities being involved in the governance of the tax system in low-income countries.

Lastly, I investigate whether the robust negative effects resulted from the empirical estimates are due not to the institutional design per se but rather to the overall transactions costs associated with tax payments in each country. Hence, to the empirical estimations are added indicators that capture the total number of hours spent in preparing, filing and paying major taxes and the total number of taxes filled by businesses in each country. The results indicate that the design of tax institutions across government tiers trumps the relevance of compliance costs at the country level. Hence, the reported adverse effects are due features embedded in the design of multi-layer tax institutions and other parameters such as the lack of tax knowledge as evidenced in

this chapter.

Apart from the main variables of interest, the results suggest that trust in public institutions and support for democracy increase tax compliance, whereas political involvement and a positive appraisal of the redistribution system lead to a much lower probability of citizens complying with their due payments. This latter finding is somewhat surprising and counter-intuitive as it appears that citizens who positively assess the performance of their respective governments in improving the livelihoods of the most impoverished strata of the population are more prone to refusing to pay their taxes. At the country-level, it is also noted that residents of wealthier countries are less compliant than those in poorer ones.

There remain numerous other channels through which inter-governmental tax institutions could impact on tax compliance. Such channels are not explored in this chapter, either due to the absence of well-established theoretical frameworks or a lack of data. Still, going forward, a possible avenue for research is to replicate this empirical enquiry using administrative data on tax compliance and other enforcement parameters. Future research endeavours could also involve laboratory and field experiments to test whether compliance with local taxes spillovers to national taxes and vice-versa, all the while using the empirical results of this chapter as stylized facts and testing the above hypotheses in controlled environments.

Bibliography

Afrobarometer (2016). Round 6.

Alesina, A., A. Devleeschauwer, W. Easterly, S. Kurlat, and R. Wacziarg (2003). Fractionalization. *Journal of Economic Growth 8*(2), 155–194.

Ali, M. (2018). Regulatory Burdens in Tax Administration and Firms' Compliance Costs in Africa.

Ali, M., O.-H. Fjeldstad, and I. H. Sjursen (2014). To Pay or Not to Pay? Citizens' Attitudes Toward Taxation in Kenya, Tanzania, Uganda, and South Africa. *World Development 64*, 828–842.

Allingham, M. G. and A. Sandmo (1972). Income tax evasion: a theoretical analysis. *Journal of Public Economics 1*(3-4), 323–338.

Alm, J. (2012). Measuring, explaining, and controlling tax evasion: lessons from theory, experiments, and field studies. *International Tax and Public Finance 19*(1), 54–77.

Alm, J., J. Martinez-Vazquez, and S. M. Indrawati (Eds.) (2004). *Reforming intergovernmental fiscal relations and the rebuilding of Indonesia: The 'big bang' program and its economic consequences*. Studies in fiscal federalism and state-local finance. Cheltenham: Edward Elgar.

Alm, J., G. H. McClelland, and W. D. Schulze (1992). Why do people pay taxes? *Journal of Public Economics 48*(1), 21–38.

Alm, J., M. McKee, and W. Beck (1992). Amazing Grace: Tax Amnesties and Compliance. *National tax journal 43*(1), 23–37.

Alm, J. and B. Torgler (2006). Culture differences and tax morale in the United States and in Europe. *Journal of Economic Psychology 27*(2), 224–246.

Anderson, G. M. (1988). Mr. Smith and the Preachers: The Economics of Religion in the Wealth of Nations. *Journal of Political Economy 96*(5), 1066–1088.

Andreoni, J., B. Erard, and J. Feinstein (1998). Tax compliance. *Journal of economic literature 36*(2), 818–860.

Benk, S., T. Budak, B. Yüzbaşı, and R. Mohdali (2016). The Impact of Religiosity on Tax Compliance among Turkish Self-Employed Taxpayers. *Religions 7*(4), 37.

Besfamille, M., N. Grosman, D. Jorrat, and O. Manzano (2017). Public Expenditures and Debt at the Subnational Level: Evidence of Fiscal Smoothing from Argentina.

Besley, T. and T. Persson (2014). Why Do Developing Countries Tax So Little? *Journal of Economic Perspectives 28*(4), 99–120.

Besley, T. J., A. Jensen, and T. Persson (2019). Norms, Enforcement, and Tax Evasion.

Bird, R. M. (2015). Improving Tax Administration in Developing Countries. *Journal of Tax Administration 1*(1), 23–45.

Blackwell, C. (2007). A Meta-Analysis of Tax Compliance Experiments. Georgia, USA.

Bobek, D. D., R. W. Roberts, and J. T. Sweeney (2007). The Social Norms of Tax Compliance: Evidence from Australia, Singapore, and the United States. *Journal of Business Ethics 74*(1), 49–64.

Bodea, C. and A. LeBas (2016). The Origins of Voluntary Compliance: Attitudes toward Taxation in Urban Nigeria. *British Journal of Political Science 46*(1), 215–238.

Bordignon, M. (1993). A fairness approach to income tax evasion. *Journal of Public Economics 52*(3), 345–362.

Carnahan, M. (2015). Taxation Challenges in Developing Countries. *Asia & the Pacific Policy Studies 2*(1), 169–182.

Chetty, R., M. Mobarak, and M. Singhal (2014). Increasing tax compliance through social recognition.

Clemens Fuest and Nadine Riedel (2010). Tax Evasion and Tax Avoidance in Developing Countries: The Role of International Profit Shifting: Working Papers.

Congdon, W. J., J. R. Kling, and S. Mullainathan (2011). *Policy and Choice: Public Finance through the Lens of Behavioral Economics*. Brookings Institution Press.

Coolidge, J. (2012). Findings of tax compliance cost surveys in developing countries. *eJournal of Tax Research 10*, 250–287.

Cowell, F. A. (1990). *Cheating the government: The economics of evasion*. Cambridge, Mass.: MIT Press.

Cowell, F. A. and J. P. F. Gordon (1988). Unwillingness to pay. *Journal of Public Economics 36*(3), 305–321.

Cullen, J. B., N. Turner, and E. Washington (2018). Political Alignment, Attitudes Toward Government and Tax Evasion.

Cummings, R. G., J. Martinez-Vazquez, and M. McKee (2001). Cross Cultural Comparisions of Tax Compliance Behavior. Georgia, USA.

Cummings, R. G., J. Martinez-Vazquez, M. McKee, and B. Torgler (2009). Tax morale affects tax compliance: Evidence from surveys and an artefactual field experiment. *Journal of Economic Behavior & Organization 70*(3), 447–457.

Dell'Anno, R. (2009). Tax evasion, tax morale and policy maker's effectiveness. *The Journal of Socio-Economics 38*(6), 988–997.

Dhami, S. and A. al Nowaihi (2007). Why do people pay taxes? Prospect theory versus expected utility theory. *Journal of Economic Behavior & Organization 64*(1), 171–192.

Dixit, A. (2002). Incentives and Organizations in the Public Sector: An Interpretative Review. *The Journal of Human Resources 37*(4), 696–727.

Eriksen, K. and L. Fallan (1996). Tax knowledge and attitudes towards taxation; A report on a quasi-experiment. *Journal of Economic Psychology 17*(3), 387–402.

Falkinger, J. (1995). Tax evasion, consumption of public goods and fairness. *Journal of Economic Psychology 16*(1), 63–72.

Feld, L. and B. S. Frey (2002). Trust breeds trust: How taxpayers are treated. *Economics of Governance 3*, 87–99.

Feld, L. P. and B. S. Frey (2007). Tax Compliance as the Result of a Psychological Tax Contract: The Role of Incentives and Responsive Regulation. *Law & Policy 29*(1), 102–120.

Ferrin, D. L., M. C. Bligh, and J. C. Kohles (2007). Can I Trust You to Trust Me?: A Theory of Trust, Monitoring, and Cooperation in Interpersonal and Intergroup Relationships. *Group & Organization Management 32*(4), 465–499.

Fortin, B., G. Lacroix, and M.-C. Villeval (2007). Tax evasion and social interactions. *Journal of Public Economics 91*(11-12), 2089–2112.

Frey, B. S. and B. Torgler (2007). Tax morale and conditional cooperation. *Journal of Comparative Economics 35*(1), 136–159.

Gaspar, V., D. Amaglobeli, M. Garcia-Escribano, D. Prady, and M. Soto (2019). Fiscal Policy and Development: Human, social, and physical investment for the SDGs. Washington D.C., USA.

Güth, W., V. Levati, and R. Sausgruber (2005). Tax Morale and (De-)Centralization: An Experimental Study. *Public Choice 125*(1/2), 171–188.

Hartl, B., E. Hofmann, K. Gangl, M. Hartner-Tiefenthaler, and E. Kirchler (2015). Does the sole description of a tax authority affect tax evasion?–the impact of described coercive and legitimate power. *PloS one 10*(4), 1–19.

Hashimzade, N., G. D. Myles, and B. Tran-Nam (2012). Applications of Behavioural Economics to Tax Evasion. *Journal of Economic Surveys 27*(5), 941–977.

Hindriks, J. and G. D. Myles (2013). *Intermediate public economics* (2nd ed.). Cambridge, MA: MIT Press.

Hokamp, S. (2014). Dynamics of tax evasion with back auditing, social norm updating, and public goods provision – An agent-based simulation. *Journal of Economic Psychology 40*, 187–199.

Holgado-Tello, F. P., S. Chacón-Moscoso, I. Barbero-García, and E. Vila-Abad (2008). Polychoric versus Pearson correlations in exploratory and confirmatory factor analysis of ordinal variables. *Quality & Quantity 44*(1), 153.

Hooghe, L., G. Marks, A. H. Schakel, S. Niedzwiecki, S. C. Osterkatz, and S. Shair-Rosenfield (2016). *Measuring regional authority: A postfunctionalist theory of governance*. Transformations in governance. Oxford, United Kingdom: Oxford University Press.

Hull, B. and F. Bold (2007). Hell, Religion, and Cultural Change. *Journal of Institutional and Theoretical Economics 150*(3), 447–464.

IBFD (Access: 2015-2017). Tax Research Platform.

Janský, P. and M. Palanský (2019). Estimating the scale of profit shifting and tax revenue losses related to foreign direct investment. *International Tax and Public Finance 26*(5), 1048–1103.

Keen, M. and C. Kotsogiannis (2003). Leviathan and Capital Tax Competition in Federations. *Journal of Public Economic Theory 5*(2), 177–199.

Keen, M. and J. Slemrod (2017). Optimal tax administration. *Journal of Public Economics 152*, 133–142.

Keen, M. J. and C. Kotsogiannis (2004). Tax competition in federations and the welfare consequences of decentralization. *Journal of Urban Economics 56*(3), 397–407.

Kouamé, W. A. (2015). Tax Morale and Trust in Public Institutions: Cahiers de recherche.

Lago-Peñas, I. and S. Lago-Peñas (2010). The determinants of tax morale in comparative perspective: Evidence from European countries. *European Journal of Political Economy 26*(4), 441–453.

Latinóbarometro (2015). 2015.

Lee, S. Y., W. Y. Poon, and P. M. Bentler (1995). A two-stage estimation of structural equation models with continuous and polytomous variables. *The British journal of mathematical and statistical psychology 48 (Pt 2)*, 339–358.

Lockwood, B. (2005). Fiscal Decentralization: A Political Economy Perspective.

Ma, J., K. Guo, and J. Yu (2020). Democracy and tax avoidance: An international study. *Journal of Corporate Accounting & Finance 31*(1), 18–52.

Marks, G., L. Hooghe, and A. H. Schakel (2008). Measuring Regional Authority. *Regional & Federal Studies 18*(2-3), 111–121.

Martinez-Vazquez, J. and A. Timofeev (2009). Decentralization Measures Revisited: International Center for Public Policy Working Paper Series, at AYSPS, GSU.

Mascagni, G. (2018). FROM THE LAB TO THE FIELD: A REVIEW OF TAX EXPERIMENTS. *Journal of Economic Surveys 32*(2), 273–301.

Mayshar, J. (1991). Taxation with Costly Administration. *The Scandinavian Journal of Economics 93*(1), 75.

Moore, M. (2004). Revenues, State Formation, and the Quality of Governance in Developing Countries. *International Political Science Review 25*(3), 297–319.

Oates, W. E. (2005). Toward a second-generation theory of fiscal federalism. *International Tax and Public Finance 12*(4), 349–373.

OECD (1999). *Taxing Powers of State and Local Government*, Volume 1 of *OECD Tax Policy Studies*. OECD Publishing.

OECD (2019). Revenue Statistics 2019.

Pommerehne, W. W. and H. Weck-Hannemann (1996). Tax Rates, Tax Administration and Income Tax Evasion in Switzerland. *Public Choice 88*(1/2), 161–170.

Prud'Homme, R. (1995). The dangers of decentralization. *The world bank research observer 10*(2), 201–220.

Rabe-Hesketh, S. and A. Skrondal (2012). *Multilevel and longitudinal modeling using Stata* (3rd ed. ed.). College Station, Tex.: Stata.

Raudenbush, S. W. and A. S. Bryk (2002). *Hierarchical linear models: Applications and data analysis methods* (2nd ed.). Advanced quantitative techniques in the social sciences. Thousand Oaks: Sage Publications.

Reinikka, R. and J. Svensson (2006). Using Micro-Surveys to Measure and Explain Corruption. *World Development 34*(2), 359–370.

Rodden, J. (2002). The Dilemma of Fiscal Federalism: Grants and Fiscal Performance around the World. *American Journal of Political Science 46*(3), 670.

Rodden, J. (2006). *Hamilton's paradox: The promise and peril of fiscal federalism*. Cambridge University Press.

Saad, N. (2014). Tax Knowledge, Tax Complexity and Tax Compliance: Taxpayers' View. *Procedia - Social and Behavioral Sciences 109*, 1069–1075.

Scartascini, C., C. Cruz, and P. Keefer (2018). The Database of Political Institutions 2017 (DPI2017).

Slemrod, J. (2002). *Trust in Public Finance*. Cambridge, MA: National Bureau of Economic Research.

Snow, A. and R. Warren (2005). Ambiguity about Audit Probability, Tax Compliance, and Taxpayer Welfare. *Economic Inquiry 43*(4), 865–871.

Teorell, J., S. Dahlberg, S. Holmberg, B. Rothstein, A. Khomenko, and R. Svensson (2017). QoG Standard Dataset 2017.

Tiebout, C. M. (1956). A Pure Theory of Local Expenditures. *Journal of Political Economy 64*(5), 416–424.

Torgler, B. (2004). Tax morale in Asian countries. *Journal of Asian Economics 15*(2), 237–266.

Torgler, B. (2005a). Tax morale and direct democracy. *European Journal of Political Economy 21*(2), 525–531.

Torgler, B. (2005b). Tax morale in Latin America. *Public Choice 122*(1-2), 133–157.

Torgler, B. (2011). Tax Morale and Compliance: Review of Evidence and Case Studies for Europe. Washington D.C, USA.

Torgler, B. and C. A. Schaltegger (2006). Tax Morale: A Survey with a Special Focus on Switzerland. *Swiss Journal of Economics and Statistics (SJES) 142*(III), 395–425.

Torgler, B. and F. Schneider (2007). What Shapes Attitudes Toward Paying Taxes? Evidence from Multicultural European Countries. *Social Science Quarterly 88*(2), 443–470.

Torgler, B., F. Schneider, and C. A. Schaltegger (2010). Local autonomy, tax morale, and the shadow economy. *Public Choice 144*(1-2), 293–321.

Torgler, B. and J. Werner (2005). Fiscal Autonomy and Tax Morale: Evidence from Germany: CREMA Working Paper Series.

Traxler, C. (2010). Social norms and conditional cooperative taxpayers. *European Journal of Political Economy 26*(1), 89–103.

Tripp, A. M. (1997). *Changing the rules: The politics of liberalization and the urban informal economy in Tanzania / Aili Mari Tripp*. Berkeley and London: University of California Press.

Tversky, A. and D. Kahneman (1991). Loss Aversion in Riskless Choice: A Reference-Dependent Model. *The Quarterly Journal of Economics 106*(4), 1039–1061.

Verboon, P. and S. Goslinga (2009). The role of fairness in tax compliance. *Netherlands Journal of Psychology 65*(4), 136–145.

Wahl, I., B. Kastlunger, and E. Kirchler (2010). Trust in Authorities and Power to Enforce Tax Compliance: An Empirical Analysis of the "Slippery Slope Framework". *Law & Policy 32*(4), 383–406.

Wahl, I., S. Muehlbacher, and E. Kirchler (2010). The impact of voting on tax payments. *Kyklos 63*(1), 144–158.

Weber, T. O., J. Fooken, and B. Herrmann (2014). Behavioural Economics and Taxation. Luxembourg, Luxembourg.

Weingast, B. R. (2009). Second generation fiscal federalism: The implications of fiscal incentives. *Journal of Urban Economics 65*(3), 279–293.

Weingast, B. R. (2014). Second Generation Fiscal Federalism: Political Aspects of Decentralization and Economic Development. *World Development 53*, 14–25.

Wilson, J. D. (1999). Theories of Tax Competition. *National tax journal 52*(2), 269–304.

World Bank (2018). World Development Indicators: 1960-2016.

Yitzhaki, S. (1974). Income tax evasion: A theoretical analysis. *Journal of Public Economics 3*(2), 201–202.

APPENDIX: CHAPTER 4

Table A4.1: Variables Description and Data Sources

VARIABLES	DESCRIPTION & DATA SOURCES
Tax Assignment Index	Sub-national Taxing Rights. Data Source: Author's
Tax Assignment Index (*)	Sub-national Taxing Rights (*). *Data Source:* Author's
Tax Administration Assignment	Sub-national Discretion over Tax Administration . *Data Source:* Author's
Tax Administration Assignment (*)	Sub-national Discretion over Tax Administration (*). *Data Source:* Author's
Tax Rate Assignment	Sub-national Discretion over Tax Rate . *Data Source:* Author's
Tax Rate Assignment (*)	Sub-national Discretion over Tax Rate (*). *Data Source:* Author's
Tax Assignment Index (I,C,P)	Sub-national Taxing Rights (Income, Consumption, Property). *Data Source:* Author's
Tax Assignment Index (*I,C,P)	Sub-national Taxing Rights (*Income, Consumption, Property). *Data Source:* Author's
Tax Administration Assignment (I,C,P)	Sub-national Discretion over Tax Administration (Income, Consumption, Property) . *Data Source:* Author's
Tax Administration Assignment (*I,C,P)	Sub-national Discretion over Tax Administration (*Income, Consumption, Property). *Data Source:* Author's
Tax Rate Assignment (I,C,P)	Sub-national Discretion over Tax Rate (Income, Consumption, Property) . *Data Source:* Author's
Tax Rate Assignment (*I,C,P)	Sub-national Discretion over Tax Rate (*Income, Consumption, Property). *Data Source:* Author's
Per Capita GDP (ln)	Per Capita GDP (natural logarithm). *Data Source:* World Development Indicators
WGI Government Effectiveness	World Governance Indicators - Government Effectiveness *Data Source:* World Governance Indicators
Ethnic fractionalization	Ethnic fractionalization *Data Source:* Quality of Government Dataset
Low-Income Country	Low-income countries (World Bank Classification 2016). *Data Source:* World Development Indicators
Hours to Pay Taxes	Total number of hours per year it takes to prepare, file, and pay (or withhold) three major types of taxes: the corporate income tax, the value-added or sales tax, and labour taxes, including payroll taxes and social security contributions. *Data Source:* World Development Indicators
Number of Tax Payments	The total number of taxes paid by businesses, including electronic filing. *Data Source:* World Development Indicators

Continued on the next page

VARIABLES	DESCRIPTION & DATA SOURCES
Number of taxing tiers	Number of layers of government with taxing rights. *Data Source:* Author's
Number of second-tier	Number of second-tier governments. *Data Source:* Political Institutions Database
Tax Compliance (binary)	Respondent has never refused to pay taxes or fees to his/her government. *Data Source:* Afrobarometer; Latinobarómetro
Tax Compliance (*1=Have done*)	Respondent has refused to pay taxes and fees to his/her government. *Data Source:* Afrobarometer; Latinobarómetro
Tax Compliance (*2=Could do*)	Respondent could refuse to pay taxes and fees to his/her government. *Data Source:* Afrobarometer; Latinobarómetro
Tax Compliance (*3=Never*)	Respondent has never refused to pay taxes or fees to his/her government. *Data Source:* Afrobarometer; Latinobarómetro
Age (ln)	Age of the respondent (in natural logarithm). *Data Source:* Afrobarometer; Latinobarómetro
Gender	Gender of the respondent (*1=male; 0=female*). *Data Source:* Afrobarometer; Latinobarómetro
Education	Education level of the respondent (categorical). *Data Source:* Afrobarometer; Latinobarómetro
Employment Status	Respondent is employed at the time of the survey. *Data Source:* Afrobarometer; Latinobarómetro
Religiosity	Respondent adheres to a religious group or a religious assembly. *Data Source:* Afrobarometer; Latinobarómetro
Perception of Redistribution	Respondent positively views the current redistributive system. *Data Source:* Afrobarometer; Latinobarómetro
Trust in Institutions	Composite variable of trust in institutions. *Data Source:* Afrobarometer; Latinobarómetro
Pro-Democracy	Respondent supports democracy (democracy is preferable). *Data Source:* Afrobarometer; Latinobarómetro
Political Involvement	Composite variable of political involvement. *Data Source:* Afrobarometer; Latinobarómetro
Trust in Institutions$^{\overline{r}}$	Regional average of the composite indicator of trust in institutions. *Data Source:* Afrobarometer; Latinobarómetro
Pro-Democracy$^{\overline{r}}$	Regional average of respondents that support democracy. *Data Source:* Afrobarometer; Latinobarómetro
Political Involvement$^{\overline{r}}$	Regional average of the composite indicator on political involvement. *Data Source:* Afrobarometer; Latinobarómetro
Perception of Redistribution$^{\overline{r}}$	Regional average of respondents that positively appraise the redistribution system. *Data Source:* Afrobarometer; Latinobarómetro

Continued on the next page

VARIABLES	DESCRIPTION & DATA SOURCES
Scarcity of Tax Knowledge$^{\overline{r}}$	Regional average of the number of respondents with scarcity in tax knowledge. *Data Source:* Afrobarometer

Notes: (I,C,P) refers to the indicators that account solely for income, consumption and property taxes. (*) implies that the indicator has been revised to account for the relevance of intermediate level of governments in joint decisions with central and local authorities. $^{\overline{r}}$ implies that these variables are averaged at the regional level (or enumeration areas).

Table A4.2: Summary Statistics

	N	Mean	SD	Min	Max
	Country-Level				
Tax Assignment Index	67319	0.152	0.146	0	0.64
Tax Assignment Index (*)	67319	0.154	0.148	0	0.65
Tax Administration Assignment	67319	0.300	0.173	0	0.71
Tax Administration Assignment (*)	67319	0.303	0.176	0	0.73
Tax Rate Assignment	67319	0.149	0.164	0	0.80
Tax Rate Assignment (*)	67319	0.152	0.167	0	0.80
Tax Assignment Index (I,C,P)	67319	0.115	0.123	0	0.70
Tax Assignment Index (*I,C,P)	67319	0.116	0.123	0	0.70
Tax Administration Assignment (I,C,P)	67319	0.243	0.168	0	0.71
Tax Administration Assignment (*I,C,P)	67319	0.244	0.169	0	0.71
Tax Rate Assignment (I,C,P)	67319	0.103	0.137	0	0.67
Tax Rate Assignment (*I,C,P)	67319	0.104	0.137	0	0.67
Per Capita GDP (ln)	67319	8.560	0.971	6.65	10.03
WGI Government Effectiveness	67319	-0.483	0.564	-1.51	1.09
Ethnic fractionalization	66229	0.579	0.239	0.04	0.93
Low-Income Country	67319	0.292	0.455	0	1
Hours to Pay Taxes	67319	5.623	0.519	4.80	7.79
Number of Tax Payments	67319	32.098	16.822	6	70
Number of taxing tiers	67319	2.101	0.644	1	3
Number of second-tier	67319	15.609	9.860	0	48
	Individual-Level				
Tax Compliance (binary)	56340	0.890	0.313	0	1
Tax Compliance (1=Have done)	67319	0.092	0.289	0	1
Tax Compliance (2=Could do)	67319	0.163	0.369	0	1
Tax Compliance (3=Never)	67319	0.745	0.436	0	1
Age (ln)	67087	3.567	0.387	2.77	4.65
Gender (male=1)	67319	0.493	0.500	0	1
Education (1=no formal education)	67203	0.161	0.367	0	1
Education (2=primary education)	67203	0.297	0.457	0	1
Education (3=secondary education)	67203	0.373	0.484	0	1
Education (4=post-secondary education)	67203	0.169	0.374	0	1
Employment Status	67157	0.443	0.497	0	1
Religiosity	64441	0.363	0.481	0	1
Perception of Redistribution	63850	0.229	0.420	0	1
Trust in Institutions	59943	2.120	1.143	0	4.27
Pro-Democracy	60920	0.711	0.453	0	1
Political Involvement	61541	0.497	0.313	0	1.02
	Regional-Level				
Trust in Institutions$^{\overline{r}}$	65242	2.121	0.762	0.31	3.90
Pro-Democracy$^{\overline{r}}$	67319	0.710	0.160	0.15	1
Political Involvement$^{\overline{r}}$	66206	0.496	0.126	0.05	0.85
Perception of Redistribution$^{\overline{r}}$	66229	0.230	0.138	0	1
Scarcity of Tax Knowledge$^{\overline{r}}$	47749	0.441	0.190	0.03	1
N	67319				

Notes: (I,C,P) refers to the indicators that account solely for income, consumption and property taxes. (*) implies that the indicator has been revised to account for the relevance of the intermediate level of governments in joint decisions with central and local authorities. $^{\overline{r}}$ implies that these variables are averaged at the regional level (or enumeration areas).

Table A4.3: Tax Compliance in Multi-Layer Tax Structure:
Baseline Model (Sensitivity Checks)

	MIXED-EFFECTS PROBIT					
	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable: Tax Compliance (binary)						
COUNTRY-LEVEL						
Tax Assignment Index(*)	-1.171***	-1.501***	-0.830**			
	(0.249)	(0.271)	(0.343)			
Tax Assignment Index(I,C,P*)				-1.504***	-1.782***	-1.144***
				(0.298)	(0.410)	(0.378)
Per Capita GDP (ln)			-0.320***			-0.325***
			(0.108)			(0.100)
WGI Government Effectiveness			0.242			0.259*
			(0.161)			(0.152)
Ethnic Fractionalization			0.047			0.053
			(0.317)			(0.311)
INDIVIDUAL-LEVEL						
Age (ln)		0.057**	0.059**		0.057**	0.059**
		(0.028)	(0.028)		(0.028)	(0.028)
Gender (male)		-0.023	-0.024		-0.023	-0.024
		(0.020)	(0.020)		(0.020)	(0.020)
Education (base= post-secondary)						
No formal education		-0.173***	-0.177***		-0.172***	-0.177***
		(0.049)	(0.049)		(0.049)	(0.049)
Primary education		-0.068*	-0.071*		-0.068*	-0.070*
		(0.039)	(0.039)		(0.039)	(0.039)
Secondary Education		-0.065***	-0.066***		-0.065***	-0.066***
		(0.024)	(0.024)		(0.024)	(0.024)
Employment Status		-0.025	-0.024		-0.025	-0.024
		(0.029)	(0.029)		(0.029)	(0.029)
Religiosity		-0.029	-0.030		-0.029	-0.030
		(0.033)	(0.033)		(0.033)	(0.033)
Perception of Redistribution		-0.076*	-0.075*		-0.076*	-0.075*
		(0.039)	(0.039)		(0.039)	(0.039)
Trust in Institutions		0.078***	0.079***		0.078***	0.079***
		(0.013)	(0.014)		(0.013)	(0.013)
Pro-Democracy		0.209***	0.209***		0.209***	0.208***
		(0.025)	(0.025)		(0.025)	(0.025)
Political Involvement		-0.803***	-0.804***		-0.803***	-0.804***
		(0.069)	(0.069)		(0.069)	(0.069)
Constant	1.541***	1.626***	4.366***	1.535***	1.607***	4.416***
	(0.086)	(0.141)	(1.077)	(0.082)	(0.146)	(1.017)
Variance(intercept,country)	0.180***	0.234***	0.180***	0.176***	0.232***	0.174***
	(0.039)	(0.051)	(0.035)	(0.037)	(0.047)	(0.033)
N Respondents	56340	39556	39556	56340	39556	39556
N Countries	53	49	49	53	49	49
χ^2	22.140	264.800	319.112	25.484	268.262	325.233
Log-likelihood	-17999.233	-11852.916	-11846.675	-17998.594	-11852.696	-11845.870
AIC	36004.466	23733.831	23727.349	36003.188	23733.393	23725.740
ICC	0.153	0.189	0.152	0.150	0.188	0.148

Notes: Standard errors (in parentheses) are clustered at the country level. Significance level * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. (I,C,P) refers to the indicators that account solely for income, consumption and property taxes. (*) implies that the indicator has been revised to account for the relevance of the intermediate level of governments in joint decisions with central and local authorities. Trust in Institutions and Political involvement are composite indicators that capture the respondents' trust in major political institutions and their involvement in political discussion and political life. ICC refers to the intra-class correlation or the proportion of the total variance that is due to between-country differences. σ_2^2 refers to the variance of the random components (country-level).

Table A4.4: Tax Compliance in Multi-Layer Tax Structure:
Sub-national Discretion over Tax Administration and Tax Rates (Sensitivity Checks)

	MIXED-EFFECTS PROBIT			
	(1)	(2)	(3)	(4)
Dependent Variable: Tax Compliance (binary)				
COUNTRY-LEVEL				
Tax Administration Assignment (*)	-0.648**			
	(0.323)			
Tax Administration Assignment (*I,C,P)		-0.797***		
		(0.293)		
Tax Rate Assignment (*)			-0.320	
			(0.393)	
Tax Rate Assignment (*I,C,P)				-0.685
				(0.426)
Per Capita GDP (ln)	-0.346***	-0.359***	-0.363***	-0.352***
	(0.098)	(0.092)	(0.112)	(0.106)
WGI Government Effectiveness	0.246	0.271*	0.272*	0.279*
	(0.159)	(0.156)	(0.162)	(0.156)
Ethnic Fractionalization	-0.035	-0.053	0.044	0.087
	(0.315)	(0.307)	(0.339)	(0.338)
INDIVIDUAL-LEVEL				
Perception of Redistribution	-0.075*	-0.075*	-0.075*	-0.075*
	(0.040)	(0.039)	(0.039)	(0.039)
Trust in Institutions	0.079***	0.079***	0.078***	0.078***
	(0.013)	(0.013)	(0.014)	(0.014)
Pro-Democracy	0.208***	0.208***	0.209***	0.209***
	(0.025)	(0.025)	(0.025)	(0.025)
Political Involvement	-0.805***	-0.804***	-0.805***	-0.805***
	(0.069)	(0.069)	(0.069)	(0.069)
Constant	4.711***	4.847***	4.677***	4.579***
	(0.981)	(0.954)	(1.130)	(1.087)
σ_2^2	0.179***	0.173***	0.190***	0.186***
	(0.036)	(0.034)	(0.035)	(0.034)
N Respondents	39556	39556	39556	39556
N Countries	49	49	49	49
χ^2	332.108	357.148	336.886	358.644
Log-likelihood	-11846.650	-11845.759	-11847.973	-11847.443
AIC	23727.300	23725.518	23729.946	23728.886
ICC	0.152	0.148	0.160	0.157

Notes: Standard errors (in parentheses) are clustered at the country level. Significance level * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. (I,C,P) refers to the indicators that account solely for income, consumption and property taxes. (*) implies that the indicator has been revised to account for the relevance of the intermediate level of governments in joint decisions with central and local authorities. Trust in Institutions and Political involvement are composite indicators that capture the respondents' trust in major political institutions and their involvement in political discussion and political life. Age (ln), Gender, Education, Employment Status, and Religiosity are included in all specifications but not reported. The coefficient estimates on age are positive and statistically significant, thus implying that tax compliance increases with age. Respondents with no formal education or secondary education tend to be less compliant than those with post-secondary level education. ICC refers to the intra-class correlation or the proportion of the total variance that is due to between-country differences. σ_2^2 refers to the variance of the random components (country-level).

Table A4.5: Tax Compliance in Multi-Layer Tax Structure:
Estimations with Instrumental Variables

	EXTENDED PROBIT WITH IV							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent Variable: Tax Compliance (binary)								
Tax Assignment Index	-0.603***				-0.334***			
	(0.098)				(0.098)			
Tax Assignment Index (I,C,P)		-0.798***				-0.400***		
		(0.125)				(0.129)		
Tax Administration Assignment			-0.383***				-0.234***	
			(0.077)				(0.077)	
Tax Administration Assignment (I,C,P)				-0.431***				-0.270***
				(0.096)				(0.096)
Country-level Covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual-level Covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First-Stage								
Number of taxing layers	0.133***	0.100***	0.178***	0.146***	0.148***	0.114***	0.192***	0.155***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Number of second-tier	0.003***	0.003***	0.003***	0.002***				
	(0.000)	(0.000)	(0.000)	(0.000)				
Constant	-0.178***	-0.142***	-0.119***	-0.090***	-0.153***	-0.119***	-0.095***	-0.073***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
$\sigma^2_{\varepsilon_{ijc}}$	0.011***	0.010***	0.014***	0.020***	0.012***	0.011***	0.015***	0.020***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$corr(\varepsilon_{ijc}, \varepsilon_{ij})$	0.013	0.010	-0.028**	-0.024	-0.037***	-0.048***	-0.066***	-0.058***
	(0.013)	(0.015)	(0.012)	(0.016)	(0.014)	(0.016)	(0.013)	(0.016)
N Respondents	39556	39556	39556	39556	39556	39556	39556	39556
N Countries	49	49	49	49	49	49	49	49
χ^2	1523.696	1542.610	1554.486	1563.816	1371.151	1385.343	1439.360	1493.670
Log-likelihood	21105.942	23213.056	15858.867	8947.153	19231.313	21409.341	14512.750	8511.696
AIC	-42169.884	-46384.113	-31675.735	-17852.306	-38422.626	-42778.683	-28985.499	-16983.393

Notes: Standard errors (in parentheses) are clustered at the country level. Significance level * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. (I,C,P) refers to the indicators that account solely for income, consumption and property taxes. Trust in Institutions and Political involvement are composite indicators that capture the respondents' trust in major political institutions and their involvement in political discussion and political life. Age (ln), Gender, Education, Employment Status, and Religiosity are included in all specifications but not reported. The coefficient estimates on age are positive and statistically significant, thus implying that tax compliance increases with age. Respondents with education level lower than post-secondary tend to be less compliant. Coefficient estimates on political attitude variables are consistent with previous reports.

Table A4.6: Tax Compliance in Multi-Layer Tax Structure:
Estimations with Ordered Outcome and Instrumental Variables

	EXTENDED ORDERED PROBIT WITH IV			
	(1)	(2)	(3)	(4)
Dependent Variable: Tax Compliance (ordered categorical)				
Tax Assignment Index	-0.271***			
	(0.072)			
Tax Assignment Index(I,C,P)		-0.403***		
		(0.093)		
Tax Assignment Index(*)			-0.263***	
			(0.071)	
Tax Assignment Index(*I,C,P)				-0.400***
				(0.092)
Country-level Covariates	Yes	Yes	Yes	Yes
Individual-level Covariates	Yes	Yes	Yes	Yes
First-Stage				
Number of taxing layers	0.127***	0.092***	0.130***	0.093***
	(0.001)	(0.001)	(0.001)	(0.001)
Number of second-tier	0.003***	0.003***	0.003***	0.003***
	(0.000)	(0.000)	(0.000)	(0.000)
Constant	-0.161***	-0.124***	-0.165***	-0.125***
	(0.002)	(0.002)	(0.002)	(0.002)
$\sigma^2_{\varepsilon_{ijc}}$	0.010***	0.009***	0.010***	0.009***
	(0.000)	(0.000)	(0.000)	(0.000)
$corr(\varepsilon_{ijc},\varepsilon_{ij})$	-0.002	-0.015	-0.003	-0.016
	(0.009)	(0.010)	(0.009)	(0.010)
N Respondents	47120	47120	47120	47120
N Countries	49	49	49	49
χ^2	1104.785	1109.872	1104.568	1109.944
Log-likelihood	8849.564	11367.885	7979.349	11299.597
AIC	-17655.128	-22691.769	-15914.698	-22555.194

Notes: Standard errors (in parentheses) are clustered at the country level. Significance level * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. (I,C,P) refers to the indicators that account solely for income, consumption and property taxes. (*) implies that the indicator has been revised to account for the relevance of the intermediate level of governments in joint decisions with central and local authorities. Trust in Institutions and Political involvement are composite indicators that capture the respondents' trust in major political institutions and their involvement in political discussion and political life. Age (ln), Gender, Education, Employment Status, and Religiosity are included in all specifications but not reported. The coefficient estimates on age are positive and statistically significant, thus implying that tax compliance increases with age. Respondents with education level lower than post-secondary tend to be less compliant. Coefficient estimates on political attitude variables are consistent with previous reports.

Chapter 5

Historical Path Dependence in Intergovernmental Tax Arrangements

Abstract

This chapter investigates the role of deep historical elements in shaping intergovernmental tax arrangements as an alternative to the various modern-day features suggested by economic theories. I connect historical elements and key explanatory factors embedded in ethno-cultural diversity and geography to new indicators measuring the taxation rights of sub-national governments. I estimate the impact of both modern-day (economically relevant) variables and historical-institutional variables on the current design of the multi-layer tax structure across 76 countries in Africa, the Middle East and Asia. The results confirm the relevance of the historical variables. Sub-national governments in countries with a higher degree of pre-colonial state centralization tend to have greater discretionary power over tax matters today. The path out of colonization also matters: countries that have experienced a violent independence movement tend to have a more centralized tax structure. Contrary to the conventional view, ethno-cultural diversity falls short in explaining multi-layer tax arrangements. However, the standard economic theories are not all irrelevant: country size and terrain ruggedness tend to imply greater decentralization of tax-related decisions. The results are robust to an extensive set of control variables and a range of IV-GMM estimations using ecological diversity, the Tsetse suitability index and Neolithic transition timing as instrumental variables for pre-colonial centralization.

Keywords: Pre-colonial Centralization; Intergovernmental Fiscal Relations; Tax Institutions
JEL Codes: H77; H11; N40
Acknowledgements: This chapter is a joint work with Dr. Kaj Thomsson.

5.1 Introduction

In this chapter, I evaluate the relevance of institutional and historical variables relative to standard economics variables in explaining the shape of intergovernmental tax arrangements. While economic theories suggest that fiscal institutions are (or should be) determined by geographical characteristics and ethno-cultural diversity, a growing body of empirical research shows that modern-day institutions (more generally) carry within them both pre-colonial structures and the legacy of colonial experiences. I show that such historical and institutional features are also important for understanding tax arrangements. Specifically, I find that sub-national governments in countries with a higher level of pre-colonial state centralization tend to have greater discretionary power over tax matters today. I also show that colonial experiences and the path out of colonization shape modern-day arrangements: countries that have experienced a violent independence movement tend to have a more centralized tax structure. Some, but not all, explanatory features suggested by standard economic theories do matter too: country size and terrain ruggedness tend to foster greater decentralization of tax-related decisions. However, other variables suggested by economic theories, such as ethno-cultural diversity, appear to be less irrelevant.

Intergovernmental tax arrangements have long been a central topic in the fiscal federalism literature and in economics more broadly. The conventional approach to the governance of tax systems is such that tax bases suitable for economic redistribution or stabilization are (or should be) assigned to central-level governments whereas those with low inter-jurisdictional mobility should be assigned to lower-tier authorities. While public finance economists do not unanimously share this view (see for e.g. Bird, 1999; Liberati, 2011), a near-consensus over these principles, grounded in theoretical insights that emphasize the challenges associated with decentralizing the tax system (see for e.g. Prud'Homme, 1995; Rodden, 2002, 2006; Ambrosanio and Bordignon, 2015), has guided the design of tax institutions.

Moreover, while the existing theory might (seemingly) give clear-cut suggestions, intergovernmental tax arrangements have so far received less empirical considerations. Research that touches upon the driving factors of intergovernmental tax institutions often analyses the subject through the broader lens of fiscal decentralization (Patsouratis, 1990; Panizza, 1999; Arzaghi and Henderson, 2005; Letelier, 2005; Bodman and Hodge, 2010). Some of the most cited explanatory factors in this broader literature include countries' income level (Patsouratis, 1990; Panizza, 1999; Arzaghi and Henderson, 2005; Letelier, 2005; Bodman and Hodge, 2010), geographical

characteristics such as land area or country size (Panizza, 1999; Arzaghi and Henderson, 2005), geographical fragmentation (Canavire-Bacarreza et al., 2017), ethnic fractionalization (Panizza, 1999), urbanization and population concentration (Letelier, 2005; Arzaghi and Henderson, 2005), and the level of democracy (Panizza, 1999; Arzaghi and Henderson, 2005). However, there remains limited empirical evidence on the explanatory factors of cross-country variation in intergovernmental tax-decision arrangements. This chapter addresses the existing gap in two ways.

First, I focus on the determinants of sub-national governments' taxing rights instead of the broader concept of fiscal decentralization. The empirical evidence that does exist, including from Chapter 2 of this dissertation, suggests that there are significant cross-country variations in how the fiscal space is governed across government layers. Furthermore, the evidence suggests that much of the variation cannot be explained by standard economic theories and that such variation is not well captured by the conventional classification of countries into federal or unitary states. Malaysia, a federal country, has a much more centralized tax system than Colombia, which itself is a unitary state. According to Chambas and Audras (2012), sub-national governments in Ghana and Kenya are quite similar in their financial autonomy, which implies that the geographical proximity of Ghana and Burkina Faso has not induced a spillover in the design of intergovernmental tax institutions. In Tanzania, the local finance systems have developed without much interference from the central level (Fjeldstad, 2001), while in Benin a large part of what is defined as own-revenues of local governments is administratively collected by the central treasury administration and redistributed to respective jurisdictions (Dafflon and Madiès, 2012; Caldeira and Rota-Grasiozi, 2014; OECD and UCLG, 2019). Thus, any conventional indicator of tax decentralization based on national accounts statistics – such as the ratio of sub-national in consolidated general government tax revenue – is likely to over- or under-estimate the extent of sub-national or central governments' discretion over the fiscal space, and would, therefore, not reflect the design of tax institutions.

Second, this chapter investigates the role of deep-historical elements in shaping intergovernmental tax arrangements. While (most) existing economic theories suggest that the level of fiscal decentralization should primarily be shaped by heterogeneous demands embedded in geographical and ethno-cultural diversity, a growing body of evidence suggests that institutions are long-lasting and modern-day establishments carry within them features of early and pre-modern institutions (Bockstette et al., 2002; Gennaioli and Rainer, 2007; Acemoglu and Robinson, 2008a,b). With this in mind, I postulate that the multi-layer governance of tax matters may have emerged and persisted throughout the years. The empirical analysis thus looks into deep-rooted

determinants and explores the extent to which countries' historical trajectories and pre-modern characteristics explain modern-day fiscal institutions.

The relevance of a historical perspective in analyzing intergovernmental tax arrangements has been hinted by McLure (2001) who argues that the current level of tax and revenue assignment may have resulted from the historical trajectories of countries and the process of bargaining power among political and societal groups. Countries such as the United States, Switzerland and Canada also appear to have refuted the top-down perspective on tax assignment. As these countries were formed out of independent colonies, the governance of the fiscal space began from the perspective of the sub-national governments which agreed to transfer legitimacy and power to upper-tier authorities (ibid.). This suggests that the historical trajectories of countries (may) still matter today. Exploring cross-country tax assignment through a historical lens also aligns with a growing body of research on the role of pre-colonial and colonial features in shaping modern-day economic and political development (Sokoloff and Engerman, 2000; Robinson et al., 2001; Gennaioli and Rainer, 2007; Michalopoulos and Papaioannou, 2013a,b; Broich et al., 2015).

The empirical framework in this chapter is based on the indicators of sub-national governments' taxing rights from the new dataset described in chapter 2. The primary variable of interest is the *"Tax Assignment Index (TAI)"* which reflects the discretionary power of sub-national governments over the tax system in the country sample. It is derived using information from legal documents (e.g. constitutions, tax codes, local government acts), laws and decrees on taxation, scientific and policy documents on fiscal decentralization and public finance, and archives from the international bureau of fiscal documentation. In addition, the new dataset allows me to explore sub-national authorities' discretion over tax administration and the setting of tax rates as alternative outcome variables. To the best of my knowledge, this constitutes the first empirical attempt to explain decentralized decision-making with respect to tax rates and tax administration.

Building on the discussion above, I adjoin two groups of explanatory factors to the new indicators of sub-national governments' taxing rights. The first one draws on the existing literature on the determinants of decentralization based on costs and benefits – which I denote the economic approach. The variables in this group include ethno-linguistic fragmentation and geographical characteristics (e.g. country size and population density; terrain ruggedness), and factors that are likely to impose a transaction cost on the public sector or trigger fiscal erosion (e.g. bargaining power of minority groups, risk of conflicts over natural resources). With the second group of explanatory factors, I take on a more comprehensive approach and consider pre-

modern and pre-colonial characteristics of countries, as well as colonial legacy and other related features. I call this the historical approach.

The baseline model in this chapter is estimated using ordinary least squares regressions (OLS) where the results serve to illustrate rather than demonstrate the conjectures highlighted in section 5.2. The coefficient estimates from the baseline model point to the existence of historical path dependence in intergovernmental tax arrangements. The results suggest that sub-central governments in countries with a higher degree of pre-colonial state centralization tend to have a greater discretionary power over tax matters in modern-time. The path out of colonization is also relevant as countries which have experienced a violent independence movement tend to have a more centralized tax structure. On the economic arguments, geographical characteristics such as country size and the mean ruggedness of terrain – which can be regarded as proxies for the spatial decay and access to infrastructure – trump all other variables. Ethno-linguistic, ethno-political and religious fragmentations fall short in explaining sub-national governments' discretion over tax matters. However, the salience of territorial conflicts and the number politically relevant ethnic groups with regional autonomy between 1946 and 1970 have, respectively, a positive and negative impact on sub-national government taxing rights in a sub-sample of African and Middle-Eastern countries.

The results are robust to a range of sensitivity checks. While it is unclear whether concerns about endogeneity regarding pre-colonial state centralization are warranted, it has been argued that such historical variables might be correlated with unobserved characteristics omitted in OLS models. To alleviate such endogeneity concerns, I use a number of instrumental variables approaches with general methods of moments (IV-GMM) techniques. In these estimations, I instrument the pre-colonial state centralization with ecological diversity, the Tsetse suitability index and the Neolithic Transition Timing (as of 1500 C.E.). Previous research has established that these instruments account for much of the variation in pre-colonial and early institutions (Diamond, 2002; Fenske, 2014; Alsan, 2015; Archibong, 2019). The findings from the IV-GMM model corroborate the baseline results in that the historical trajectories of countries matter in explaining the current multi-layer governance structure of the tax system. In addition, the findings also suggest that pre-colonial state centralization explains a large part of the cross-country variation in sub-national governments discretion over tax administration and the setting of tax rates. Overall, these results point to a significantly greater role of historical and institutional factors in determining the degree to which sub-national governments are involved in tax matters and tax (de)centralization than it has previously been recognized.

In what follows, Section 5.2 presents the analytical framework and lays out the main conjectures that are empirically tested in this chapter. In line with the conjectures, Section 5.3 describes the various data sources and recalls the construction of the outcome variables, which are described in chapter 2. Section 5.4 outlines the empirical strategy and estimation techniques. The results are presented and discussed in Section 5.5, whereas concluding remarks are highlighted in Section 5.6.

5.2 Analytical Framework

As mentioned in the introduction, the analytical framework bridges two strands of existing research. The first one, which so far has been the most influential intellectual framework when it comes to shaping scholarly thinking on federalism and (de)centralization, relates to the determinants of decentralization and the cost-benefit of decentralized institutions. I denote it the economic approach. The second strand takes a more comprehensive route and analyses the development of political and fiscal institutions. Most importantly, it explores the influence of historical trajectories and legacies on the design of fiscal arrangements. I will refer to it as the historical approach in this chapter.

The two approaches are not mutually exclusive; both economic and historical forces likely shape modern-day (tax) institutions. That said, there is, of course, an element of competition between these strands of thinking, as the historical approach refutes the notion that tax arrangements primarily (or at least largely) are determined by economic arguments about costs and benefits.

5.2.1 The Economic Approach

The literature on the drivers of decentralization reforms revolves around two main branches. The first, and dominant, intellectual framework focuses on the conditions under which it might be more efficient for local governments to provide public goods and services within their jurisdictions, instead of having such task undertaken by central authorities (Oates, 1972; Wallis and Oates, 1988; Oates, 2005). The early works in this literature refer to this as the "decentralization theorem". It highlights the relevance of the informational advantage of local governments in reaching public allocation efficiency (Musgrave, 1959; Oates, 1972, 1977). By bringing political decision-making closer to the citizens, decentralization, it is argued, reduces

information asymmetries and improves the adequacy of public policies, under the assumption that local authorities have a more holistic understanding of the needs and preferences of the citizens. It is thereby derived that the benefits of decentralization are enhanced when there are heterogeneous demands for public goods, embedded in factors such as ethno-cultural diversity, linguistic and regional disparities, and spatial decay.

Ethno-cultural Diversity

Existing research supports the idea that ethnic polarization contributes to shaping public policies and institutions in a general sense. According to Alesina et al. (2003), polarized societies are prone to competitive rent-seeking by groups with different tastes and preferences. Easterly and Levine (1997) further suggest that the high level of ethnic diversity in African countries is strongly linked to high black-market premiums, poor financial development, low provision of infrastructure, and low levels of education. Wantchekon (2003) and Wantchekon and Vermeersch (2011) also corroborate the influence of ethnic affinity in public goods and political preferences in Benin.

I also find similar ideas in the more specific decentralization literature. The first branch of this literature postulates and empirically corroborates that ethno-cultural diversity, ethnic groups and hinterlands' preferences for greater autonomy tend to foster decentralization (Watts, 1999; Panizza, 1999; Arzaghi and Henderson, 2005). As assigning taxing powers to lower-tier governments is an important component of decentralization reform, one might predict that ethno-linguistic diversity is also a key explanatory factor of such dimension. In fact, Campbell (2003) previously indicated that ethnically fragmented countries tend to have a preference for decentralized tax institutions. The following conjecture will thus be tested using various indicators that reflect the ethno-cultural diversity and polarization within countries in the sample.

Conjecture 1.a: *Sub-national governments' taxing rights increase with the level of ethno-cultural diversity.*

Spatial Decay

Geography has been a recurring theme in institutional economics. Many scholars have argued that geographical and environmental features – including climate, soil

suitability and geology – impact on the quality of institutions and countries' economic performance (Gallup et al., 1999; Sokoloff and Engerman, 2000; Acemoglu et al., 2002; Alsan, 2015). There is also some evidence that the level of decentralization is driven by geographical features (Panizza, 1999; Arzaghi and Henderson, 2005; Canavire-Bacarreza et al., 2017).

One might expect country size, population density and high transportation cost to increase the pressure to decentralize as hinterlands tend to be poorly served by the central government. Low population density, combined with abundant arable land, may also weaken central governments' control over sparsely settled territories (Tiebout, 1956). According to Alesina and Spolaore (1997), transportation cost could be viewed as a dis-utility endured by individuals when they are located far away from the public good: the further away are the inhabitants from the centralized provision of a public good, the less they value the consumption of that good. Thus, decentralized institutions contribute to minimizing the spatial decay in public provision.

With this in mind, I argue that the spatial decay that drives the demands for local public provision could also drive the demands for decentralized fiscal institutions. Numerous publications in the fiscal federalism literature have argued that matching revenue and expenditure powers is necessary to foster optimal local spending decisions and bring about the accountability of local authorities (Oates, 1972; Rodden et al., 2003; Guo, 2008; Eyraud and Lusinyan, 2011). Rodden et al. (2003), for instance, have highlighted that the alignment of revenue and expenditure fosters a hard budget constraint that limits inefficient spending decisions by lower-tier authorities. I, therefore, conjecture that the spatial decay would increase the demands for fiscal autonomy by hinterlands and remote regions, and thereby increase the lower-tier government discretion over tax matters.

Conjecture 1.b: *Sub-national governments' taxing rights increase with spatial decay.*

In the empirical analysis, I proxy the spatial decay within countries through an array of geographical variables such as country size, mean elevation, the mean ruggedness of terrain, and the distance to coastline or sea- navigable river. Besides measuring the remoteness of regions within and across borders, these variables also convey the differences in transportation costs and the likelihood of some regions being more or less favourable to trade and integration – which might ultimately shape the development of state and fiscal institutions.

Bargaining Power of Societal Groups and Resources Endowments

Another component of the economics-oriented fiscal federalism literature points to the transaction and administrative costs imposed by decentralized institutions. Besides the public efficiency argument, decentralization of power is often argued to be a valid strategy by central authorities to preserve territorial wholeness, appease secessionist movements and ethnic or regional conflicts (Panizza, 1999; Walter, 2006). Nonetheless, through this process, central authorities may also be forced to concede control over resources if the bargaining power of ethnic and regional actors dominates (North and Weingast, 1989; North, 1990). Severe problems of coordination of the fiscal space may therefrom arise, especially if ethno-linguistic and regional disparities trigger conflicts over lucrative tax bases.

In recent decades, the body of research on the linkages between decentralization, violence and secessionist movements has grown significantly. The emerged empirical evidence leans towards complex interactions between central authorities and ethno-regional autonomous entities in decentralized governance systems. For instance, Sambanis and Milanovic (2014), using data collected at the level of second-tier administrative divisions in 48 decentralized countries, found that approximately 21% of regions that enjoy some degree of autonomy experienced violent relations with central authorities. Ethno-federalism and ethnic control of regional governments have also been identified as triggers for secessionist movements and a destabilizing force (Hale, 2004), with strong evidence regarding Nigeria (Suberu, 2001; Christin and Hug, 2012) and ex-Soviet Union countries (Cornell, 2002). Christin and Hug (2012) also found that countries with substantial ethno-federal subdivisions, such as Brazil and Nigeria, are the most prone to ethnic conflicts. Decentralization, alongside severe ethnic and regional disparities, can further exacerbate the threats to central governance, especially when wealthier regions that are net contributors to fiscal equalization schemes (Madiès et al., 2018).

Therefore, while the transfer of tax-related decisions to lower-tier authorities could facilitate government response to complex and heterogeneous demands of different regions, as postulated in Conjectures $(1.a)$ and $(1.b)$, such arrangements can also grant secessionist regions access to vast resources at the expenses of central authorities. It is thus expected that the threats of fiscal erosion and the need for central authorities to control and tap onto revenues from potentially conflict-ridden regions with resources endowments (such as oil, gas and arable land) would induce tighter regulatory control by central agencies, and therefore a lesser discretion of lower-tier authorities over tax matters. Watts (1999) also points out that it might deem desirable for central authorities

to have sufficient powers to resist territorial fragmentation, and that includes financial power. Furthermore, while country size is evidenced to be a driving factor of decentralization (also alluded in Conjecture $(1.b)$), it can also be a hindering element, especially when it comes down to the tax and revenue mobilization system. As countries grow, inter-regional distribution might also become the primary objective of central governments, resulting thereby in a centralized revenue mobilization system and policy decision-making. Contrarily to the United States or Switzerland, rich countries like France tend to have a more generous redistributive system and centrally determined tax policies (McLure, 1994, 2001).

Research results from Panizza (1999) and Arzaghi and Henderson (2005) have so far suggested that democratization and federalism go hand-in-hand as democratically elected regional governments tend to align their policy agenda with citizens demands, which might induce greater autonomy from central authorities. Nevertheless, if the electoral process overly intensifies inter-jurisdictional competition, a centralized tax and revenue system might result as a precautionary measure to prevent fiscal erosion (Prud'Homme, 1995; Rodden, 2006; Martinez-Vazquez, 2015).

Therefore, I postulate that the level of tax-related decisions carried by lower-tier government units would be lower the higher the risk of fiscal erosion, the bargaining power of heterogeneous groups in society, the likelihood of secessionist movements or regional conflicts, and the greater the need for central authorities to tap unto revenues from natural resources endowments.

Conjecture 1.c: *Sub-national governments' taxing rights decrease with the bargaining power of heterogeneous groups, the salience of political and regional conflicts, and the size of natural resources endowments.*

In the empirical analysis, I proxy the bargaining power of heterogeneous groups, the salience of regional conflicts and autonomy through time-lagged parameters from the Ethnic Power Relations Database family (EPR) (Vogt et al., 2015; Girardin et al., 2015) (see subsection 5.3.2). The EPR databases provide information on ethnic and regional groups' access to executive governments, their involvement in civil wars and administrative units. To the EPR, I adjoin indicators on natural resources endowments, such as the share of arable land and soil fertility, which, as argued above, may give way to more centralized regulatory tax systems. In addition, I also consider the total average of natural resources rents as a share of GDP between 1970 and 1975 as an alternative proxy for resources endowments in sensitivity analyses.

Joining the different economic arguments, one could assume that intergovernmental tax institutions are designed to minimize the costs imposed by sub-national authorities' involvement in tax matters. This, by and large, constitutes the bulk of the existing research and thinking on fiscal federalism and decentralization processes. However, beyond the economic rationales, there are reasons to believe that countries' historical trajectories also play a role in shaping intergovernmental arrangements and fiscal institutions more broadly. In recent years, economic historians and political scientists have, in other settings, demonstrated that institutions (can) persist even when they deem inefficient (Acemoglu, 2006; Greif, 2006; Acemoglu and Robinson, 2008a,b). Thus, I might assume that (possibly inefficient) intergovernmental tax arrangements may have persisted despite the above economic arguments and rationales. In the following sub-section, I make a case for considering historical elements in the quest to understand the cross-country variations in the multi-layer tax structure.

5.2.2 The Historical Approach

For many years, social scientists have attempted to bring about explanations to cross-country differences in institutions. LaPorta et al. (1999) provide a seminal overview of the most influential theories on why institutions look the way they do. The economic theories dictate that institutions are created whenever the social benefits exceed the costs. The rationales provided by the branches of the fiscal federalism literature (discussed above) align with the economic theories whereby the level of sub-national government taxing rights result from an optimal balance between the cost and the benefits. The cultural theories, on the other hand, imply that institutions are anchored in societal values and preferences, whereas the political theories suggest that policies and institutions are shaped by those in power with the objective of amassing resources. Unlike the above conjectures, the cultural and political theories would suggest that existing intergovernmental institutions are shaped by forces embedded in power structure or societal values.

Institutions are defined by North (1990) as the humanly devised constraints that shape social interactions. As such, they persist through inter-generational legacy which ensures the survival of cultural, political, hierarchical structures in society. Therefore, as any other form of institutions, the multi-layer tax structure may have emerged and persisted despite a non-compliance to the above conjectures and economic rationales. The relevance of a historical perspective in analysing intergovernmental tax arrangements has also been outlined by McLure (2001) who argues that the current

level of tax and revenue assignment may have resulted from countries' historical trajectories and the process of bargaining among political and societal groups. Yet, to the best of my knowledge, no prior empirical research has attempted to confirm or invalidate these claims.

Recent findings, mostly in economic history, have highlighted the relevance of pre-colonial characteristics in explaining variations in modern-day economic performance, public goods provision and state capacity, especially in Sub-Saharan Africa (Gennaioli and Rainer, 2007; Michalopoulos and Papaioannou, 2013a,b; Osafo-Kwaako and Robinson, 2013; Dippel, 2014; Alsan, 2015). According to Gennaioli and Rainer (2007), the observed variation in the quality of institutions in modern-day may be due to the accountability of local chiefs in a hierarchical and centralized structure in pre-colonial time. The authors argue that in less hierarchical settings – inhabited by politically fragmented groups – the presence of too many stakeholders may have rendered bargaining very costly, leading to less coordinated policies and disorder. Hence, pre-colonial state centralization, which can be regarded as a measure of state integration, appears to have fostered organized state institutions which persisted through time.

Some of these contributions have also argued that pre-colonial institutions were not only crucial during the colonial period but also after the independence of most African countries. On the one hand, colonial institutions were built upon (or influenced by) the ones that colonizers found upon their arrival (LaPorta et al., 1999; Acemoglu et al., 2002). By collaborating with senior traditional leaders, the colonialists were able to control local chiefs and induce them to rule in the interest of their communities. Traditional institutions have thus contributed to maintaining the hierarchical structure of governance which persist until today. On the other hand, traditional patterns of politics also appear to have influenced the nature of post-colonial leaders, especially at the local level where post-colonial regimes could not reach their objectives without the cooperation of traditional leaders. Unable to create entirely new institutions, both colonial and post-colonial leaders had to rely on and exploit the existence of pre-colonial leadership structures.

Existing evidence suggests that many pre-colonial institutions were deeply entrenched in local communities. de Juan (2017) argues that pre-colonial institutions are likely to remain salient in the historical strongholds of pre-colonial political and cultural systems where certain traditions have been internalized in cultural paradigms over many centuries. It can therefore be assumed that the pre-colonial institutional structure and the level of state integration in pre-modern time which, according to the empirical evidence, explain modern-day variation in institutions, can also explain the cross-country variation in the hierarchical structure of tax institutions.

Most countries in the sample have been colonized at some point in their history. Numerous publications have highlighted the lasting impact of colonizers' conquests and ruling on modern-day economic development and institutions (Sokoloff and Engerman, 2000; Acemoglu et al., 2001; Huillery, 2009; Jones, 2013; Frankema and van Waijenburg, 2014). Official languages, legal and regulatory systems, religion and culture constitute some of the most observable characteristics of the colonial legacy.

The literature has also highlighted key differences in colonization styles of Great Britain and France (Crowder, 1964; Sokoloff and Engerman, 2000; Acemoglu et al., 2001). Crowder (1964), for instance, suggests that the British colonizers were more likely to use traditional boundaries and authorities than the French or the Spanish. Under the British ruling, local authorities remained largely autonomous, although they carried the obligation of collecting taxes for the administration according to the rules set by the colonizers. This strategy is known as the indirect rule, or the "divide and rule" (Ali et al., 2018). The French style, on the other hand, was prone to the breaking-up of traditional governance units and the own-selection of native rulers rather than through traditional means, although historical evidence suggests some exceptions such as in Senegal where traditional leaders played an intermediary role between their followers and the French colonial administration (see for e.g. Diouf, 2013). Yet, across the board, it is argued that the French generally minimized local decision-making and instead adopted the principles of centralized planning with little regards for pre-existing institutions (Mamdani, 2018).

The interplay between pre-colonial and colonial institutions has been very relevant in the post-independence era of most countries. For instance, Acemoglu et al. (2001), Hjort (2010) and others have partly attributed the success of Botswana to both its pre-colonial institutions and the limited impact of British colonialism. Kjaer (2009) illustrates the interplay between pre-colonial institutions and colonization style in the context of Uganda. The author attributes the variation in the extractive capacity of local authorities to variation in trust, which stems from the pre-colonial era and differed across districts belonging to different kingdoms. The Ankole kingdom, a centralized administrative unit with a tradition of organized tax collection, has high extractive capacity today. In pre-colonial times, Ankole was a well-established centralized monarchy with unity and social cohesion which have persisted even after the kingship was abolished. The British colonizers thus relied on the pre-existing administrative unit of the Ankole kingdom in their ruling. In comparison to Ankole, the administrative unit of Busoga experienced a different trajectory. The district of Busoga had no prior history of centralized institutions nor organized tax collection in pre-colonial times. As such, the British had to impose a new system which was more

closely administered and animated stronger resistance against the central government, resulting in less trust and thus less capacity of local authorities in modern times.

In most contexts, the interplay between the pre-colonial features and colonial legacy makes the prediction on the effects of historical variables very ambiguous. Yet, under the assumption that sub-national governments' taxing rights reflect the bureaucratic capacity of local governments, it can be expected a positive association between the pre-colonial state centralization (or state integration) and sub-national governments' taxing rights, and as such, an extension of the existing literature on pre-colonial state centralization and state capacity (Gennaioli and Rainer, 2007; Broich et al., 2015). I summarize the above arguments in the following conjecture:

Conjecture 2.a: *Sub-central governments' taxing rights are historically path-dependent, and state structures that were in place before colonial times shape modern day tax arrangements.*

As discussed above, it is generally expected that the indirect ruling of British colonizers, in comparison to the French or Spaniards, has fostered the maintenance of precolonial institutions. By extension, it could be assumed that traditional, ethnic and regional ruling, under the British, will have maintained some level of discretion and involvement in governance matters which persisted till today. Nevertheless, that assumption remains very strong. Research by Blanton et al. (2001), for instance, suggests that the indirect, decentralized rule of the British fostered an unranked system of ethnic stratification which triggered competition between ethnic groups and ultimately ethnic conflicts. Their findings also indicate that, unlike the French colonies that were left with a centralized bureaucratic power structure that impeded ethnic mobilization, British colonial legacy is positively associated with both the frequency and intensity of ethnic conflicts. Following the arguments that led to conjecture $(1.c)$ on the bargaining power of ethnic groups and the salience of territorial conflicts, the British legacy, based on the findings of Blanton et al. (2001), could have also led more centralized tax systems as a preventive measure of fiscal erosion and resources-ridden ethnic conflicts.

The path out of colonization is also expected to matter. For instance, violent independence movements in some countries and the re-construction of state bureaucracy that followed may have fostered centralized state institutions, in comparison to countries with a peaceful independence process where the bureaucratic apparel may have remained intact. Given that most countries in the sample have been colonized, I therefore postulate that the path out of colonization would influence the

current intergovernmental tax arrangements. This leads to a second history-linked conjecture:

Conjecture 2.b: *Sub-central governments' taxing rights are anchored in countries' colonial trajectory and the path out of colonization.*

To wrap up this section, despite there being some remaining ambiguity, the literature clearly points to the fact that institutions can persist over time, even if they are not efficient in standard economic ways, and that the explanations to differences in societal and political organizations are anchored in decades of historical development (Huillery, 2009; Jones, 2013; Frankema and van Waijenburg, 2014). I postulate that intergovernmental tax arrangements are rooted in historical and societal features which date back to pre-colonial and colonial periods and that the current level of sub-national government taxing rights is historically path dependent, even when such arrangements would be considered inefficient by standard economic rationale.

In the empirical part of this chapter, Conjectures $(2.a)$ and $(2.b)$ are tested using a wide range of ethnographic and historical variables that capture the characteristics of pre-industrial economies, the traditional system in pre-modern times and the colonial legacy in the sample of countries. The empirical strategy is developed to account for deep-rooted exogenous and time-lagged variables to limit the bias associated with omitted variables.

5.3 Data Description and Sources

5.3.1 Dependent Variables

In this chapter, the dependent variable is a measure of sub-national governments' taxing rights, described in chapter 2. The overall *Tax Assignment Index (TAI)* is used to reflect the broader control of sub-central authorities over the tax system. As a reminder, note that I obtain this measure by aggregating the discretionary power of lower-tier authorities over existing tax instruments and across four types of decisions – the setting of the instruments, the definition of tax bases, the setting of tax rates and the administration of revenue from said instruments. This measure provides a more comprehensive understanding of intergovernmental tax arrangements compared to previous ones in the existing literature. Unlike other indicators of tax decentralization,

it reflects the decision power of sub-central authorities, and a high score implies that these latter have great authority over the tax system.

The estimated models are tested for sensitivity by using the indicators derived from the alternative scoring procedures. As described in subsection 2.4.3, the intermediate level of government (regions or provinces) in many countries (including unitary states) carries discretionary power over the tax system. Thus, bundling intermediate and local governments and assigning a single weight to "sub-national" authorities as a whole might undermine the relevance of sub-national governments (local and intermediate combined) relatively to the central. It is therefore adopted an alternative scoring approach in which regional governments are assigned a specific weight such that if a certain tax-related decision is jointly taken by central, local and intermediate authorities, the weight assigned to "sub-national" government is equivalent to $^2/_3$ instead of $^1/_2$. The indicators from the alternative scoring procedures are also used as outcome variables for all key specifications. Furthermore, the empirical framework goes beyond the overall discretion over the tax system to also explore the role of key variables in explaining sub-national governments' discretion over tax administration and the setting of tax rates. The setting of tax rates and tax administration are important regulatory dimensions that shape the interactions between state authorities, business and residents.

5.3.2 Explanatory Variables

The conjectures in section 5.2 infer that intergovernmental tax arrangements are, potentially, driven by two types of factors. I will first describe the variables intended to operationalize the factors labelled as the economic ones in the analytical framework section: ethno-cultural diversity, spatial decay, and the bargaining power of societal groups intertwined with natural resources endowments. I will then proceed to describe the variables intended to capture the factors falling under the alternative (competing) explanatory framework and focused on the historical trajectory of a given country. This second category will contain variables that can be traced back to pre-colonial as well as colonial times.

Ethno-cultural diversity

Ethno-cultural diversity is captured through indicators of ethno-linguistic and cultural fragmentation and polarization by Desmet et al. (2012) and Alesina et al. (2003).

The ethnic, linguistic and religious fractionalization indicators of Alesina et al. (2003) indicate the probability that two randomly selected individuals will differ by their ethnic and religious groups. Desmet et al. (2012), on the other hand, propose alternative measures of fractionalization and polarization at different levels of linguistic aggregations. The resulting indicators reveal deep cleavages within countries (Desmet et al., 2012). The indicators from Desmet et al. (2012) and Alesina et al. (2003) are used interchangeably in the empirical estimations. Based on the existing literature, described in the analytical framework above, one would expect sub-national governments' taxing rights to be the higher in the presence of extensive ethno-cultural diversity.

Spatial Decay

Spatial decay is captured through geographical characteristics that have the potential to increase the pressure to decentralize the tax system, should one use an efficiency-based approach to the determination of the appropriate level of decentralization. These include country size and population density, which point to the sparseness of the territory and the likelihood of hinterlands being less adequately served by the central government (Panizza, 1999; Arzaghi and Henderson, 2005; Canavire-Bacarreza et al., 2017). I also include countries' mean elevation, mean ruggedness of terrain and the average distance to the nearest coastline or sea-navigable river, as these variables convey the differences in transportation costs and the likelihood of some areas being more favourable to trade and integration.

Among others, Nunn and Puga (2010) suggest that mean elevation and ruggedness of terrain reflect the cost of accessing public infrastructure, which has been empirically shown to affect countries' development. Geographical characteristics of countries have also contributed to shaping colonial institutions and ethnic relations. Land area, elevation, mean distance to coast and rivers, distance from country centroids to coast and rivers, and population in tropical zones are accounted for with information compiled by the Center for International Development of Harvard University (CID Harvard University, 2001). Geographical features are generally assumed to be exogenous proxies of spatial decay in related empirical analyses (see for e.g. Panizza, 1999; Arzaghi and Henderson, 2005; Canavire-Bacarreza et al., 2017).

Bargaining Power of Societal Groups and Resources Endowments

In section 5.2, I argued that the interactions among societal, minority and ethnic groups would influence the structure of the tax system in each given country. Such interactions are captured through variables from the Ethnic Power Relations Databases (EPR) which so far stand as the most comprehensive information source on ethnic relations and power structure within societies in recent decades. The dataset family was introduced by Vogt et al. (2015) and updated in 2018 to include a series of data on ethnicity, civil wars and conflicts that occurred in more recent years. The EPR databases have been widely used in research across political science and political economy.

From the EPR, I draw several proxies that account for the bargaining power of ethnic and minority groups. These include, among others, the number of ethnic groups of political relevance, the population share of ethnic relevant groups with regional autonomy, and the incidence of territorial conflicts. Politically relevant ethnic groups refer to those that either have representatives making political claims on their behalf or are singled out by the state as a result of discrimination (Girardin et al., 2015). Given that interactions among societal groups are likely to evolve with changes in institutions, I limit the selected variables to the time period of 1946 to 1970 and consider their averages of these variables across that period.

Besides having 1946 as the first data point for countries in the EPR databases, the selection of the 1946-1970 time period is based on two other rationales. First, the indicators of sub-national governments' taxing rights are cross-sectional and constructed with information from 2010 to 2017. A time-lag helps to reduce the bias (reverse causality) in the empirical estimates. Second, most countries in the sample are located in Sub-Saharan African and Asia, where it has been demonstrated that the prominent waves of decentralization reforms began in the late 1990s, hence a two-decade gap (Dafflon and Madiès, 2012; Caldeira, 2011; Chatry and Vincent, 2019). It is therefore expected that the ethnic-power relations during and in the aftermath of the independence of most African countries, for instance, have contributed to shaping the decentralization discourse in the 1990s and, by extension, the tax structure across government layers today. Notwithstanding, some countries may have embarked on the decentralization wagon much earlier. Therefore, to test the sensitivity of the results, a different time period (1946-1960) is also considered in the empirical estimations.

I have argued, in the analytical framework, that natural resources endowments alongside the salience of ethnic and minority influence and conflicts may trigger

tighter regulatory control by central authorities. The need to tap onto rents from resources' extraction and national production, be it for redistributive purpose or to limit fiscal erosion, might incentivize central authorities to adopt a centralized tax system. Thus, in addition to what is described above, I include soil fertility and the percentage of arable land as proxies for the types of resources endowments that might lead to tensions and thereby increase the appeal of centralized tax institutions and tax-related decision-making. Moreover, to test the monetary relevance of resources extraction, I include the total average of natural resources rents as a percentage of GDP between 1970 and 1975 as an alternative proxy. It is expected that the bargaining power of regional and ethnic groups, the salience of territorial conflicts and resources endowment would induce less sub-national discretion over the tax system.

Historical Variables

The variables used to operationalize the pre-colonial and colonial aspects from the history-focused part of the analytical framework are drawn from the Atlas of Pre-Colonial Societies (Müller, 1999; University of Zurich, 2017) and from the ICOW Colonial History dataset (Hensel, 2014). These two datasets are, respectively, considered to be the primer sources of information on pre-colonial societies and the colonial trajectory of countries.

The Atlas of Pre-Colonial Societies was assembled and made available by researchers of the University of Zurich and the Swiss National Science Foundation. For the most part, the definitions of the variables are identical to those of the Ethnographic Atlas by G.P. Murdock. As inferred from its description, the Atlas presents a compendium of the cultural heritage of the non-western world and covering 95 African, Asian and Melanesian countries. It describes the pre-industrial economies, the traditional systems of kinship and pre-colonial modes of political organization, intending to facilitate the understanding of the cultural diversity of contemporary nation-states. In the original dataset, an ethnic group is regarded as centralized if it has more than two jurisdictional levels above the local community, and fragmented otherwise.

As most ethnic societies are split across countries based on modern-day boundaries, the aggregation method of the index is done using a systematic methodology based on the population of each recorded ethnic unit. The indicators for pre-colonial institutions are thus constructed in a way that is reflective of modern-day state boundaries (see for e.g. University of Zurich, 2017). This allows me to use country-level indicators on pre-colonial state centralization, pre-colonial agro-technical level and pre-colonial asymmetric work distribution. These latter two capture, respectively, the level of

economic development and the labour market structure between men and women in the pre-colonial era.

The ICOW colonial history dataset provides detailed information on the colonial trajectory of many countries, including the identity of the primary colonizers, the legacy of the colonial period in terms of the legal and institutional framework, and indicators capturing how countries obtained their independence. Following the work on the consequences of British versus French colonial ruling (Crowder, 1964; Sokoloff and Engerman, 2000; Acemoglu et al., 2001), a binary variable capturing British legal origin is added to identify countries that were primarily governed through the indirect ruling of British colonizers and that have eventually maintained their traditional and pre-modern structure.

In addition, I also consider a binary indicator for whether a country obtained its independence through violence. As argued above, the reconstruction process in the aftermath of a violent independence process, as opposed to a peaceful transition, might have pressured a country to develop a centralized governance system as a mean of fostering integration and national cohesion. Based on the arguments in the analytical framework section, if there is path dependence in institutional trajectories, such early centralized state institutions (including tax institutions) may have persisted across the years, independently of whether there would be any efficiency-based (economic) reason for their existence today. Furthermore, sensitivity analyses also integrate a binary indicator for countries which have experienced a socialist regime between 1946 and 1990 as those may have developed a more centralized fiscal regime in recent decades. Also in line with the historical path dependency arguments, institutions in countries with a socialist regime before or at the time of the decentralization wave in the early 1990s may have persisted. The most recent historical trajectory of these countries could, to some extent, invalidate the hypothesis on the persistence of pre-colonial and colonial institutions. The data on socialist states are compiled from various sources (Ottaway, 1987; Schmid, 1992; Kornai, 1992; Kornai et al., 2001; Guo, 2006).

Additional Control Variables

Besides the main variables of interest, most econometric specifications include additional socio-economic, cultural and geographical control variables. Among others, I consider the predicted genetic homogeneity by Ashraf and Galor (2013) which incorporates the pairwise genetic distances between ancestral populations and the expected heterozygosity of pre-colonial ancestral populations of contemporary sub-

national groups. The predicted genetic homogeneity accounts for deep-rooted pre-historic factors that may have affected countries' development and institutions since the emergence of human civilization, and also accounts for persistent ethno-cultural diversity. I also consider the percentage of Catholics in the 1980s – as to further account for colonial legacy and its cultural heritage as in LaPorta et al. (1999) – and other deep-rooted geographical variables such as the percentage of lands in the tropics, the percentage of the population in temperate zones, and the distance to regional frontiers in 1000 C.E. Most estimations also account for potential spatial spillovers of fiscal institutions through regional fixed effects.

5.4 Empirical Framework

As this chapter is (largely) focused on the (possible) effects of deep-rooted determinants, the empirical analysis begins with ordinary least squares regressions instead of, say, panel data methods. This has some obvious limitations in terms of econometric identification and causal inference, but these limitations are unavoidable, as several variables or primary interest do not (by definition) change during modern times. The estimations are performed on a sample of 76 countries located in Africa, Asia and the Middle-East. The baseline model is specified as follows, where Y_i refers to the level of taxing rights of sub-national governments of countries in the sample, α a constant, and ε_i the error term.

$$Y_i = \alpha + \mathbf{C}_{1a}\beta' + \mathbf{C}_{1b}\vartheta' + \mathbf{C}_{1c}\theta' + \mathbf{C}_{2a}\lambda' + \mathbf{C}_{2b}\xi' + \mathbf{X}\delta' + \epsilon_i \tag{5.1}$$

$\mathbf{C}_{1a}$ is a vector of covariates that captures the ethno-cultural diversity and polarization within a country. $\mathbf{C}_{1b}$ is a set of variables accounting for the spatial decay and other factors that may impede access to the centralized provision of public services – and thereby foster the decentralization of public services delivery and the tax system. $\mathbf{C}_{1c}$ is a vector of variables that accounts for the bargaining power of politically relevant ethnic groups between 1946 and 1970, and natural resource endowments, whereas $\mathbf{C}_{2.a}$ and $\mathbf{C}_{2.b}$ are the vectors of historical parameters, including pre-colonial characteristics and colonial legacy. $\mathbf{X}$ is a vector of additional control variables which includes, in some specifications, the regional dummies. Given the time-invariant structure of the data, regional fixed-effects are used instead of country-level fixed effects.

To recap some of the theory, note that the conjectures $(1.a)$, $(1.b)$ and $(1.c)$ are capturing the economic arguments that have previously been emphasized in the literature on

fiscal federalism and decentralization (Panizza, 1999; Arzaghi and Henderson, 2005; Bodman and Hodge, 2010; Suberu, 2001; Canavire-Bacarreza et al., 2017), although primarily theoretically and with older and less detailed measures of decentralization. Hence, the inclusion of the variables in $\mathbf{C}_{2a}$ and $\mathbf{C}_{2b}$, and the combined focus on both economic and historical variables, and the competition between these two types of explanations, is novel to this chapter and therefore of primary interest.

Instrumental Variables with GMM Estimator

One of the primary threats to the validity of OLS estimates is the endogeneity of the regressors. The strategy to counter this limitation is to restrain the model to likely exogenous variables and characteristics that are lagged in time by at least twenty years. The residuals are likely to be unbiased if it is argued that the included variables are exogenous and that the empirical model has controlled for all relevant parameters.

It has been argued that historical variables such as pre-colonial centralization and pre-independence conditions could be correlated with unobservable characteristics that are omitted in ordinary least-squares specifications (see for e.g. Archibong, 2019). Therefore, I recur to an instrumental variables' estimation technique with general methods of moments estimator (IV-GMM), in which I instrument the indicator of pre-colonial state centralization with the Tsetse suitability index first used by Alsan (2015), the ecological diversity index provided by Fenske (2014), and the predicted Neolithic transition timing (as of 1500 CE) introduced by Ashraf and Galor (2013).

Thus, the estimation of the impact of pre-colonial state centralization on modern-day sub-national governments' taxing rights is done in two stages, where $Precol_i$ is the indicator of pre-colonial state centralization, and $\widehat{Precol}_i$ its predicted value from the first-stage equation. $\mathbf{C}_{2a_i}$ refers to all remaining historically-linked variables except for the pre-colonial state centralization.

First stage:

$$Precol_i = \rho + \mathbf{C}_{1a}\tau' + \mathbf{C}_{1b}\sigma' + \mathbf{C}_{2}\varpi' + \mathbf{C}_{2a_i}\kappa' + \mathbf{C}_{2b}\omega' + \mathbf{X}\eta' + \mu_i \tag{5.2}$$

Second stage:

$$Y_i = \alpha + \mathbf{C}_{1a}\beta' + \mathbf{C}_{1b}\vartheta' + \mathbf{C}_{1c}\theta' + \mathbf{C}_{2a_i}\lambda' + \psi\widehat{Precol}_i + \mathbf{C}_{2b}\xi' + \mathbf{X}\delta' + \epsilon_i \tag{5.3}$$

As described by Baum et al. (2003) and Hayashi (2000), the IV-GMM holds the advantage of producing more accurate statistical inferences than the traditional 2SLS-IV approach if the error term is heteroskedastic. While the consistency of the 2SLS coefficients is not affected by the heteroskedastic error, the standard errors would be inconsistent in such case and thus lead to biased inferences. The IV-GMM approach overcomes this issue by using the orthogonality conditions to allow for efficient estimations in the presence of heteroskedasticity of unknown form.

The instrumental variables are selected with insights from the existing literature. According to Alsan (2015), a lower burden of the *Tsetse* is associated with intense cultivation and political centralization in pre-modern times. The findings of Alsan (2015) are consistent with archaeological evidence of more advanced civilizations which are supported by intensive agricultural systems and in places where the fly could not survive, such as Great Zimbabwe. In addition to the Tsetse suitability index, I follow Archibong (2019) and adopt the ecological diversity index from Fenske (2014) as the second instrumental variable. The ecological diversity accounts for the probability that two or more different ecological zones are contained within a particular ethnic state area. According to Bates (1983) and Fenske (2014), states on ecological boundaries were able to benefit from gains from trade, which then fuelled higher levels of pre-colonial centralization.

The third instrument is the Neolithic transition timing provided by Ashraf and Galor (2013) with data issued from Putterman (2008). The variable is defined as the number of years elapsed since the onset of sedentary agriculture as of the year 1500 C.E., thus before the wave of colonization of most countries in the sample. Diamond (2002) has suggested this timing since the Neolithic revolution as a proximate determinant of economic development. Considering that the level of centralization and organization of the state in the pre-modern era is an indicator of state integration, it is expected that the Neolithic transition timing, with 1500 C.E. as the reference year, would be a significant driver of pre-colonial state institutions.

Given the limited availability of the instrumental variables for all countries, especially the TseTse suitability index, the sample is limited to 42 countries. The results are tested for robustness by considering the sub-sample of countries with which the IV-GMM model is estimated.

5.5 Results and Discussion

Before discussing the results of the empirical estimations, Figure 5.1 explores the correlation between the measurement of sub-national taxing rights – or the *Tax Assignment Index* – and key explanatory variables of interest. As it is shown, there is a positive correlation between the outcome variable and pre-colonial state centralization. Country size and mean ruggedness of terrain also display a positive correlation while the ethno-linguistic fragmentation by Desmet et al. (2012) does not hold any statistically significant linkage with sub-national governments' discretion over the tax system. The correlation between the average share of politically relevant ethnic groups between 1946 and 1970 and the Tax Assignment Index also does not stand out. However, the lower-right quadrant of Figure 5.1 suggests that the total average of natural resource rents between 1970-1975 is negatively correlated with modern-day taxing rights of lower-tier authorities, which corroborates the argument that natural resource endowments have the potential of fostering a more centralized tax system.

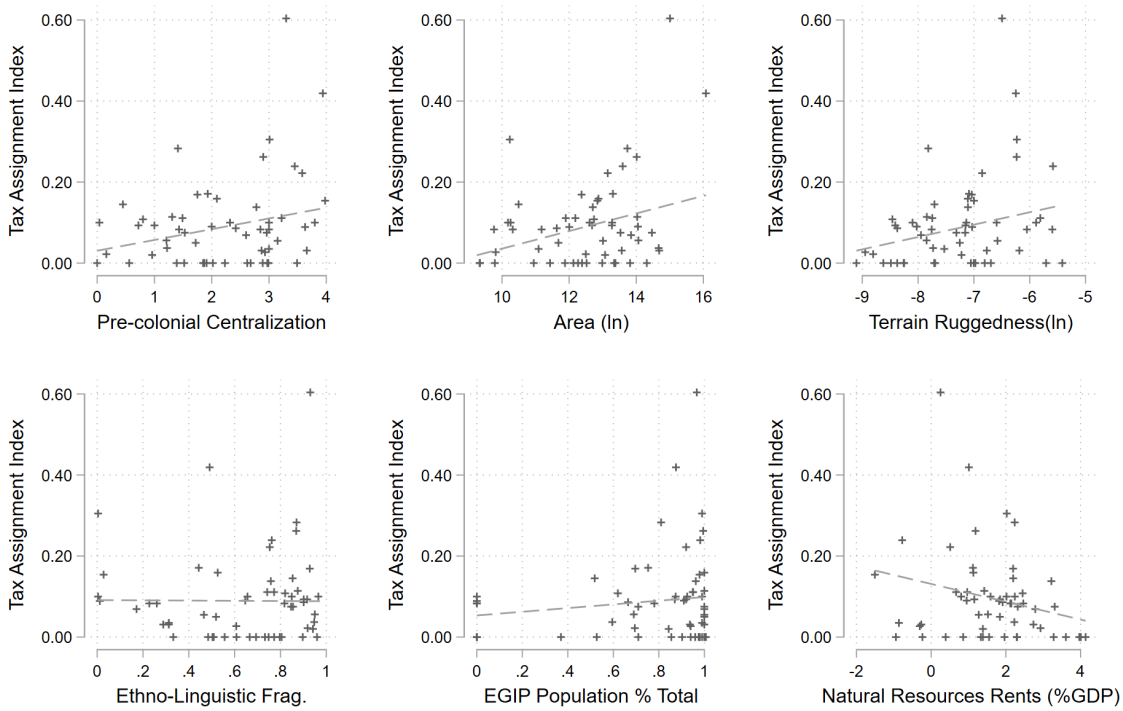
Empirical research on the linkages between pre-colonial institutions and state capacity has measured the latter through indicators of bureaucratic capacity of state officials (see for e.g. Broich et al., 2015). Indicators of bureaucratic capacity, or state capacity more generally, are often not dis-aggregated and fail to echo the capacity of sub-national authorities. Nevertheless, assuming that the level of tax decisions legally assigned to lower-tier governments in a country is a reflection of their capacity to raise taxes and rule over essential tax matters, then the correlation between pre-colonial state centralization and the Tax Assignment Index observed in Figure 5.1 would imply that:

(*i*) There is a correlation between bureaucratic capacity and sub-national governments' involvement in tax matters.

(*ii*) The relationship between pre-colonial centralization and bureaucratic capacity found in the existing literature partly carries within it the link between sub-national state capacity and pre-colonial state centralization.

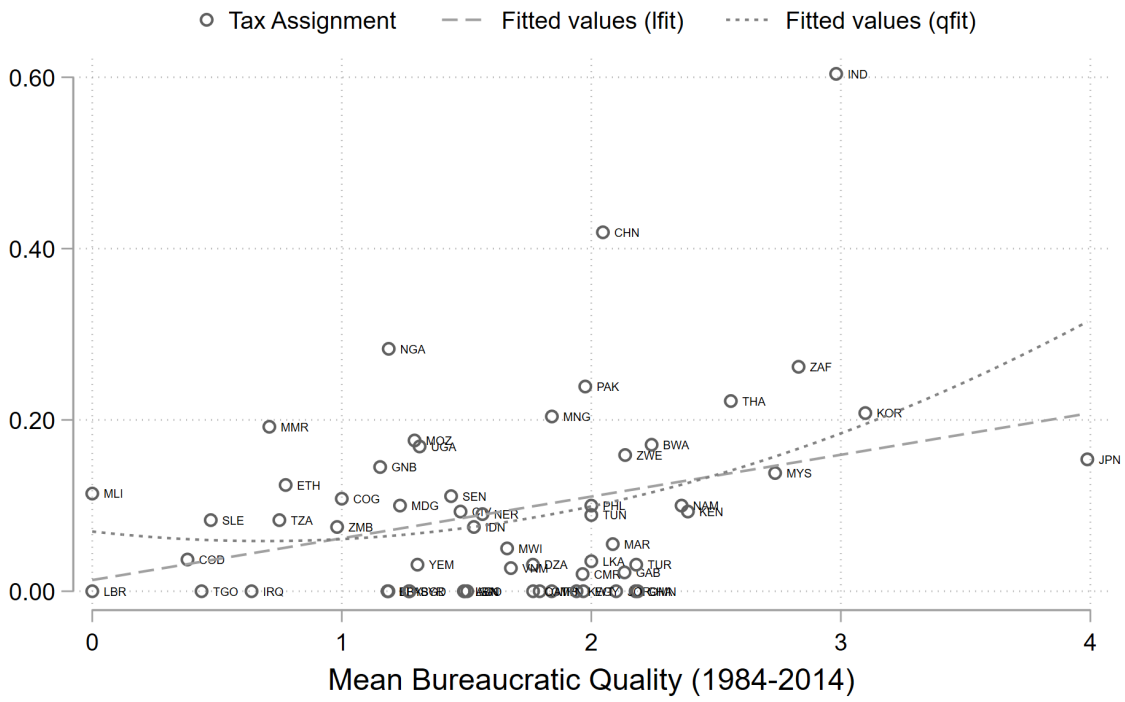
While the empirical framework does not include measurements of bureaucratic capacity, these assumptions are corroborated by the following figures. Figure 5.2 suggests that there is a positive correlation between the mean bureaucratic capacity (1984-2014) of countries and the measurement of sub-national governments' taxing rights as measured by the Tax Assignment Index. Figure 5.3 suggests that the pre-colonial state centralization variable is positively correlated with the mean

Figure 5.1: Crossplot of key determinants



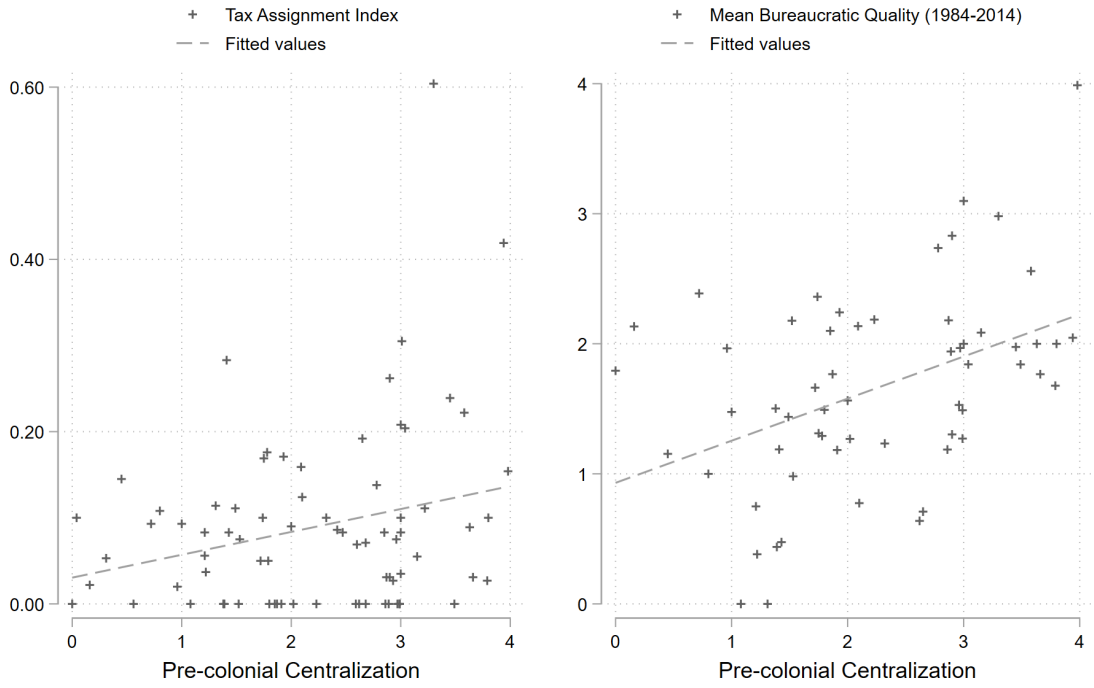
Notes: This figure shows the correlation between key explanatory variables and the proxy for sub-national taxing rights (or the *Tax Assignment Index*). Ethno-Linguistic Fragmentation is at the first aggregation level (thus implying a higher level of diversity. See Desmet et al. (2012) for further details). Natural resources rents are averaged over 1970 and 1975 and displayed in natural logarithm. EGIP Population % Total refers to the share of ethnic groups of political relevance as a percentage of the total population (See Girardin et al. (2015) for conceptual definition).

Figure 5.2: Bureaucratic Quality and Tax Assignment



Notes: This figure shows the correlation between the average bureaucratic quality of state institutions in countries in the sample and across the period of 1984 to 2014 and the level of sub-national taxing rights measured by the *Tax Assignment Index*. The measurement for bureaucratic quality is issued from the International Country Risk Guide dataset.

Figure 5.3: Pre-colonial Centralization, Tax Assignment and Bureaucratic Quality



Notes: This figure shows the correlation between pre-colonial centralization and the *Tax Assignment Index* on the one hand, and pre-colonial centralization and the average bureaucratic quality of countries in the sample on the other. The measurement for bureaucratic quality is issued from the International Country Risk Guide dataset.

bureaucratic capacity and sub-national governments' taxing rights. Although exploring the relationship between sub-national bureaucratic capacity and sub-national governments' discretion over taxation is beyond the scope of this research, this points to an important avenue for future research, more specifically on how pre-colonial and pre-modern institutions impact the modern-day capacity of lower-tier governments to tap onto their revenue sources.

5.5.1 Baseline Model

Table 5.1 reports the baseline cross-sectional OLS estimates. The sets of variables that capture ethno-linguistic diversity and polarization, spatial decay (country size, typical population density, terrain ruggedness, elevation, distance to the coast or sea-navigable river), ethnic bargaining power and territorial conflicts (averaged between 1946 and 1970), and natural resources' endowment (arable land and soil fertility) are included alongside the historical variables – namely the binary indicator the British colonial legacy, the characteristics of independence movement (violent or not) and the pre-colonial state centralization.

As described in subsection 5.3.1, the dependent variable – *Tax Assignment Index* – measures the discretionary power of sub-national government authorities over the tax system. In specifications (5*) and (6*), the index issued from the alternative scoring procedures – in which I account for the relevance for the relevance of intermediate level of governments in joint decisions with central authorities (such that $(C, I, L) = 2/3$ instead of $1/2$; see subsection 2.4.3 in chapter 2) – is used as the outcome variable.

The results, in all specifications, indicate a positive correlation between the pre-colonial state centralization and modern-day sub-central decision-making power over the tax system. It is also noted that larger countries and those with a higher mean of terrain ruggedness are more likely to grant a higher discretion over tax matters to sub-national governments. In contrast, countries that have experienced a violent independence, as expected, tend to have a more centralized tax structure.

The variables on ethnic diversity, territorial conflicts and the salience of ethnic relations fall short in explaining the current tax structure of countries in the sample. Hence, I see a mixed picture: some of the economic factors that have been emphasized in the previous research on fiscal federalism and decentralization come out as relevant here too, but not all of these factors hold up, while some historical features emphasized in this chapter appear highly relevant for explaining the level of sub-national taxing rights.

Table 5.1: Historical Path Dependence in Intergovernmental Tax Arrangements: Baseline Model - OLS Estimates

	(1)	(2)	(3)	(4)	(5*)	(6*)
Dependent Variable: Sub-national taxing rights (*Tax Assignment Index*)						
Pre-colonial Centralization	0.030**	0.035**	0.039***	0.043***	0.039***	0.043***
	(0.015)	(0.015)	(0.014)	(0.014)	(0.014)	(0.014)
British Legal Origin	0.062	0.053	0.037	0.033	0.037	0.032
	(0.038)	(0.037)	(0.038)	(0.030)	(0.038)	(0.030)
Violent independence	-0.067**	-0.066**	-0.071**	-0.076**	-0.071**	-0.075**
	(0.031)	(0.030)	(0.030)	(0.034)	(0.030)	(0.034)
Area (ln)	0.058***	0.055***	0.054***	0.039***	0.054***	0.039***
	(0.015)	(0.014)	(0.014)	(0.011)	(0.014)	(0.011)
Typical Population Density (ln)	0.031***	0.033***	0.022	0.013	0.022	0.013
	(0.011)	(0.012)	(0.015)	(0.013)	(0.015)	(0.013)
Terrain ruggedness within 100km (ln)[b]	0.087***	0.087***	0.079***	0.081***	0.079***	0.080***
	(0.027)	(0.027)	(0.028)	(0.030)	(0.028)	(0.030)
Elevation (ln)[b]	-0.057**	-0.062**	-0.067**	-0.066**	-0.067**	-0.066**
	(0.028)	(0.029)	(0.033)	(0.027)	(0.033)	(0.027)
Distance (km) to coast or navigable river(ln)[b]	0.016	0.020	0.022	0.028	0.022	0.028
	(0.018)	(0.019)	(0.028)	(0.026)	(0.028)	(0.026)
Ethno-linguistic Fragmentation (ln)[b]		0.049	0.073	0.047	0.072	0.046
		(0.077)	(0.083)	(0.083)	(0.083)	(0.083)
Polarization (ln)[b]		-0.039	-0.060	-0.037	-0.059	-0.036
		(0.074)	(0.081)	(0.080)	(0.081)	(0.080)
Arable land (%)			0.000	-0.000	0.000	-0.000
			(0.002)	(0.002)	(0.002)	(0.002)
Soil fertility			0.163	0.112	0.164	0.114
			(0.101)	(0.082)	(0.101)	(0.083)
EGIP Count[b]				0.008		0.008
				(0.008)		(0.008)
Territorial Conflicts[b]				0.180		0.180
				(0.220)		(0.221)
EGIP population with regional autonomy[b]				-0.021		-0.011
				(0.451)		(0.451)
Constant	-0.151	-0.094	-0.161	-0.063	-0.170	-0.071
	(0.214)	(0.213)	(0.255)	(0.249)	(0.256)	(0.251)
N Countries	76	76	76	74	76	74
R^2	0.49	0.50	0.52	0.59	0.52	0.59
Adj-R^2	0.40	0.39	0.40	0.45	0.40	0.45
AIC	-114.09	-111.60	-111.75	-111.69	-111.19	-111.19

Notes:

[a] Standard errors (in parentheses) are robust-clustered at the country level. Significance level: *p<0.10, **p<0.05, ***p<0.01. (*) implies that the indicator has been revised to account for the relevance of intermediate level of governments in joint decisions with central and local authorities (columns 5 and 6; see subsection 2.4.3 and Table 2.4 for methodological explanations and illustrations). Control variables include pre-colonial agro-technical level, pre-colonial asymmetric work distribution, and total years of independence (ln). Pre-colonial agro-technical level is negative and statistically significant, which somewhat echoes previous research on the reversal fortune of some countries, especially in Sub-Saharan Africa (Acemoglu et al., 2002; Huillery, 2009).

[b] Terrain ruggedness, elevation, distance to the nearest coast or navigable river are averaged at the country level. Ethno-linguistic fragmentation and polarization are at the first level of aggregation (Desmet et al., 2012). EGIP: ethnic groups of political relevance (see Girardin et al. (2015) for conceptual definitions). EGIP Count, Territorial Conflicts, and EGIP Population with regional autonomy are averaged over the period of 1946 to 1970 (see section 5.3).

Baseline with additional covariates

The baseline specifications in Table 5.1 are refined with the addition of an array of other control variables that capture the level of pre-colonial development and cultural features, as well as geographical and demographic characteristics. These include, for instance, the distance to the regional frontier in 1000 C.E., the population density in 1000 C.E., the percentage of lands in the tropics, the percentage of the population living in temperate zones, the percentage of Catholic in the 1980s (to further capture the legacy and cultural traits of colonizers), the predicted genetic homogeneity (adjusted for ancestry) from Ashraf and Galor (2013) as an alternative proxy for diversity. In addition, regional fixed effects are accounted for as a way to capture the likelihood of spatial spillovers in the design of fiscal institutions. Given that many neighbouring countries share the same primary colonizer and ethnic ties, public institutions which originate from colonial times or which are built upon ethnic and cultural preferences could have been set according to similar patterns.

The new results are reported in Table 5.2. The comparative statistics suggest an overall improvement of the models. The coefficient estimates on pre-colonial state centralization, country size (area), mean terrain ruggedness, and violent independence corroborate the results of the baseline model in Table 5.1. In particular, the coefficient estimates on pre-colonial state centralization are positive and increase both in magnitude and significance. Ethno-cultural diversity, the potential bargaining power of ethnic groups and natural resource endowments remain insignificant as in previous settings. In specifications (3) and (4), the ethno-linguistic fragmentation and polarization by Desmet et al. (2012) are substituted by the ones proposed by Alesina et al. (2003) on ethnic and religious fractionalization. The estimates do not vary much, nor the relevance of other key variables.

5.5.2 Estimations with Instrumental Variables (IV-GMM)

Table 5.3 presents the main results of the IV-GMM estimations. As discussed in section 5.4, the indicator of pre-colonial state centralization is instrumented with the ecological diversity index from Fenske (2014), the Neolithic transition timing from Ashraf and Galor (2013) and the Tsetse suitability index from Alsan (2015). The sample is, however, reduced to 42 countries due to the limited availability of observations for these instruments. Of the 42 countries, 5 are located in the Middle-East and North Africa, and 37 in Sub-Saharan Africa.

Table 5.2: Historical Path Dependence in Intergovernmental Tax Arrangements: Baseline Model with additional covariates – OLS Estimates

	(1)	(2*)	(3)	(4*)	(5)	(6*)
Dependent Variable: Sub-national taxing rights (*Tax Assignment Index*)						
Pre-colonial Centralization	0.059**	0.059**	0.066**	0.065**	0.059**	0.059**
	(0.025)	(0.025)	(0.029)	(0.029)	(0.025)	(0.025)
British Legal Origin	0.025	0.025	0.023	0.022	0.025	0.025
	(0.035)	(0.035)	(0.032)	(0.032)	(0.035)	(0.035)
Violent independence	-0.090**	-0.090**	-0.111***	-0.111***	-0.090**	-0.090**
	(0.039)	(0.039)	(0.041)	(0.041)	(0.039)	(0.039)
Area (ln)	0.046***	0.046***	0.055***	0.055***	0.046***	0.046***
	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)
Terrain ruggedness within 100km (ln)[b]	0.091***	0.091***	0.106***	0.105***	0.091***	0.091***
	(0.034)	(0.034)	(0.038)	(0.038)	(0.034)	(0.034)
Ethno-linguistic Fragmentation(ln)[b]	0.069	0.065			0.069	0.065
	(0.124)	(0.124)			(0.124)	(0.124)
Polarization (ln)[b]	-0.060	-0.057			-0.060	-0.057
	(0.119)	(0.119)			(0.119)	(0.119)
Ethnic Fractionalization (ln)[b]			0.015	0.013		
			(0.031)	(0.031)		
Religious Fractionalization (ln)[b]			-0.003	-0.002		
			(0.016)	(0.016)		
Arable land (%)	-0.000	-0.000	0.000	0.000	-0.000	-0.000
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Soil fertility	0.091	0.085	0.002	-0.002	0.091	0.085
	(0.110)	(0.109)	(0.102)	(0.102)	(0.110)	(0.109)
EGIP Count[b]	0.008	0.008	0.007	0.007		
	(0.007)	(0.007)	(0.008)	(0.008)		
Territorial Conflicts[b]	0.193	0.194	0.198	0.197		
	(0.214)	(0.214)	(0.211)	(0.211)		
EGIP population with regional autonomy[b]	-0.086	-0.077	-0.145	-0.135		
	(0.454)	(0.454)	(0.453)	(0.454)		
EGIP Count(2)[b]					0.008	0.008
					(0.007)	(0.007)
Territorial Conflicts(2)[b]					0.193	0.194
					(0.214)	(0.214)
EGIP population with regional autonomy(2)[b]					-0.086	-0.077
					(0.454)	(0.454)
Constant	0.538	0.535	0.856	0.851	0.538	0.535
	(0.615)	(0.617)	(0.631)	(0.632)	(0.615)	(0.617)
Regional FE	Yes	Yes	Yes	Yes	Yes	Yes
N Countries	72	72	71	71	72	72
R^2	0.63	0.64	0.65	0.65	0.63	0.64
Adj-R^2	0.42	0.42	0.45	0.45	0.42	0.42
AIC	-99.05	-98.81	-99.97	-99.72	-99.05	-98.81

Notes:

[a] Standard errors (in parentheses) are robust-clustered at the country level. Significance level: * p<0.10, **p<0.05, ***p<0.01. (*) implies that the indicator has been revised to account for the relevance of intermediate level of governments in joint decisions with central and local authorities (columns 2, 4, and 6; see subsection 2.4.3 and Table 2.4 for methodological explanations and illustrations). Control variables include: pre-colonial agro-technical level, pre-colonial asymmetric work distribution, and total years of independence (ln), typical population density, mean elevation, mean distance to the nearest coast or navigable river (km), percentage of catholic in the 1980s, genetic homogeneity(ancestry adjusted), % land in the tropics, % population in temperate zones, population density in 1000 C.E. (ln), distance to regional frontier in 1000 C.E. (ln). Regional FE account for the regional location of countries (Sub-Saharan Africa, Middle East and North Africa, base=Other).

[b] Terrain ruggedness is averaged at the country level. Ethno-linguistic fragmentation and polarization are at the first level of aggregation (Desmet et al., 2012). Columns (3) and (4) include the Alesina et al. (2003)'s measures of ethnic and religious fractionalization. EGIP: ethnic groups of political relevance (see Girardin et al. (2015) for conceptual definition). EGIP: ethnic groups of political relevance (see Girardin et al. (2015) for conceptual definitions). EGIP Count, Territorial Conflicts, and EGIP Population with regional autonomy are averaged over the period of 1946 to 1970 (see section 5.3), except in columns (5) and (6) in which they are averaged over the period of 1946 to 1960.

Based on the two standard criteria for a valid instrument (Greene, 2017), the first-stage results and comparative statistics suggest that the instruments are valid. First, the coefficient estimates are jointly statistically significant (relevance); the rejection of the null hypothesis LM test statistic for under-identification also corroborates the relevance of the instruments. Second, the p-value of the Hansen-J test implies that the instruments have met the over-identification criteria and are thus valid in this context.

Table 5.3: Historical Path Dependence in Intergovernmental Tax Arrangements: IV-GMM Estimates

	(1)	(2*)	(3)	(4*)
Dependent Variables: Sub-national taxing rights (*Tax Assignment Index*)				
Pre-colonial Centralization	0.142***	0.142***	0.073**	0.074**
	(0.038)	(0.038)	(0.033)	(0.034)
Violent independence	-0.152***	-0.152***	-0.131***	-0.131***
	(0.026)	(0.026)	(0.027)	(0.027)
Area (ln)	0.074***	0.074***	0.056***	0.057***
	(0.019)	(0.020)	(0.017)	(0.017)
Terrain ruggedness index within 100km (ln)	0.164***	0.165***	0.179***	0.181***
	(0.031)	(0.031)	(0.030)	(0.031)
Territorial Conflicts	0.517***	0.514***	0.532***	0.528***
	(0.104)	(0.105)	(0.097)	(0.099)
EGIP population with regional autonomy	-1.101***	-1.106***	-0.819***	-0.821***
	(0.197)	(0.200)	(0.207)	(0.208)
Constant	2.061***	2.073***	2.814***	2.840***
	(0.471)	(0.475)	(0.896)	(0.906)
Regional FE	Yes	Yes	Yes	Yes
First-Stage				
Ecological Diversity	2.167**	2.167**	1.555*	1.555*
	(1.007)	(1.007)	(0.871)	(0.871)
TseTse Suitability Index	0.086	0.086	0.433*	0.433*
	(0.238)	(0.238)	(0.202)	(0.202)
Neolithic Transition Timing (ln)	-0.914	-0.914	-1.906**	-1.906**
	(1.038)	(1.038)	(0.756)	(0.756)
N Countries	42	42	42	42
R^2 *(second-stage)*	0.90	0.90	0.90	0.90
Adj-R^2 *(second-stage)*	0.74	0.73	0.75	0.75
AIC	-92.50	-91.95	-94.74	-94.13
Hansen J (*p-value*)	0.36	0.36	0.34	0.35
Under-identification (*p-value*)	0.03	0.03	0.03	0.03

Notes: Standard errors (in parentheses) are robust-clustered at the country level. Significance level: * p<0.10, **p<0.05, ***p<0.01. (*) implies that the indicator has been revised to account for the relevance of intermediate level of governments in joint decisions with central and local authorities (columns 2 and 4; see subsection 2.4.3 and Table 2.4 for methodological explanations and illustrations). Control variables (also included in the first-stage regressions) include: pre-colonial agro-technical level, pre-colonial asymmetric work distribution, and total years of independence (ln), typical population density, mean elevation, mean distance to the nearest coast or navigable river(km), arable land, soil fertility, EGIP Count (number of ethnic groups of political relevance), percentage of catholic in the 1980s, genetic homogeneity (ancestry adjusted), ethno-linguistic fragmentation and polarization at the first level of aggregation from Desmet et al. (2012), % land in the tropics, % population in temperate zones, population density in 1000 C.E. (ln), distance to regional frontier in 1000 C.E. (ln). EGIP Count, Territorial Conflicts, and EGIP Population with regional autonomy are averaged over the period of 1946 to 1970. Regional FE account for the regional location of countries (Sub-Saharan Africa, Middle East and North Africa, base=Other).

The coefficient estimates on the key variables of interest are consistent with the

previous OLS estimates. The results confirm that there is a positive and statistically significant impact of pre-colonial state centralization on the current level of sub-central taxing powers. They also corroborate that sub-central authorities in countries that have experienced violent independence movements tend to have a lower discretionary power over tax matters. In contrast, the mean ruggedness of terrain and country size lead to a much higher discretion. Unlike with the full sample (Table 5.2), the average number of groups with regional autonomy between 1946-1970 is associated with a lower level of sub-national governments' discretion over tax matters in modern days, whereas the average number of territorial conflicts in 1946-1970 appears to have positively shaped the distribution of power between the upper and lower levels of governments.

Table 5.4: Historical Path-Dependence in Intergovernmental Tax Arrangements: OLS estimates using sub-sample from IV-GMM estimations (Table 5.3)

	(1)	(2*)
Dependent Variables: Sub-national taxing rights (*Tax Assignment Index*)		
Pre-colonial Centralization	0.076**	0.077**
	(0.036)	(0.036)
Violent independence	-0.130***	-0.130***
	(0.038)	(0.038)
Area (ln)	0.053*	0.054*
	(0.029)	(0.029)
Terrain ruggedness index within 100km (ln)	0.172***	0.172***
	(0.044)	(0.044)
Territorial Conflicts	0.571***	0.569***
	(0.159)	(0.161)
EGIP population with regional autonomy	-1.031***	-1.033***
	(0.317)	(0.321)
Constant	1.920***	1.933***
	(0.706)	(0.713)
Regional FE	Yes	Yes
N Countries	42	42
R^2	0.92	0.92
Adj-R^2	0.79	0.79
AIC	-102.65	-101.82

Notes: Standard errors (in parentheses) are robust-clustered at the country level. Significance level: * p<0.10, **p<0.05, ***p<0.01. (*) implies that the indicator has been revised to account for the relevance of intermediate level of governments in joint decisions with central and local authorities (column 2; see subsection 2.4.3 and Table 2.4 for methodological explanations and illustrations). Control variables (also included in the first-stage regressions) include: pre-colonial agro-technical level, pre-colonial asymmetric work distribution, and total years of independence (ln), typical population density, mean elevation, mean distance to coast or navigable river(km), arable land, soil fertility, EGIP Count (number of ethnic groups of political relevance; see Girardin et al. (2015) for conceptual definition), percentage of catholic in the 1980s, genetic homogeneity (ancestry adjusted), ethno-linguistic fragmentation and polarization at the first level of aggregation from Desmet et al. (2012), % land in the tropics, % population in temperate zones, population density in 1000 C.E. (ln), distance to regional frontier in 1000 C.E. (ln). EGIP Count, Territorial Conflicts, and EGIP Population with regional autonomy are averaged over the period of 1946 to 1970. Regional FE is a dummy variable referring to countries not located in Sub-Saharan Africa (approximately 11% of the sub-sample).

To test the sensitivity of the IV-GMM results to the changes in sample size,

specifications (4) and (6) of Table 5.2 are re-estimated using the sub-sample of countries in the IV-GMM model. The findings, reported in Table 5.4, are in line with the results of Table 5.3, implying that for the sub-group of African and Middle-Eastern countries, there is a positive impact of pre-colonial state centralization, violent independence, country size (area), and mean terrain ruggedness on the current level of taxing powers of lower-tier authorities. In addition, the average number of groups with regional autonomy between 1946-1970 and the number of territorial conflicts throughout the same period do have, respectively, a positive and a negative effect on lower-tier governments' discretion on taxing issues.

5.5.3 Sub-national Discretion over Tax administration and Tax Rates

As an alternative to the overall *Tax Assignment Index*, I explore, using the larger sample of countries, the effects of the key explanatory variables on different decision dimensions – namely the sub-national governments' discretion over tax administration and the setting of tax rates.

Columns (1.1) to (1.2) of Table 5.6 report the estimates using OLS regressions on the larger sample of countries. While the significance or direction of other key variables fluctuates, pre-colonial state centralization remains statistically significant in all models and trumps all other parameters. Hence, sub-national governments in countries with a higher pre-colonial state centralization appear to have greater discretionary power over tax administration and the settings of tax rates. The mean ruggedness of terrain, as in previous estimates, also yields a positive correlation with the ability of lower-tier authorities to be involved in tax administration and the setting of tax rates.

In columns (2.1) to (2.4), I report the estimates using the IV-GMM specification and the reduced sample of 42 African and Middle-Eastern countries. The instrumental variables are unchanged. As with previous models, it is shown that the level of pre-colonial state centralization, country size, mean ruggedness of terrain and the violence of independence movement all significantly impact on the current level of subnational governments' discretion over tax administration and tax rates. The instrumental variables satisfy the criteria of relevance and over-identification on a 95% confidence interval. The LM test statistic for under-identification also corroborates the relevance of the instruments.

Table 5.5: Historical Path Dependence in Intergovernmental Tax Arrangements: Sub-national Discretion over Tax Administration and Tax Rates

	OLS				IV-GMM			
	(1.1)	(1.2*)	(1.3)	(1.4*)	(2.1)	(2.2*)	(2.3)	(2.4*)
Dependent Variables: Tax [...] Assignment	Administration		Rates		Administration		Rates	
Pre-colonial Centralization	0.083**	0.083**	0.084**	0.084**	0.313***	0.314***	0.162**	0.162**
	(0.037)	(0.038)	(0.036)	(0.036)	(0.110)	(0.111)	(0.066)	(0.066)
Violent independence	-0.041	-0.039	-0.116**	-0.115**	-0.175**	-0.174**	-0.235***	-0.237***
	(0.059)	(0.060)	(0.049)	(0.049)	(0.074)	(0.075)	(0.045)	(0.045)
Area (ln)	0.043	0.044	0.045**	0.045**	0.156***	0.159***	0.051**	0.051**
	(0.028)	(0.028)	(0.021)	(0.021)	(0.050)	(0.051)	(0.025)	(0.025)
Terrain ruggedness within 100km (ln)	0.082*	0.081*	0.112**	0.111**	0.348***	0.351***	0.126***	0.127***
	(0.048)	(0.049)	(0.042)	(0.043)	(0.075)	(0.076)	(0.047)	(0.048)
Constant	0.061	0.056	0.679	0.674	4.685***	4.700***	1.724**	1.755**
	(0.953)	(0.954)	(0.738)	(0.739)	(1.259)	(1.276)	(0.798)	(0.801)
Regional FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First-Stage								
Ecological Diversity					2.167**	2.167**	2.167**	2.167**
					(1.007)	(1.007)	(1.007)	(1.007)
TseTse Suitability Index					0.086	0.086	0.086	0.086
					(0.238)	(0.238)	(0.238)	(0.238)
Neolithic Transition Timing (ln)					-0.914	-0.914	-0.914	-0.914
					(1.038)	(1.038)	(1.038)	(1.038)
N Countries	72	72	72	72	42	42	42	42
R^2 *(second-stage)*	0.56	0.57	0.61	0.61	0.60	0.60	0.88	0.88
Adj-R^2 *(second-stage)*	0.31	0.32	0.38	0.38	-0.03	-0.04	0.69	0.68
AIC	-31.89	-31.49	-61.75	-61.22	-11.57	-10.87	-60.63	-60.03
Hansen J (*p-value*)					0.07	0.07	0.97	0.96
Under-identification*(p-value)*					0.03	0.03	0.03	0.03

Notes: Standard errors (in parentheses) are robust-clustered at the country level. Significance level: * p<0.10, **p<0.05, ***p<0.01. (*) implies that the indicator has been revised to account for the relevance of intermediate level of governments in joint decisions with central and local authorities (columns (1.2), (1.4), (2.2), and (2.4); see subsection 2.4.3 and Table 2.4 for methodological explanations and illustrations). Control variables (also included in the first-stage regressions) include: pre-colonial agro-technical level, pre-colonial asymmetric work distribution, and total years of independence (ln), typical population density, mean elevation, mean distance to the nearest coast or navigable river(km), arable land, soil fertility, EGIP Count (number of ethnic groups of political relevance), percentage of catholic in the 1980s, genetic homogeneity (ancestry adjusted), ethno-linguistic fragmentation and polarization at the first level of aggregation from Desmet et al. (2012), % land in the tropics, % population in temperate zones, population density in 1000 C.E. (ln), distance to regional frontier in 1000 C.E. (ln). EGIP Count, Territorial Conflicts, and EGIP Population with regional autonomy are averaged over the period of 1946 to 1970. Regional FE account for the regional location of countries (Sub-Saharan Africa, Middle East and North Africa, base=Other).

5.5.4 Further Sensitivity Analyses

The Relevance of Natural Resources Rents (as % of GDP between 1970 and 1975)

The explanatory power of soil fertility and arable land as a percentage of total land remained unnoticed and not statistically significant in previous results tables (see Table 5.1, Table 5.2, and Table 5.3). As an alternative to those variables, I re-estimate the specifications of columns (4) and (6) of Table 5.2 using the total average of natural resources rents as a percentage of GDP across the time period of 1970-1975.

While this variable might trigger some spurious correlations, it is noted that the indicators on pre-colonial state centralization and violent independence have retained their direction and significance for their linkages to the level of sub-national governments' taxing rights. As previously hinted by Figure 5.1, the negative correlation between the average natural resources rents and the degree of discretion granted to sub-national authorities is corroborated in these regressions and therefore supports the hypothesis that the need for central authorities to mobilize revenues from natural resources may have fostered more centralized tax systems in the country sample.

The Relevance of Socialist Regimes and Institutions between 1946 and 1990

As stated in subsection 5.3.2, the aftermath of World Word II and the more recent history of countries could have contributed to change the structure of fiscal institutions. More specifically, institutions that were devised or reformed under socialist regimes between 1946 and 1990 could have not only altered the legacy of pre-colonial and post-independence institutions but also shaped inter-governmental relations which emerged in the 1990s and persisted until today. In other words, the existence of socialist institutions in recent history could invalidate the hypotheses on the persistence of colonial and post-colonial institutions.

Hence, in further sensitivity analyses, I test whether countries which have experienced a socialist regime throughout 1946 and 1990 have a more centralized fiscal regime in current days. As previously stated, the data on socialist states are compiled from various sources (Ottaway, 1987; Schmid, 1992; Kornai, 1992; Kornai et al., 2001; Guo, 2006). The results are reported in Table 5.7 and are constituent with previous findings. The existence of a socialist regime in recent history falls short in explaining the current inter-governmental fiscal arrangements. In contrast, the persistence of pre-

Table 5.6: Historical Path-Dependence in Intergovernmental Tax Arrangements: OLS Estimates, with Natural Resources Rents (%GDP, 1970-1975)

	(1)	(2*)
Dependent Variables: Sub-national taxing rights (*Tax Assignment Index*)		
Pre-colonial Centralization	0.070***	0.071***
	(0.023)	(0.023)
British Legal Origin	-0.016	-0.017
	(0.044)	(0.044)
Violent independence	-0.092**	-0.092**
	(0.040)	(0.040)
Area (ln)	0.023	0.023
	(0.019)	(0.019)
Terrain ruggedness within 100km(ln)	0.054	0.053
	(0.033)	(0.033)
Natural Resources Rents (%GDP)	-0.053***	-0.054***
	(0.011)	(0.011)
Constant	-0.059	-0.075
	(0.637)	(0.630)
Regional FE	Yes	Yes
Observations	58	58
R^2	0.83	0.84
Adj-R^2	0.68	0.69
AIC	-104.46	-105.12

Notes: Standard errors (in parentheses) are robust-clustered at the country level. Significance level: * p<0.10, **p<0.05, ***p<0.01. (*) implies that the indicator has been revised to account for the relevance of intermediate level of governments in joint decisions with central and local authorities (columns 2 and 4; see subsection 2.4.3 and Table 2.4 for methodological explanations and illustrations). Control variables (also included in the first-stage regressions) include: pre-colonial agro-technical level, pre-colonial asymmetric work distribution, and total years of independence (ln), typical population density, mean elevation, mean distance to the nearest coast or navigable river(km), arable land, soil fertility, EGIP Count (number of ethnic groups of political relevance), percentage of catholic in the 1980s, genetic homogeneity (ancestry adjusted), ethno-linguistic fragmentation and polarization at the first level of aggregation from Desmet et al. (2012), % land in the tropics, % population in temperate zones, population density in 1000 C.E. (ln), distance to regional frontier in 1000 C.E. (ln). EGIP Count, Territorial Conflicts, and EGIP Population with regional autonomy are averaged over the period of 1946 to 1970. Regional FE account for the regional location of countries (Sub-Saharan Africa, Middle East and North Africa, base=Other).

Table 5.7: Historical Path-Dependence in Intergovernmental Tax Arrangements: OLS Estimates, with Dummy for the Former Socialist States

	(1)	(2*)
Dependent Variables: Sub-national taxing rights (*Tax Assignment Index*)		
Pre-colonial Centralization	0.060**	0.060**
	(0.026)	(0.026)
British Legal Origin	0.025	0.024
	(0.036)	(0.036)
Violent independence	-0.091**	-0.090**
	(0.039)	(0.039)
Area (ln)	0.046***	0.046***
	(0.016)	(0.016)
Terrain ruggedness within 100km (ln)	0.093***	0.092***
	(0.034)	(0.034)
Socialist State between 1946-1990	-0.013	-0.013
	(0.035)	(0.035)
Constant	0.553	0.550
	(0.615)	(0.617)
Regional FE	Yes	Yes
N Countries	72	72
R^2	0.64	0.64
Adj-R^2	0.41	0.41
AIC	-97.29	-97.04

Notes: Standard errors (in parentheses) are robust-clustered at the country level. Significance level: * p<0.10, **p<0.05, ***p<0.01. (*) implies that the indicator has been revised to account for the relevance of intermediate level of governments in joint decisions with central and local authorities (columns 2 and 4; see subsection 2.4.3 and Table 2.4 for methodological explanations and illustrations). Control variables (also included in the first-stage regressions) include: pre-colonial agro-technical level, pre-colonial asymmetric work distribution, and total years of independence (ln), typical population density, mean elevation, mean distance to the nearest coast or navigable river(km), arable land, soil fertility, EGIP Count (number of ethnic groups of political relevance), percentage of catholic in the 1980s, genetic homogeneity (ancestry adjusted), ethno-linguistic fragmentation and polarization at the first level of aggregation from Desmet et al. (2012), % land in the tropics, % population in temperate zones, population density in 1000 C.E. (ln), distance to regional frontier in 1000 C.E. (ln). EGIP Count, Territorial Conflicts, and EGIP Population with regional autonomy are averaged over the period of 1946 to 1970. Social State is a binary indicator for countries that had a socialist regime between 1946 and 1990. Regional FE account for the regional location of countries (Sub-Saharan Africa, Middle East and North Africa, base=Other).

colonial state centralization, country size, mean terrain ruggedness and the type of independence in explaining the level of sub-national governments taxing rights in modern times remains evident.

5.6 Conclusion

This chapter brings evidence on the deep-rooted economic, cultural and historical factors that shape multi-layer tax institutions across countries. More specifically, I set up an econometric framework aimed at explaining the current level of sub-national governments' discretion over tax matters in a sample of broadly 76 countries located in Africa, the Middle-East, Central and East-Asia.

The analytical framework in this chapter is built around two main strands of the literature. The first one relates to the cost-benefit analysis of decentralization and decentralized institutions. The second strand of literature takes on a more comprehensive approach and explores the intergovernmental tax arrangements through the lens of countries' historical trajectories.

Sub-national governments' taxing rights are proxied by the new *Tax Assignment Index* developed as part of this dissertation and discussed in chapter 2. The index is computed with information from the new cross-country comparative database on multi-layer tax arrangements. This indicator captures the extent to which lower-tier authorities (intermediate and local) are involved in a broad range of decisions regarding taxation. In addition to that indicator, the empirical framework also draws on specific dimensions such as the discretion of lower-tier authorities over the setting of tax rates and tax administration.

The empirical findings point to a historical path dependence in the intergovernmental tax arrangements. Using both OLS and IV-GMM models, I find a significant effect of pre-colonial state centralization on modern-day sub-national control over the tax system. These results are robust to an array of control variables, including regional dummies, that capture the potential spillovers in the design of fiscal institutions. In addition, I find that the path out of colonization also matters: countries that have experienced a violent independence movement tend to have a more centralized tax structure. This result also points to the relevance of historical experiences. Furthermore, sensitivity analyses confirm the predominance of pre-colonial institutions and the type of independence over post-World War II institutional reforms under socialist regimes. The legal origin of the colonizer, proxied by a binary

variable for former British colonies, yields no significant impact on the current design of intergovernmental tax institutions.

Regarding the conventional determinants of the level of decentralization, as suggested by the existing literature and which I describe as "economic" in the analytical framework, the results reveal that larger countries and those with a higher mean of terrain ruggedness tend to have a more decentralized tax system. In a sub-sample of African and Middle-East countries, estimates with IV-GMM corroborate these findings.

Yet, unlike the predominant view, variables that account for ethno-cultural diversity fall short as determinants of intergovernmental tax arrangements. Ethnic bargaining power and interactions also fall short with the full sample of countries. Notwithstanding, in a sub-sample of 42 African and Middle-Eastern countries where the number of ethnic groups with regional autonomy and the salience of territorial conflicts throughout 1946-70 appear to have influenced the current level of taxing rights granted to sub-national authorities.

The most striking finding of the chapter is perhaps that pre-colonial centralization, consistently throughout all specifications, has a strong explanatory power when it comes to present-day fiscal arrangements. Graphical analysis suggests that the average bureaucratic quality at the country-level between 1980 and 2014, and the level of sub-national taxing rights, go hand in hand, and that both indicators appear to be driven by the level of pre-colonial state centralization. This chapter, therefore, points to interesting avenues for research, not only on sub-national bureaucratic capacity and its relevance in taxing matters but also on how pre-colonial institutions are linked to the capacity of modern-day local governments to enforce fiscal rules and effectively raise revenues.

Bibliography

Acemoglu, D. (2006). A Simple Model of Inefficient Institutions. *Scandinavian Journal of Economics 108*(4), 515–546.

Acemoglu, D., S. H. Johnson, and J. A. Robinson (2001). An African Success Story: Botswana. Cambridge, MA.

Acemoglu, D., S. H. Johnson, and J. A. Robinson (2002). Reversal of Fortune: Geography and Institutions in the Making of the Modern World Income Distribution. *The Quarterly Journal of Economics 117*(4), 1231–1294.

Acemoglu, D. and J. A. Robinson (2008a). Persistence of Power, Elites, and Institutions. *American Economic Review 98*(1), 267–293.

Acemoglu, D. and J. A. Robinson (2008b). The Persistence and Change of Institutions in the Americas. *Southern Economic Journal 75*(2), 282–299.

Alesina, A., A. Devleeschauwer, W. Easterly, S. Kurlat, and R. Wacziarg (2003). Fractionalization. *Journal of Economic Growth 8*(2), 155–194.

Alesina, A. and E. Spolaore (1997). On the Number and Size of Nations. *The Quarterly Journal of Economics 112*(4), 1027–1056.

Ali, M., O.-H. Fjeldstad, B. Jiang, and A. B. Shifa (2018). Colonial Legacy, State-building and the Salience of Ethnicity in Sub-Saharan Africa. *The Economic Journal 101*(7), 1048–1081.

Alsan, M. (2015). The Effect of the TseTse Fly on African Development. *American Economic Review 105*(1), 382–410.

Ambrosanio, F. and M. Bordignon (2015). Normative versus positive theories of revenue assignments in federations. In E. Ahmad and G. Brosio (Eds.), *Handbook of multilevel finance*, pp. 231–263. Cheltenham: Edward Elgar.

Archibong, B. (2019). Explaining divergence in the long-term effects of precolonial centralization on access to public infrastructure services in Nigeria. *World Development 121*, 123–140.

Arzaghi, M. and J. V. Henderson (2005). Why countries are fiscally decentralizing. *Journal of Public Economics 89*(7), 1157–1189.

Ashraf, Q. and O. Galor (2013). The 'Out of Africa' Hypothesis, Human Genetic Diversity, and Comparative Economic Development. *American Economic Review 103*(1), 1–46.

Bates, R. H. (1983). *Essays on the political economy of rural Africa* (1st ed.), Volume 8 of *California series on social choice and political economy*. Berkeley: University of California Press.

Baum, C. F., M. E. Schaffer, and S. Stillman (2003). Instrumental variables and GMM: Estimation and testing. *The Stata Journal 3*(1), 1–31.

Bird, R. M. (1999). Rethinking Subnational Taxes: A New Look at Tax Assignment. Washington DC, USA.

Blanton, R., T. D. Mason, and B. Athow (2001). Colonial Style and Post-Colonial Ethnic Conflict in Africa. *Journal of Peace Research 38*(4), 473–491.

Bockstette, V., A. Chanda, and L. Putterman (2002). States and Markets: The Advantage of an Early Start. *Journal of Economic Growth 7*(4), 347–369.

Bodman, P. and A. Hodge (2010). What Drives Fiscal Decentralisation? Further Assessing the Role of Income. *Fiscal Studies 31*(3), 373–404.

Broich, T., A. Szirmai, and K. Thomsson (2015). Precolonial centralisation, foreign aid and modern state capacity in Africa. Maastricht, NL.

Caldeira, E. (2011). *Essays on Decentralization in Developing Countries*. Ph. D. thesis, Université d'Auvergne, Clermont-Ferrand 1, Clermont-Ferrand, France.

Caldeira, E. and G. Rota-Grasiozi (2014). The Crowding-in Effect of Simple Unconditional Central Grants on Local Own-Source Revenue: The Case of Benin. *Journal of African Economies 23*(3), 1–27.

Campbell, H. F. (2003). Are Culturally Diverse Countries More Fiscally Decentralized? In H. Bloch (Ed.), *Growth and Development in the Global Economy*. Cheltenham: Edward Elgar Publishing.

Canavire-Bacarreza, G., J. Martinez-Vazquez, and B. Yedgenov (2017). Reexamining the determinants of fiscal decentralization: what is the role of geography? *Journal of Economic Geography 17*(6), 1209–1249.

Chambas, G. and F. Audras (2012). Comments and Concrete Ways forward. In B. Dafflon and T. Madiès (Eds.), *The Political Economy of Decentralization in Sub-Saharan Africa*, pp. 287–299. Washington DC, USA: The World Bank Group.

Chatry, I. and R. C. Vincent (2019). A global view of sub-national governments in Asia: Structure and finance. In OECD (Ed.), *Fiscal Decentralisation and Inclusive Growth in Asia*, OECD Fiscal Federalism Studies, pp. 27–57. Paris, France: OECD Publishing.

Christin, T. and S. Hug (2012). Federalism, the Geographic Location of Groups, and Conflict. *Conflict Management and Peace Science 29*(1), 93–122.

CID Harvard University (2001). Physical Factors.

Cornell, S. E. (2002). Autonomy as a Source of Conflict: Caucasian Conflicts in Theoretical Perspective. *World Politics 54*(02), 245–276.

Crowder, M. (1964). Indirect Rule—French and British Style. *Africa 34*(03), 197–205.

Dafflon, B. and T. Madiès (2012). *The Political Economy of Decentralization in Sub-Saharan Africa: A New Implementation Model in Burkina Faso, Ghana, Kenya, and Senegal*. Washington DC, USA: The World Bank Group.

de Juan, A. (2017). "Traditional" Resolution of Land Conflicts: The Survival of Precolonial Dispute Settlement in Burundi. *Comparative Political Studies 50*(13), 1835–1868.

Desmet, K., I. Ortuño-Ortín, and R. Wacziarg (2012). The political economy of linguistic cleavages. *Journal of Development Economics 97*(2), 322–338.

Diamond, J. (2002). Evolution, consequences and future of plant and animal domestication. *Nature 418*, 700–708.

Diouf, M. (2013). *Tolerance, Democracy, and Sufis in Senegal*. New York Chichester, West Sussex: Columbia University Press.

Dippel, C. (2014). Forced Coexistence and Economic Development: Evidence From Native American Reservations. *Econometrica 82*(6), 2131–2165.

Easterly, W. and R. Levine (1997). Africa's Growth Tragedy: Policies and Ethnic Divisions*. *The Quarterly Journal of Economics 112*(4), 1203–1250.

Eyraud, L. and L. Lusinyan (2011). Decentralizing Spending More than Revenue: Does It Hurt Fiscal Performance? Washington D.C., USA.

Fenske, J. (2014). Ecology, Trade, and States in Pre-Colonial Africa. *Journal of the European Economic Association 12*(3), 612–640.

Fjeldstad, O.-H. (2001). Taxation, coercion and donors: Local government tax enforcement in Tanzania. *The Journal of Modern African Studies 39*(02), 289–306.

Frankema, E. and M. van Waijenburg (2014). Metropolitan blueprints of colonial taxation? Lessons from fiscal capacity building in British and French Africa, c. 1880-1940. *The Journal of African History 55*(03), 371–400.

Gallup, J. L., J. D. Sachs, and A. D. Mellinger (1999). Geography and Economic Development. *International Regional Science Review 22*(2), 179–232.

Gennaioli, N. and I. Rainer (2007). The modern impact of precolonial centralization in Africa. *Journal of Economic Growth 12*(3), 185–234.

Girardin, L., P. Hunziker, L.-E. Cederman, N.-C. Bormann, and M. Vogt (2015). GROWup - Geographical Research On War, Unified Platform.

Greene, W. H. (2017). *Econometric analysis* (Eighth ed.). New York: Pearson.

Greif, A. (2006). Family Structure, Institutions, and Growth: The Origins and Implications of Western Corporations. *American Economic Review 96*(2), 308–312.

Guo, G. (2008). Vertical Imbalance and Local Fiscal Discipline in China. *Journal of East Asian Studies 8*(01), 61–88.

Guo, S. (2006). *The political economy of Asian transition from communism*. Transition and development. Aldershot: Ashgate.

Hale, H. E. (2004). Divided We Stand: Institutional Sources of Ethnofederal State Survival and Collapse. *World Politics 56*(02), 165–193.

Hayashi, F. (2000). *Econometrics*. Princeton and Oxford: Princeton University Press.

Hensel, P. R. (2014). ICOW Colonial History Data Set.

Hjort, J. (2010). Pre-colonial culture, post-colonial economic success? The Tswana and the African economic miracle. *The Economic History Review 63*(3), 688–709.

Huillery, E. (2009). History Matters: The Long-Term Impact of Colonial Public Investments in French West Africa. *American Economic Journal: Applied Economics 1*(2), 176–215.

Jones, P. (2013). History matters: New evidence on the long run impact of colonial rule on institutions. *Journal of Comparative Economics 41*(1), 181–200.

Kjaer, A. M. (2009). Sources of local government extractive capacity: The role of trust and pre-colonial legacy in the case of Uganda. *Public Administration and Development 29*(3), 228–238.

Kornai, J. (1992). *The Socialist System: The Political Economy of Communism*. Oxford: Oxford University Press.

Kornai, J., S. Haggard, and R. Kaufman (Eds.) (2001). *Reforming the state: Fiscal and welfare reform in post-socialist countries*. Cambridge: Cambridge University Press.

LaPorta, R., F. Lopez-de Silanes, A. Shleifer, and R. Vishny (1999). The Quality of Government. *Journal of Law, Economics and Organization 15*(1), 222–279.

Letelier, L. S. (2005). Explaining Fiscal Decentralization. *Public Finance Review 33*(2), 155–183.

Liberati, P. (2011). Which Tax or Which Tax for What? Tax Assignment in the Theory of Fiscal Federalism. *Public Finance Review 39*(3), 365–392.

Madiès, T., G. Rota-Grasiozi, J.-P. Tranchant, and C. Trépier (2018). The economics of secession: a review of legal, theoretical, and empirical aspects. *Swiss journal of economics and statistics 154*(1), 2–19.

Mamdani, M. (2018). *Citizen and subject: Contemporary Africa and the legacy of late colonialism* (New paperback ed.). Princeton studies in culture/power/history. Princeton New Jersey: Princeton University Press.

Martinez-Vazquez, J. (2015). Tax assignments at the regional and local levels. In E. Ahmad and G. Brosio (Eds.), *Handbook of Multilevel Finance*, pp. 358–388. Cheltenham: Edward Elgar Publishing.

McLure, C. E. (1994). Tax Assignment Problem: Ends, Means, and Constraints. *Australian Tax Forum 11*(2), 153–183.

McLure, C. E. (2001). The Tax Assignment Problem: Ruminations on How Theory and Practice Depend on History. *National Tax Journal 54*(2), 339–363.

Michalopoulos, S. and E. Papaioannou (2013a). National Institutions and Subnational Development in Africa. *The Quarterly Journal of Economics 129*(1), 151–213.

Michalopoulos, S. and E. Papaioannou (2013b). Pre-colonial Ethnic Institutions and Contemporary African Development. *Econometrica : journal of the Econometric Society 81*(1), 113–152.

Müller, H.-P. (1999). Atlas vorkolonialer Gesellschaften: Kulturelles Erbe und Sozialstrukturen der Staaten Afrikas, Asiens und Melanesiens ein ethnologisches Kartenwerk für 95 Länder, mit digitalem Buch, Datenbanken und Dokumentationen aud CD-ROM.

Musgrave, R. A. (1959). *The theory of public finance: A study in public economy*. New York: McGraw-Hill.

North, D. C. (1990). *Institutions, institutional change and economic performance*. Political economy of institutions and decisions. Cambridge: Cambridge University Press.

North, D. C. and B. R. Weingast (1989). Constitutions and Commitment: The Evolution of Institutions Governing Public Choice in Seventeenth-Century England. *The Journal of Economic History 49*(4), 803–832.

Nunn, N. and D. Puga (2010). Ruggedness: The Blessing of Bad Geography in Africa. *The Review of Economics and Statistics 94*(1), 20–36.

Oates, W. E. (1972). *Fiscal federalism*. The Harbrace series in business and economics. New York: Harcourt Brace Jovanovich.

Oates, W. E. (1977). *The Political economy of fiscal federalism*. Lexington, Mass.: Lexington Books.

Oates, W. E. (2005). Toward a second-generation theory of fiscal federalism. *International Tax and Public Finance 12*(4), 349–373.

OECD and UCLG (2019). 2019 Report on the World Observatory on Subnational Government Finance and Investment: Key Findings. Paris.

Osafo-Kwaako, P. and J. A. Robinson (2013). Political Centralization in Pre-Colonial Africa. *Journal of Comparative Economics 41*(1), 534–564.

Ottaway, M. S. (1987). The Crisis of the Socialist State in Africa. In Z. Ergas (Ed.), *The African State in Transition*, pp. 169–190. London: Palgrave Macmillan UK.

Panizza, U. (1999). On the determinants of fiscal centralization: Theory and evidence. *Journal of Public Economics 74*(1), 97–139.

Patsouratis, V. A. (1990). Fiscal Decentralization in the EEC Countries. *Public Finance = Finances publiques 45*(3), 423–439.

Prud'Homme, R. (1995). The dangers of decentralization. *The World Bank Research Observer 10*(2), 201–220.

Putterman, L. (2008). Agriculture, Diffusion and Development: Ripple Effects of the Neolithic Revolution. *Economica 75*(300), 729–748.

Robinson, J. A., D. Acemoglu, and S. H. Johnson (2001). The Colonial Origins of Comparative Development: An Empirical Investigation. *American Economic Review 91*, 1369–1401.

Rodden, J. (2002). The Dilemma of Fiscal Federalism: Grants and Fiscal Performance around the World. *American Journal of Political Science 46*(3), 670.

Rodden, J. (2006). *Hamilton's paradox: The promise and peril of fiscal federalism*. Cambridge University Press.

Rodden, J., G. S. Eskeland, and J. I. Litvack (2003). *Fiscal decentralization and the challenge of hard budget constraints*. Cambridge, Mass. and London: MIT Press.

Sambanis, N. and B. Milanovic (2014). Explaining Regional Autonomy Differences in Decentralized Countries. *Comparative Political Studies 47*(13), 1830–1855.

Schmid, A. A. (1992). Legal Foundations of the Market: Implications for the Formerly Socialist Countries of Eastern Europe and Africa. *Journal of Economic Issues 26*(3), 707–732.

Sokoloff, K. L. and S. L. Engerman (2000). History Lessons: Institutions, Factor Endowments, and Paths of Development in the New World. *Journal of Economic Perspectives 14*(3), 217–232.

Suberu, R. T. (2001). *Federalism and ethnic conflict in Nigeria*. Washington, D.C. and Great Britain: United States Institute of Peace Press.

Teorell, J., S. Dahlberg, S. Holmberg, B. Rothstein, N. Alvarado Pachon, and R. Svensson (2018). QoG Standard Dataset 2018. Gothenburg, Sweden.

Tiebout, C. M. (1956). A Pure Theory of Local Expenditures. *Journal of Political Economy 64*(5), 416–424.

University of Zurich (Access: 2017). World Development.

Vogt, M., N.-C. Bormann, S. Rüegger, L.-E. Cederman, P. Hunziker, and L. Girardin (2015). Integrating data on ethnicity, geography, and conflict: The ethnic power relations data set family. *Journal of Conflict Resolution 59*(7), 1327–1342.

Wallis, J. J. and W. E. Oates (1988). Decentralization in the public sector: An empirical study of state and local government. In H. S. Rosen (Ed.), *Fiscal federalism*, A National Bureau of Economic Research project report, pp. 5–32. Chicago and London: University of Chicago Press.

Walter, B. F. (2006). Information, Uncertainty, and the Decision to Secede. *International Organization 60*(1), 105–135.

Wantchekon, L. (2003). Clientelism and Voting Behavior: Evidence from a Field Experiment in Benin. *World Politics 55*(3), 399–422.

Wantchekon, L. and C. Vermeersch (2011). Information, Social Networks, and the Demand for Public Goods: Experimental Evidence from Benin. In S. Odugbemi and T. Lee (Eds.), *Accountability through public opinion*, pp. 123–135. Washington, D.C.: World Bank.

Watts, R. L. (1999). *Comparing federal systems* (2nd ed.). Montreal: School of Policy Studies, Queen's University.

APPENDIX: CHAPTER 5

Table A5.1: Variables Description and Data Sources

VARIABLES	DESCRIPTION & DATA SOURCES
Tax Assignment Index	Proxy for Sub-national Taxing Rights. *Data Source:* Author's
Tax Assignment Index (*)	Proxy for Sub-national Taxing Rights. *Data Source:* Author's
Tax Administration Assignment	Proxy for Sub-national Discretion on Tax Administration. *Data Source:* Author's
Tax Administration Assignment (*)	Proxy for Sub-national Discretion on Tax Administration. *Data Source:* Author's
Tax Rate Assignment	Proxy for Sub-national Discretion on Tax Rates. *Data Source:* Author's
Tax Rate Assignment (*)	Proxy for Sub-national Discretion on Tax Rates. *Data Source:* Author's
Pre-colonial Centralization	Measurement of Pre-colonial State Centralization. *Data Source:* Atlas of precolonial Societies (Müller, 1999)
Pre-colonial Agro-technical level	Measurement of Pre-colonial Agro-technical level. *Data Source:* Atlas of precolonial Societies (Müller, 1999)
Pre-colonial Asymmetric Work Distribution	Measurement of gender differences in work distribution. *Data Source:* Atlas of precolonial Societies (Müller, 1999)
British Legal Origin	Legal Origin of countries (British=1; Otherwise=0). *Data Source:* ICOW Dataset (Hensel, 2014)
Violent independence	Whether a country experienced a violent independence (Yes=1, otherwise=0). *Data Source:* ICOW Dataset (Hensel, 2014)
Socialist State between 1946-1990	Binary indicator for whether a country had a socialist regime between 1946 and 1990 (Yes=1, otherwise=0). *Data Source:* Author's with data from various sources
Years of independence (ln)	Number of years since a country gained its independence. *Data Source:* ICOW Dataset (Hensel, 2014)
Area (ln)	Country size. *Data Source:* Physical Factors (CID Harvard University, 2001)
Typical Population Density(ln)	Typical population density. *Data Source:* Physical Factors (CID Harvard University, 2001)
Terrain ruggedness index within 100km(ln)	Mean terrain ruggedness within 100 km. *Data Source:* Physical Factors (CID Harvard University, 2001)
Elevation(ln)	Mean elevation. *Data Source:* Physical Factors (CID Harvard University, 2001)
Distance(km)to coast or navigable river (ln)	Average distance in km to the nearest coast or navigable river. *Data Source:* Physical Factors (CID Harvard University, 2001)
Ethno-linguistic Fragmentation (ln)	Ethno-linguistic fragmentation at the 1st level of aggregation. *Data Source:* Desmet et al. (2012)

Continued on the next page

VARIABLES	DESCRIPTION & DATA SOURCES
Polarization (ln)	Ethno-linguistic Polarization at the 1st aggregation level. *Data Source:* Desmet et al. (2012)
Ethnic Fractionalization (ln)	Ethnic Fractionalization. *Data Source:* Alesina et al. (2003)
Religious Fractionalization (ln)	Religious Fractionalization. *Data Source:*Alesina et al. (2003)
Arable land %	Arable land as a percentage of total land. *Data Source:* Ashraf and Galor (2013)
Soil fertility	Fertility of soil. *Data Source:* Ashraf and Galor (2013)
Natural Resources Rents (% GDP, 1970-1975)	Average of natural resources rents as a share of GDP between 1970 and 1975. *Data Source:* World Bank Development Indicators
EGIP Count (1946-1970)	Average number of ethnic groups of political relevance between 1946-1970. *Data Source:* Authors with EPR data (Vogt et al., 2015; Girardin et al., 2015)
Territorial Conflicts (1946-1970)	Average number of Territorial Conflicts between 1946-1970. *Data Source:* Authors with EPR data (Vogt et al., 2015; Girardin et al., 2015)
EGIP population with regional autonomy (1946-1970)	Average share of ethnically relevant population with regional autonomy between 1946-1960. *Data Source:* Authors with EPR data (Vogt et al., 2015; Girardin et al., 2015)
EGIP Count (1946-1960)	Average number of ethnic group of political relevance between 1946-1960. *Data Source:* Authors with EPR data (Vogt et al., 2015; Girardin et al., 2015)
Territorial Conflicts (1946-1960)	Average number of Territorial Conflicts between 1946-1960. *Data Source:* Authors with EPR data (Vogt et al., 2015; Girardin et al., 2015)
EGIP population with regional autonomy (1946-1960)	Average share of ethnically relevant population with regional autonomy between 1946-1960. *Data Source:* Authors with EPR data (Vogt et al., 2015; Girardin et al., 2015)
% Catholic in 1980s	Average share of Catholics in the total population in the 1980s. *Data Source:* Quality of Government Dataset (Teorell et al., 2018)
Genetic homogeneity (ancestry adjusted)	Predicted genetic homogeneity/diversity adjusted for ancestry given the modern country borders. *Data Source:* Ashraf and Galor (2013)
% Land in the tropics	Percentage of land in the tropics. *Data Source:* Ashraf and Galor (2013)
% Population in temperate zones	Percentage of population living in temperate zones. *Data Source:* Ashraf and Galor (2013)
Population density in 1000 C.E. (ln)	Population density in the 11th century. *Data Source:* Ashraf and Galor (2013)
Distance to regional frontier in 1000 C.E. (ln)	Distance to regional frontier in the 11th century. *Data Source:* Ashraf and Galor (2013)
Mean Bureaucratic Quality (1984-2014)	Average bureaucratic quality between 1984 and 2014. *Data Source:* Authors' with data from ICRG Country Risk

Continued on the next page

VARIABLES	DESCRIPTION & DATA SOURCES
Regions	Regions: Sub-Saharan Africa, Middle-East and North-Africa, Others. *Data Source:* World Development Indicators
	Instrumental Variables
TseTse Suitability Index	TseTse Suitability Index. *Data Source:* Alsan (2015)
Neolithic Transition Timing (ln)	Number of years elapsed since the onset of sedentary agriculture as of 1500 C.E. . *Data Source:* Ashraf and Galor (2013)
Ecological Diversity	Probability that two or more different ecological zones are contained within a particular ethnic state area. *Data Source:* Fenske (2014)

Notes: (*) implies that the indicator has been revised to account for the relevance of the intermediate level of governments in joint decisions with central authorities.

Table A5.2: Summary Statistics

	N	MEAN	SD	MIN	MAX
Tax Assignment Index	76	0.108	0.137	0.000	0.612
Tax Assignment Index (*)	76	0.108	0.137	0.000	0.612
Tax Administration Assignment	76	0.220	0.203	0.000	0.892
Tax Administration Assignment (*)	76	0.221	0.205	0.000	0.892
Tax Rate Assignment	76	0.111	0.172	0.000	0.800
Tax Rate Assignment (*)	76	0.112	0.172	0.000	0.800
Precolonial Centralisation	76	2.215	0.985	0.000	3.980
Precolonial Agro-technical level	76	64.000	26.683	0.000	100.000
Precolonial Assymetric Work Distribution	76	66.965	21.619	19.330	100.000
British Legal Origin	76	0.355	0.482	0	1
Violent independence	76	0.342	0.478	0	1
Socialist State between 1946-1990	76	0.316	0.468	0	1
Years of independence (ln)	76	4.326	0.693	3.219	6.477
Area (ln)	76	12.650	1.505	9.250	16.077
Typical Population Density(ln)	76	3.871	1.340	0.593	6.931
Terrain ruggedness index within 100km(ln)	76	-7.122	0.856	-9.104	-5.417
Elevation(ln)	76	-0.761	0.880	-3.369	0.886
Distance (km) to coast or navigable river (ln)	76	5.509	1.144	2.652	7.424
Ethnolinguistic Fragmentation (ln)	76	-2.830	1.935	-6.908	-0.572
Polirization (ln)	76	-2.254	2.027	-6.908	-0.037
Ethnic Fractionalization (ln)	75	-0.777	0.979	-5.810	-0.071
Religious Fractionalization (ln)	76	-1.250	1.343	-6.038	-0.150
Arable land %	76	12.530	12.756	0.000	62.110
Soil fertility	76	0.496	0.165	0.175	0.871
Natural Resources Rents (% GDP)	59	1.340	1.961	-6.598	4.135
EGIP Count (1946-1970)	74	2.090	2.192	0.000	14.000
Territorial Conflicts (1946-1970)	74	0.079	0.194	0.000	1.000
EGIP population with regional autonomy (1946-1970)	74	0.018	0.075	0.000	0.469
EGIP Count (1946-1960)	74	2.090	2.192	0.000	14.000
Territorial Conflicts (1946-1960)	74	0.079	0.194	0.000	1.000
EGIP population with regional autonomy (1946-1960)	74	0.018	0.075	0.000	0.469
% Catholic in the 1980s	76	14.686	20.518	0.000	84.100
Genetic homogeneity (ancestry adjusted)	75	0.265	0.024	0.226	0.343
% Land in the tropics	76	0.660	0.447	0.000	1.000
% Population in temperate zones	76	0.087	0.233	0.000	1.000
Population density in 1000 C.E. (ln)	75	0.488	1.328	-2.632	2.989
Distance to regional frontier in 1000 C.E. (ln)	76	7.572	1.484	0.000	8.799
Region = Sub-Saharan Africa	76	0.539	0.502	0	1
Region = Middle-East and North-Africa	76	0.197	0.401	0	1
Region = Other	76	0.263	0.443	0	1
Mean Bureaucratic Quality (1984-2014)	62	1.635	0.761	0.000	3.988
Instrumental Variables					
Ecological Diversity	43	0.246	0.159	0.000	0.637
TseTse Suitability Index	43	-0.119	0.915	-1.735	1.371
Neolithic Transition Timing(ln)	74	8.313	0.536	7.213	9.250
N Countries	76				

Notes: (*) indicates that the indicators are constructed based on the alternative scoring method such that $(C, I, L) = 2/3$ instead of $1/2$. See Table 2.3 and Table 2.4 for illustrations. EGIP refers to the ethnic groups of political relevance. See Girardin et al. (2015) for conceptual and methodological details.

Chapter 6

Concluding Remarks

This dissertation proposed to build a greater understanding of the multi-layer structure of tax institutions in a large number of countries, to fill the empirical gap on the linkages between inter-governmental tax arrangements and economic and behavioural outcomes, and to provide insights into the origins of cross-country differences in intergovernmental tax institutions. The dissertation is written under the premises that the structure of the tax system across tiers of government and the discretion of different government authorities on tax-related decisions set the basis upon which interact all stakeholders in the economy, be they government authorities, residents and firms. As such, the design of inter-governmental tax institutions matter to various extents for policy-targeted socio-economic and behavioural outcomes. The dissertation echoes recent developments in the fiscal federalism literature which emphasize the working of political and fiscal institutions, the incentives that they embody and the resulting behaviours of stakeholders across the multi-layer structure of the public sector.

The research began with the study of the legal assignment of taxing powers across different tiers of authorities and across countries, using content analysis of legal documents and policy papers that set the framework of intergovernmental fiscal relations. **CHAPTER 2** describes a conceptual approach which captures the discretionary power of all governments tiers over the tax system more broadly, over principal tax instruments – such as income, consumption and property taxes – and over specific decision dimensions – such as the setting of tax rates and tax administration – in advanced, emerging and developing economies. The gathered information is translated into a new dataset which is described in chapter 2, and which informs on the multi-layer tax structure across more than one hundred countries. The underlying coding of the dataset facilitates the creation of multiple indicators that compare and contrast inter-governmental tax arrangements concerning specific tax instruments or decision parameters. This empirical endeavour contributes to answering the question on *"Who Taxes, Where, and What?"*, as a mirror to the tax assignment problem succinctly framed by Musgrave as *"Who Should Tax, Where and What?"*. Core findings from the

dataset suggest that inter-governmental tax arrangements vary significantly across countries, across the types of decision that are assigned to different tiers of government and the tax instruments which they can influence.

CHAPTERS 2, 3 and **4** convey empirical enquiries into the linkages between the multi-layer structure of tax institutions and economic and behavioural outcomes. Using a scoring technique, I derived, from the aforementioned dataset, several indicators that capture the level of sub-national governments' taxing rights more broadly, and their discretion over specific tax instruments and decision dimensions. These indicators are linked to per capita GDP growth of countries (*Chapter 2*), to the business climate and the fiscal burden reported by private firms in more than 100 developing and emerging economies (*Chapter 3*), and to tax compliance behaviours of residents in 49 Latin-American and Sub-Saharan African countries (*Chapter 4*). *Chapter 3* and *4* rely on micro-level survey data which are matched with the new indicators of sub-national taxing rights and primarily use multi-level analyses for the empirical estimations – thereby providing a glance into the complex, multi-level and multi-dimensional relationship between the structure of tax institutions at the macro-level and micro-level outcomes.

The empirical results from **CHAPTER 2** point to an inverted U-shaped relationship between the level of sub-national taxing rights and per capita GDP growth in 90 *non-* OECD member countries, whereas there is no evidence of a statistically significant relationship for OECD member states. Zooming into specific decisions assigned to different tiers of government, the findings suggest that there might be an economic dividend to granting sub-central governments some discretionary power over the setting of tax rates in *non-* OECD member states, although an extensive form of discretion might be detrimental as indicated by the inverted U-shaped relationship. These results are the first to depict the extent to which lower-tier governments' discretion over tax matters is linked to the economic performance in a large number of developing and emerging states which have primarily been often left out in prominent empirical enquiries on the effect of sub-national tax autonomy on economic growth.

The findings from **CHAPTER 3** indicate that firms in countries with a higher sub-national discretionary power over the fiscal space tend to report a higher burden of tax rates and tax administration on their business operations. Results from the empirical exercise also indicate that lower-tier authorities' legal ability to set tax rates is particularly harmful to the private sector. Exploring other constraints faced by private enterprises, the chapter reveals that the probability of being audited, the likelihood of tax officials requesting bribe during tax audits, and the average time that managers spend dealing with government regulations all significantly increase the higher the level of taxing rights granted to sub-national authorities or the greater

their oversight on tax administration. Hence, while the arguments linking China's intergovernmental fiscal contract in the 1980s to the country's economic prosperity might, to some extent, be valid, a higher sub-national discretion on tax matters appear to be harmful elsewhere in developing and emerging economies where underdeveloped fiscal institutions could well generate perverse incentives.

CHAPTER 4 evidences the relevance of intergovernmental tax institutions in the quest to understand the drivers of tax compliance, especially in Sub-Saharan Africa and Latin America where tax avoidance continues to undermine governments' ability to provide essential public goods and services. The empirical results confirm the overarching hypothesis that the multi-layer structure of tax institutions matters. Residents in countries with a higher level of sub-national taxing rights tend to be less compliant with their tax payments. Sub-national governments' discretion over tax administration also reduces tax compliance, whereas sub-national discretion over tax rates matter to a lesser extent. Exploring different contextual parameters, it is found strong evidence that the scarcity of tax knowledge exacerbates the negative effects of sub-national taxing rights and discretion over tax administration on tax compliance. Notwithstanding, the empirical findings indicate that there might be some added-value to lower-tier governments' involvement in tax matters for tax compliance in low-income economies.

In **CHAPTER 5**, I draw from institutional economics and economic history literature to investigate the deep-rooted economic, cultural and historical factors that shape intergovernmental tax arrangements. The findings reveal that countries' historical trajectories do play a significant role in shaping their current inter-governmental tax institutions. Pre-colonial state centralization is revealed to be a major determinant of present-day fiscal arrangements: countries with a higher level of pre-colonial state centralization tend to have more decentralized tax institutions in modern days. The findings also indicate that the path out of colonization matters and much more so than countries' contemporary experience with socialist regimes. Countries that have experienced a violent independence movement tend to have a more centralized tax structure in present times. Yet, unlike the predominant view, variables that account for ethno-cultural diversity fall short in explaining the variation in multi-layer tax arrangements across the larger sample of 76 countries, although the number of ethnic groups with regional autonomy and the salience of territorial conflicts throughout 1946-70 in Sub-Saharan African and Middle-Eastern countries appears to have influenced the current level of taxing rights granted to sub-national authorities in those regions.

Together, the essays summarized above contribute to shed light into the implications of

the legal and administrative design of tax institutions across tiers of governments, and which matter for all spheres of the economy. Still, there remain several limitations to be addressed by future research. First, the dataset constructed as part of this dissertation is so far cross-sectional, thereby constraining time-series analyses into the relationship between intergovernmental tax arrangements and multi-years economic, behavioural and policy outcomes. Second, while the legal sources of information take precedence in the content analysis and information gathering, I acknowledge that such prescriptions may not always reflect the reality within countries. The choice to rely on legal parameters is based on the assumption that the legal provisions grant each layer of government the ability to claim their rights. Going forward, expanding the database by identifying the status of implementation of legal provisions, and integrating the contents of new public finance reforms – either concerning specific tax instruments or tax-related decisions – shall render such a tool more adapted to various empirical enquiries across different sub-fields of public economics and political economy. Sub-central fiscal data are increasingly becoming available for a wide range of countries, and there is an ever-growing interest in empirical investigations regarding tax institutions in developing and emerging economies. The expansion of the dataset shall contribute to in-depth analyses of the effectiveness of centrally- and locally-assigned decisions over tax instruments and the impact of such decisions on a wide range of economic and fiscal outcomes such as the pricing of real-estate properties or the growth of local economies.

Chapter 3 and *4* primarily rely on survey data on firms and individual taxpayers. Although the surveys are comparable across countries, I acknowledge that the empirical enquiries may have left out contextual and intrinsic factors which are not captured through answers to the survey questionnaires. Future research might consider administrative data on firms, and individual taxpayers, shall those be available. Administrative records might offer more reliable estimates regarding the fiscal burden of private enterprises and individual tax compliance, and would palliate further the data constraints faced by this research project. Still, more broadly, both chapters contribute to the scholarly discussion on how complex tax structure can affect the tax bases and revenue mobilization in developing and emerging states.

Regarding *Chapter 3*, more particularly, an interesting avenue for future research is the consideration of local governments' policies towards private business within and across countries. To date, cross-country administrative information on local fiscal and regulatory policies and local tax incentives to firms is very limited. The availability of such information would greatly facilitate research into how the hierarchical structure of tax and regulatory institutions affect business operations and private sector growth.

As stated in *Chapter 4*, there remain numerous unexplored channels through which the multi-layer tax structure could influence tax compliance and tax evasion. Such channels are not explored in this dissertation, either due to a lack of established theoretical frameworks or a lack of data. Future research project could consider laboratory and field experiments as core elements of their identification strategies. Experimental methodologies could allow researchers to test the potential behaviours of taxpayers in a multi-layer tax structure, all the while considering the empirical results of *Chapter 4* as stylized facts as they show that incentives embedded in intergovernmental tax institutions could extend to and drive individual compliance with tax payments.

The results from *Chapter 3* and *Chapter 4* reveal that that different tax-related decisions dimensions assigned to lower-tier authorities may yield different impact on firms and individual residents. In *Chapter 3*, sub-national governments' discretion over tax rates has a negative effect on business operations where their oversight on tax administration matters to a lesser extent for their self-reported fiscal burden. Reversely, in *Chapter 4*, it is observed that sub-national governments' discretion on tax administration has a negative influence on tax compliance more broadly. Although the fiscal burden on firms and tax compliance are two different outcomes, understanding the drivers of both is crucial to the debate on revenue mobilization. Therefore, getting ahead, it is worth exploring how and why the assignment of a specific tax-related decision to a particular government tier matters more for a specific group of stakeholders and less for others. Such a research project might give insights into how countries could design their intergovernmental tax institutions in a way that is optimal for revenue mobilization from all sets of actors. Moreover, as many countries are moving towards the digitalization of their tax administration, it would be worth exploring, in the near future, how the legal discretionary power of lower-tier governments over parameters such as the setting of tax rates or definition of tax bases evolve and the resulting impact of the new institutional design on different groups of actors and the economy as a whole.

While *Chapter 5* reveals that deep historical factors shape the present-day multi-layer tax institutions, the channels through which such an effect takes place remain under-explored. Graphical analysis from that chapter, the empirical results and previous literature suggest that country-level bureaucratic quality and the level of sub-national taxing rights are both driven by pre-colonial state centralization. Future research might seek to explore how pre-colonial state institutions are linked to sub-national bureaucratic capacity and the ability of local governments to enforce fiscal rules and effectively raise revenues within their communities in modern times.

Overall, the dissertation and its contents reveal that Musgrave's *"Who Should Tax, Where and What?"* remains a legitimate question that needs to be further addressed, not just theoretically but also empirically by looking at the effects of multi-layer tax institutions and tax arrangements on different groups of stakeholders. This research shows that there remain significant theoretical and empirical gaps in the discourse on tax institutions and tax relations across tiers of governments. Notwithstanding, it sets a new path for investigations into the deep historical and legal origins of inter-governmental tax relations, and their influence on economic, political and behavioural outcomes, especially in developing and emerging economies.

ADDENDUM ON IMPACT

The dissertation fosters a greater understanding of multi-layer tax institutions in many countries, contributes to filling the empirical gap on the linkages between inter-governmental tax arrangements and economic and behavioural outcomes, and provides evidence into the origins of cross-country variations in the design of tax institutions. It is written under the premises that the multi-layer tax structure sets the basis for interactions among stakeholders in the economy, and is, as such, expected to influence various policy-targeted outcomes. The dissertation begins with a study of the legal and administrative structure of tax institutions across tiers of governments and across more than one hundred countries. **Chapter 2** unveils a novel empirical resource: a dataset that conveys the discretionary power of all government tiers over existing tax instruments and tax-related decisions. Through its coverage and granularity, the dataset paves new ways for research into how socio-economic and behavioural outcomes are shaped by intergovernmental tax arrangements, concerning either tax instruments or tax-related decisions. The dissertation already delves, empirically, into the ramifications of the legal and administrative design of tax institutions across tiers of governments for economic performance (**Chapter 2**), business climate and the fiscal burden on private firms (**Chapter 3**), and individual tax compliance (**Chapter 4**). More particularly, the empirical enquiries from **Chapter 3** and **4** show the relevance of the multi-layer tax structure in the scholarly debate on private sector growth and revenue mobilization, especially in developing and emerging economies. Lastly, **Chapter 5** evidences a historical path dependence in the design of multi-layer tax institutions. Historical trajectories and deep-rooted factors that date back to pre-colonial and colonial periods largely explain the modern-day cross-country variations in multi-layer tax institutions. Together, and through the lens of a comparative cross-country approach, the essays from the dissertation create new avenues for investigations into the various forms of taxing rights granted to different government tiers and the challenges and opportunities embedded in the legal and administrative design of multi-layer tax institutions for various stakeholders and the economy as a whole.

About the Author

Rose Camille Vincent joined UNU-MERIT/Maastricht University as a PhD Research Fellow in 2015, and CERDI-CNRS/Université Clermont Auvergne as a dual PhD Candidate in Economics in 2016. Her research interests lie at the cross-section of Public and Development Economics. She primarily studies the legal and administrative structure of fiscal institutions and policies and their implications for economic and behavioural outcomes. She does so by collecting and compiling unique datasets using administrative records and archives that define the structure of these institutions, especially in developing and emerging economies. Rose previously obtained a Bachelor's degree in Economics from the National Taiwan University (Taipei, Taiwan ROC), a Master of Public Policy specializing in Economic Policy from the Hertie School of Governance (Berlin, Germany) and a MSc in Econometrics and Statistics from the University of Toulouse (Toulouse, France).

While at Maastricht University, Rose has been involved in various teaching activities, including in Public Economics (graduate-level), Applied Econometrics and Impact Evaluation Methods (graduate-level and executive education) and Economics and Society in Contemporary Latin America (undergraduate-level). She has also been a thesis supervisor and co-evaluator (second reader) of several Master theses in the MSc in Public Policy and Human Development Program at UNU-MERIT/MGSoG.

Outside academia, she has a proven track record of successful collaboration on multi-faceted projects related to public finance and development and led by renowned academic and policy institutions, including the UNU World Institute for Development Economics Research (UNU-WIDER), the International Centre for Tax and Development (IDS/ICTD) and the German Institute for Economic Research (DIW-Berlin). She has also worked for/consulted several international organizations including the German International Cooperation (GIZ), the World Bank Group (WBG), the Organisation for Economic Co-operation and Development (OECD), the UN World Health Organization (WHO) and the Inter-American Development Bank (IDB). Since 2017, she has been an academic contributor and member of the Steering Committee of the World Observatory on Sub-national Finance and Investment (SNG-WOFI), a joint project of the OECD and UCLG.

Upon the completion of her PhD journey, Rose will join ETH Zurich as a Post-Doctoral Researcher in Public Economics in Spring 2021.