

Kumulative Dissertation zum Themengebiet:

# **Transfer Pricing Rules and Tax Audits: Effects on Investments & Compliance**

Der Fakultät für Wirtschaftswissenschaften  
der Universität Paderborn

zur Erlangung des akademischen Grades  
Doktor der Wirtschaftswissenschaften  
– Doctor rerum politicarum –

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**2023**

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## **ACKNOWLEDGEMENTS**

The completion of this dissertation would not have been possible without the support of many people.

First and foremost, I would like to express my sincere gratitude to Prof. Dr. Dr. h.c. Dr. h.c. Caren Sureth-Sloane. Throughout the last few years, she has been extremely generous with her time and has significantly shaped the development of my research with her invaluable advice, continuous support, and patience. It was an honor for me to be a part of her team as a research assistant and doctoral student at the chair of Business Taxation at Paderborn University.

I am also deeply grateful to my co-author, Univ.-Prof. Mag. Dr. Eva Eberhartinger, for the great collaboration during the last few years. Moreover, I would like to thank my other co-author Mehrzad Azmi for fruitful debates and helpful comments.

I am very thankful for the great environment and helpful discussions at Department 2 of the Faculty of Business Administration and Economics at Paderborn University, which allowed me to improve my research. I would also like to thank my colleagues at the chair of Business Taxation for the pleasant atmosphere at the chair, the mutual support, and the great time we spent together.

I am incredibly grateful to my parents and my sister, who encouraged me and gave me the strength and courage to choose the path I loved.

Last but not least, I am extremely grateful to my husband, Ali. Without his tremendous understanding and support over the past few years, it could be impossible for me to complete my study. This work is dedicated to you.

# 1 INTRODUCTION AND SYNOPSIS

Tax avoidance and profit-shifting activities by multinational enterprises (MNEs) continue to be a major concern for regulators and have been on the international policy agenda for several years. Tax-motivated profit shifting refers to the tax planning strategies of MNEs to relocate income across affiliates in different jurisdictions to reduce their overall tax liability (e.g., Heckemeyer & Overesch, 2017; Huizinga & Laeven, 2008). Notably, the profit-shifting practices of large MNEs (e.g., Google, Apple, and Amazon)<sup>1</sup> combined with the enormous amounts of estimated lost tax revenue in high-tax countries<sup>2</sup> have gained immense media attention and led to a remarkable upheaval in tax policy. Consequently, several unilateral countermeasures have been implemented at the national level, and Action Plans such as the OECD/G20 Base Erosion and Profit Shifting (BEPS) Report (OECD, 2015) have been established to promote coordination in the fight against aggressive tax avoidance.

Transfer pricing is considered the main channel of tax avoidance (Heckemeyer & Overesch, 2017), so highly prominent anti-avoidance rules include transfer pricing rules (Johansson et al., 2016). Given the importance of the problem, substantial empirical literature has focused on understanding the potential effect of unilateral countermeasures, such as transfer pricing rules, on the activities of MNEs. What has been studied so far is that anti-avoidance measures such as transfer pricing rules seem to be effective in reducing the profit-shifting activity of firms (Beer & Loeprick, 2015; Klassen & Laplante, 2012; Lohse & Riedel, 2013), but the overall effects remain elusive. It is puzzling that the measured effectiveness does not seem to entail the potential indirect negative effects of transfer pricing rules on investments. Exceptions are De Mooij and Liu (2020) and Buettner et al. (2018). Buettner et al. (2018) explore the sensitivity of Foreign Direct Investment (FDI) of German multinationals' affiliates to tax rates and interaction with the strictness of anti-profit-shifting rules. They find that thin capitalization rules increase the sensitivity of investment to tax rates and result in lower investment by MNEs in higher tax countries, but they find no significant result regarding the effect of transfer pricing rules on FDI. Relatedly, De Mooij and Liu (2020) focus on the introduction and strictness of transfer pricing regulations across countries and examine the effect of transfer pricing rules on MNEs' investments. They provide evidence that multinational corporation affiliates reduce their

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<sup>1</sup> See for example Chee (2019) and White (2021).

<sup>2</sup> According to the OECD, the profit-shifting activities of firms cost countries between USD 100–240 billion in lost revenue annually, equivalent to 4%–10% of global corporate income tax revenues (OECD, 2017). The tax revenue loss due to profit-shifting activities of firms into tax havens estimated to be EUR 5.7 billion annually (Fuest et al., 2022).

investment following the introduction of transfer pricing regulations. However, while the prior literature documented the ambiguous effect of transfer pricing rules on MNEs' economic activities, evidence on the uncertainties arising from changes in transfer pricing rules on MNEs' behavior is scarce. Therefore, understanding the effect of changes in these rules on MNEs' behavior is crucial, as transfer pricing rules are currently under continuous changes globally.

Another important aspect of a country's tax system is tax enforcement (e.g., Hoopes et al., 2012). Prior studies examined the effect of enforcement on corporate tax behavior through audit levels and penalties (Atwood et al., 2012; DeBacker et al., 2015; Gupta & Lynch, 2016). However, the results are mixed. While some studies show that tax audits lead to less tax avoidance (Advani et al., 2021; Gupta & Lynch, 2016; Nessa et al., 2020), other studies identify the opposite effect. For example, DeBacker et al. (2015) and Finley (2019) find evidence that tax audits and tax settlements, respectively, may increase tax avoidance for corporate taxpayers. It seems that the effect of tax audits on tax avoidance depends on the audit outcome and effectiveness as perceived by taxpayers (Gemmell & Ratto, 2012). Risk profiling as a tax audit case selection strategy affects audit probability and effectiveness, not only in theory but also as perceived and anticipated by corporate taxpayers (Fischer et al., 1992; Hashimzade & Myles, 2017). Nevertheless, it is unclear how risk profiling as an audit case selection strategy affects firms' tax avoidance.

This dissertation focuses on two current international taxation issues that have triggered heated public debates in recent years: transfer pricing rules and risk profiling as audit case selection strategies. This dissertation presents three studies contributing to the growing area of research that first focus on transfer pricing rules and their effect on MNEs' economic activity (studies A and B) and then consider enforcement by focusing on tax audit case selection (study C). More precisely, study (A) focuses on changes in transfer pricing regulations across countries and examines the role of these changes on MNEs' investment decisions. For the analysis of study (A), a transfer pricing measure that includes 16 features of countries' transfer pricing rules was employed. However, despite the importance of intangible assets in the profit-shifting activity of firms, this measure does not include any component related to the transfer pricing of intangibles. Therefore, study (B) aims to analyze the main characteristics of transfer pricing rules related to intangible assets, providing an overview of the implementation of these rules across countries. Furthermore, study (C) investigates the incremental effect of risk profiling as an audit case selection strategy on firms' tax avoidance.

Study (A) by Azmi and Safaei (2022) focus on changes in transfer pricing regulations across countries and examine whether and how MNEs change their capital investment in foreign affiliates following a change in transfer pricing regulations. Given the recent policy changes triggered by the OECD BEPS Action Plans, exploring the role of changes in transfer pricing regulations and their unintended consequences is crucial. Understanding the uncertainty associated with changes in transfer pricing regulations in shaping real investment decisions is an essential prerequisite for informed policy debates and the efficiency of tax policy. Relatedly, the importance of changes in transfer pricing rules on the economic activity of MNEs is also reflected in the survey of EY (2021) that shows 58% of transfer pricing professionals see new or evolving transfer pricing legislation as the top, second, or third most critical contributor to transfer pricing risk. However, the prior literature has so far only focused on the effectiveness of transfer pricing rules to deter profit shifting (e.g., Beer & Loeprick, 2015; Lohse & Riedel, 2013) or the introduction and strictness of these rules on the investment of MNEs (Buettner et al., 2018; De Mooij & Liu, 2020). Therefore, we explore several potential explanations for how changes in transfer pricing regulations could affect MNEs' investments.

We use a cross-country approach and employ rich data on MNEs' affiliates for the years 2007 to 2015. To account for changes in transfer pricing regulations, we use the transfer pricing measure by Mescall and Klassen (2018) with 16 features of countries' transfer pricing rules and enforcement. We proxy for change in transfer pricing regulations in a country by calculating the difference between the current and previous years' transfer pricing measure and define an indicator variable equal to one when the change in country-year transfer pricing measure is greater or less than the standard deviation of all the changes in the sample. We exploit 63 significant changes in transfer pricing regulations in 38 countries and employ a first-difference model to capture time-invariant characteristics related to the investment while accommodating multiple transfer pricing changes per country.

The results indicate that the level of investment in affiliates is reduced following a change in transfer pricing regulations, implying that changes in transfer pricing rules are deemed to cause more uncertainty for MNEs. This could be due to the fact that it is difficult for firms to process the information about the regulations and implementation after the adoption of rules, and complying with them seems costly, especially in the first years after the implementation. We further find that frequent changes in transfer pricing regulations in a country are associated with lower investments in MNEs' subsidiaries, consistent with the OECD survey results that the frequency

of legislative changes in tax policy is considered a major source of tax uncertainty among tax administrations and business executives (IMF & OECD, 2017). Moreover, the cross-sectional tests in study (A) show that the negative association between transfer pricing changes and investment is more substantial for affiliates located in high-tax countries, while changes in transfer pricing regulations in developing countries lead to more affiliates' investment. Hence, our results provide evidence that developing countries can attract and boost MNEs' investments there, reducing transfer pricing uncertainty by eliminating peculiarities while aligning transfer pricing regulations with global standards.

Subsequently, study (B) by Safaei (2022) analyzes the main characteristics of transfer pricing rules related to intangible assets based on the OECD Transfer Pricing Guidelines. For the analysis of study (A), the transfer pricing measure of Mescall and Klassen (2018) is employed, which, similar to existing measures in the literature to measure transfer pricing rules, does not include any component related to the transfer pricing of intangibles, despite the critical role of intangible assets in the profit-shifting activity of firms (Dischinger & Riedel, 2011; Griffith et al., 2014; Grubert, 2003). Moreover, existing studies examining the association between MNEs' transfer pricing rules and profit-shifting activities via intangibles find limited or no effect of transfer pricing rules on the profit-shifting of intangibles (Baumann et al., 2020; Beer & Loeprick, 2015; Marques & Pinho, 2016). A potential explanation for this finding could be due to neglecting the role of transfer pricing rules for intangible assets in their analysis.

Therefore, in the first step, study (B) provides an overview of three main characteristics of the OECD Transfer Pricing Guidelines regarding intangible assets. To reach this objective, the concept of intangibles according to these guidelines is discussed, including value-adding functions and how profits can be distributed based on these functions among entities of multinational firms, and the OECD approach for hard-to-value intangibles (HTVI) is described. In the second step, study (B) exploits data on the implementation of the main characteristics of transfer pricing rules related to intangibles in 58 countries, discussing the differences in regulatory characteristics and the heterogeneity in implementing these rules. Finally, the practical challenges concerning the adoption of the OECD Guidelines regarding the transfer pricing aspect of intangibles are elaborated.

The analysis of study (B) reveals that numerous countries have implemented transfer pricing rules related to intangibles in their domestic legislation and tightened their transfer pricing legislation to prevent the BEPS activity of firms via intangible assets. Nevertheless, some

inconsistencies could be observed in implementation of transfer pricing for intangibles among countries. For example, while some countries have fully implemented the three main characteristics of transfer pricing rules for intangibles in their domestic legislation (e.g., Germany and the US), other countries have not implemented any rules related to intangibles (e.g., Brazil, Switzerland, and Panama). Among other reasons, the non-uniform definition of intangibles for transfer pricing purposes, even among countries that have adopted these rules, is a source of uncertainty and inconsistencies. Furthermore, the practical challenges related to the main characteristics of the OECD Transfer Pricing Guidelines for intangibles are outlined. Among other practical issues, onerous documentation requirements, the risk of disputes, and double taxation are pointed out as the main challenges of the implementation of transfer pricing rules for intangibles.

Study (C) by Eberhartinger et al. (2021) is the last study in this dissertation. While studies (A) and (B) focus on transfer pricing rules, study (C) takes a different approach and assess the enforcement aspect by focusing on tax audit case selection. Over the past decade, tax administrations have employed risk profiling to target high-risk taxpayers. Risk profiling uses comprehensive data on taxpayers' characteristics (e.g., tax return information, historical audits, and third-party information), employing advanced analytical techniques to this data to identify high-tax risk taxpayers. In study (C), we explore whether and to what extent the employment of risk profiling in tax audit case selection is associated with corporate tax avoidance. Prior research employs data on actual tax audits (e.g., Advani et al., 2021; Finley, 2019; Hoopes et al., 2012) and has demonstrated the link between the strategic behavior of taxpayers and tax administrations. Specifically, our study focuses on the probability of being audited as perceived by firms. This perception is determined by a firm's self-assessment of how the tax administration or its algorithm will characterize "high-risk" tax behavior, and hence the firm's tax behavior, is conditioned on the perception of the administration's risk-profiling effectiveness. Furthermore, the prior literature indicates that risk-based tax audits are associated with more compliance for individual taxpayers (Alm & McKee, 2004; Beer et al., 2020; Loyland et al., 2019). However, the results for individual taxpayers do not necessarily hold for corporate taxpayers because the data availability for corporate models may not be sufficiently advanced and, thereby, not include many aspects of tax avoidance.

To investigate the effect of risk-profiling implementation on corporate tax avoidance, we exploit data on countries' use of risk profiling from the ISORA portal and construct a binary

measure depending on if the tax administration explicitly reports employing a form of risk profiling (i.e., business rules or predictive modeling) in their audit case selection. We follow Atwood et al. (2012) and measure corporate tax avoidance by the difference between taxes calculated at the statutory tax rate and taxes actually paid. We find that employment of risk profiling is, on average, negatively associated with corporate tax avoidance. However, this relation strongly depends on the quality of risk profiling implemented by the tax administration. More precisely, our findings suggest that risk profiling effectively reduces tax avoidance only in countries with high risk-profiling expertise and sufficient employees in audits and verification that assure an adequate design and execution. Furthermore, additional tests with country-level data on tax administration performance imply that employing risk profiling is associated with higher performance of tax administrations.

Cumulatively, the results of the three studies provide a valuable contribution to the existing academic literature while paving the path for future studies on transfer pricing rules and audit case selection strategies. The results of study (A) highlight the importance of unintended consequences of transfer pricing rules, demonstrating the uncertainty associated with changes in transfer pricing regulations in shaping real investment decisions. This finding could be interesting for academia and policymakers since our results reveal that disregarding the overall effect might provide biased conclusions about the effectiveness of transfer pricing regulations. In study (B), the main characteristics of transfer pricing rules for intangibles and their implementation across countries guide future research to develop a measure for transfer pricing rules for intangibles, with high relevance for understanding, explaining and predicting profit-shifting behavior via intangibles. Finally, the findings of study (C) enrich the debate on tax enforcement design with significant implications for the growing use of risk profiling by tax administrations. They underline the importance of investing the analytical techniques of tax administrations to support advanced risk-based audit selection mechanisms.

## **2 STUDIES OF THE DISSERTATION**

## **A) Changes in Transfer Pricing Regulations and Corporate Investment Decisions**

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**Abstract:** This study examines the role of changes in transfer pricing regulations on multinational enterprises' (MNEs) investment decisions. In the wake of international guidelines, countries implement many changes in their transfer pricing regulation. We find evidence that changes in transfer pricing regulations are negatively associated with the MNEs' affiliate investment. This effect is due to the high uncertainty about the implementation and enforcement of transfer pricing regulations as perceived by MNEs, particularly in the first years after the change. Furthermore, we analyze the effect of frequent changes and find, on average, affiliates reduce their investment in countries with frequent changes in transfer pricing regulations. Additional tests suggest that affiliates respond differently to changes in transfer pricing regulations which increase or decrease transfer pricing risk and reduce (increase) investment if a change leads to higher (lower) transfer pricing risk. Lastly, the results of additional cross-sectional analyses indicate that changes in transfer pricing regulations in developing countries lead to more affiliates' investment, reflecting that changes in these countries are towards eliminating the peculiarities in transfer pricing rules and aligning the rules with global standards.

**Keywords:** Transfer pricing, tax uncertainty, investment, MNE

**Acknowledgements:** We are grateful for valuable comments by Caren Sureth-Sloane, Henning Giese, Dirk Schindler, Kenneth Klassen, Adrian Schipp, the participants of Paderborn University TAF Brown Bag Seminar 2020, Faculty Research Workshop of the Faculty of Business Administration and Economics Paderborn University 2021, 16. arqus-Jahrestagung 2021, European Accounting Association 2022. We thank Kim Schulz for excellent research assistance. Safaei gratefully acknowledge financial support from the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) – Collaborative Research Center (SFB/TRR) Project-ID 403041268 – TRR 266 Accounting for Transparency.

### 1. Introduction

In this study, we focus on changes in transfer pricing regulations across countries and examine whether and to what extent MNEs change their capital investment in foreign affiliates following a change in transfer pricing regulations. Following the path of OECD Transfer Pricing Guidelines, countries adopt changes in transfer pricing rules at different times and to different degrees. For example, OECD's Action Plan on Base Erosion and Profit Shifting (BEPS) proposed a thorough review of transfer pricing guidelines, resulting in many changes in transfer pricing regulations across countries. The implication of changes in transfer pricing rules is especially relevant for MNEs, as it affects their global operation, tax burden and compliance costs. This is reflected in the survey results of EY (2019), that executives indicate that the pace of change in transfer pricing rules is so rapid, and the degree of expanded transparency is now so pronounced that a wave of tax controversy is imminent.

Since the introduction of transfer pricing guidelines in 1979, these rules have been subject to many developments and changes.<sup>3</sup> While transfer pricing rules are underpinned by the arm's length principle, OECD reviews its application and proposes new changes to transfer pricing guidelines from time to time. These changes include, for example, changes in the extent of the transfer pricing documentation requirement, in the condition for comparability analysis, in the priority of methods for determining the transfer price, in penalties on wrong or incomplete documentation, and advance pricing agreements (e.g., Lohse & Riedel, 2013; Mescall & Klassen, 2018).<sup>4</sup> Countries mainly implement the core of OECD Guidelines into their domestic tax

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<sup>3</sup> Examples of these changes are the amendment and revision of the OECD Transfer Pricing Guidelines in 1995, the report on cost contribution arrangements in 1997, the issuance of the report on the attribution of profits to permanent establishments in 2006, the update of the OECD Transfer Pricing Guidelines in 2008, publishing of a new version for the OECD Transfer Pricing Guidelines in 2010, Guidance on Transfer Pricing Documentation and Country-by-Country Reporting in 2014, issuance of the BEPS Actions in 2015, update of OECD Transfer Pricing Guidelines in 2017 (OECD, 2010, 2017).

<sup>4</sup> For an overview of elements regarding the transfer pricing regimes across countries, see (Deloitte, 2014; EY 2017).

systems and include specific regulations according to their regulatory characteristics.

We explore several potential explanations for how changes in transfer pricing regulations could affect the compliance cost of MNEs and their economic activity. The first intuition is that firms perceive a change in transfer pricing regulations as uncertain<sup>5</sup>, regardless of whether the change leads to stricter or more lenient regulations. Particularly, this effect could be observed in the first years after a change, when there is high uncertainty regarding the implementation and enforcement of the rule, even if the change in the rule aims to create more certainty for the MNEs, such as the Advance Pricing Agreements (APA).

Some changes in transfer pricing rules increase uncertainty and risk in MNEs' transfer pricing positions, and other changes reduce uncertainty and risk.<sup>6</sup> For example, adopting a regulation that precludes foreign comparables for comparability analysis increases transfer pricing risk, and adopting APA reduces transfer pricing risk (Mescall & Klassen, 2018).

Whereas the impact of tax uncertainty on investment is ambiguous in theory (Niemann, 2004), empirical evidence is more clear-cut and indicates the adverse effect of tax uncertainty on shaping investment decisions (Edmiston, 2004; Jacob et al., 2022). Tax practitioners and politicians also highlight the negative effect of tax uncertainty on investment (e.g., IPI, 2015). We expect the impact of changes in transfer pricing regulations on investment decisions of foreign affiliates of MNEs to be highly dependent on the level of uncertainty and risks related to transfer pricing after the change in these regulations. The simple intuition underlying this relationship is that if a change in transfer pricing regulation in a country leads to more uncertainty, MNEs are expected to reduce their capital investment since firms anticipate the uncertainty of future tax burden and cash flows. However, if MNEs benefit from the uncertainty stemming from a change in the rules to avoid more taxes, they are expected to increase their investment in

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<sup>5</sup> Lisowsky et al. (2013) define tax uncertainty as the difficulty in applying the tax law and uncertainty about future tax payments.

<sup>6</sup> In line with prior literature, we define transfer pricing risk as the risk of a transfer pricing position being discovered and denied and the risk of penalties (Mescall & Klassen, 2018).

countries with more changes in transfer pricing rules. In contrast, if a transfer pricing change decreases transfer pricing uncertainty, for instance, by resolving peculiarities in transfer pricing rules, changes in transfer pricing rules might lead to more investment. Limiting the transfer pricing uncertainty by harmonizing the transfer pricing rules could foster the economic activity of firms and reduce their challenges (e.g., risk of double taxation or extensive documentation cost) stemming from different rules.

To analyze the effect of changes in transfer pricing regulations on affiliates' investment level, we use a cross-country approach and employ rich data on MNEs' affiliates for the years 2007 to 2015 taken from the ORBIS database. To account for changes in transfer pricing regulations, we use the transfer pricing measure by Mescall and Klassen (2018)<sup>7</sup>, which includes 16 features of countries' transfer pricing rules and enforcement and weights them according to an extensive survey of 76 transfer pricing practitioner experts based in 33 countries. To proxy for *change* in transfer pricing regulations in a country, we calculate the difference between the current and previous year's transfer pricing measure and define an indicator variable equal to one when the change in country-year transfer pricing measure is greater or less than the standard deviation of all the changes in the sample. We exploit 63 significant changes in transfer pricing regulations in 38 countries and employ a first-difference model to capture time-invariant characteristics related to the investment and accommodate multiple transfer pricing changes per country.

Through the analysis of a cross-country panel, we find evidence that a change in transfer pricing rules in affiliates' countries is associated with a reduction in affiliates' investment, and this effect increases over two periods. We measure investment by subsidiaries' annual change in net fixed assets scaled by lagged total assets, following Amberger et al. (2021), and control for country characteristics such as political risk and statutory tax rates and firm-specific variables that might affect investment. The results imply that, in general, changes in transfer pricing rules

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<sup>7</sup> We are grateful to Devan Mescall and Kenneth Klassen for sharing the transfer pricing data with us.

are deemed to cause more uncertainty for MNEs. This could be due to the fact that it is difficult for firms to process the information about the regulations and implementation after the adoption of the rules, and complying with the rules seems costly, especially in the first years after the implementation.

In supplementary analyses, we investigate the impact of frequent changes in transfer pricing regulations and compare the frequency of changes in these regulations by measuring the volatility of changes in transfer pricing measures across countries. Frequent changes create challenges for firms to process the information about the regulations and their implementation and also cause firms to distrust the transfer pricing framework in the country and expect more changes in the future. Therefore, MNEs are expected to reduce their investment in countries with more frequent changes. Having some countries with more changes and some with fewer and no changes helps us better understand and investigate the effect of changes in transfer pricing regulations on capital investment decisions by MNEs in their foreign affiliates. The results indicate that frequent changes in transfer pricing regulations in a country are associated with lower investments in MNE's subsidiaries. This is consistent with the OECD survey results that the frequency of legislative changes in tax policy is considered a major source of tax uncertainty among tax administrations and business executives (IMF & OECD, 2017). We further examine the direction of change regarding whether it leads to higher or lower transfer pricing risk.<sup>8</sup> We find that both changes leading to higher or lower transfer pricing risk affect corporate investment, suggesting a symmetric effect.

In cross-sectional tests, we investigate whether country characteristics influence the association between changes in transfer pricing regulations and investment. We further document that the negative association between transfer pricing changes and investment is stronger for affiliates

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<sup>8</sup> The Mescall and Klassen measure includes determinants of transfer pricing regulations and enforcement, and each feature could increase or decrease the transfer pricing risk.

located in high-tax countries, as changes in transfer pricing rules are expected to most strongly affect the transfer prices of affiliates that shift income from high-tax to low-tax affiliates. Furthermore, the analysis suggests that the effect of changes in transfer pricing differs across countries with different developmental levels. More specifically, changes in transfer pricing regulations in developing countries are associated with the increase in investment of subsidiaries in those countries. Intriguingly, subsidiaries in developing countries respond positively to the transfer pricing changes that decrease transfer pricing uncertainty by increasing their investment in these countries. On the contrary, subsidiaries do not respond to the changes that increase transfer pricing uncertainty in these countries. Therefore, the attempts of developing countries to align with global transfer pricing standards and resolve the transfer pricing peculiarities will reduce the uncertainty for firms and, thereby, increase firms' investment in these countries.

We subject this finding to several robustness tests. First, we use alternative investment measures. Second, we limit the sample period to the years after 2009 to control the potential heterogeneity that MNEs have performed differently during the Great Recession. Third, we use an alternative proxy for changes in transfer pricing rules to capture the objective changes in transfer pricing rules by gathering data from Deloitte, EY, PwC and KPMG global transfer pricing guidelines. These tests support our main results.

This study contributes to the tax literature in two ways. First, we add to the literature on taxes and investment (Becker et al., 2012; Becker & Riedel, 2012; Delis et al., 2020; Fahr et al., 2022) and, more specifically, to the literature on tax uncertainty and investment (Edmiston, 2004; Gulen & Ion, 2016; Jacob et al., 2022) by highlighting the importance of transfer pricing uncertainties arising from changes in transfer pricing rules in international tax law.

Second, while prior literature examines the effect of anti-avoidance legislation on key aspects of firm behaviour (Buettner et al., 2018; Clifford, 2019; Egger & Wamser, 2015; Hebous & Ruf, 2017), we complement these studies by investigating how changes in transfer pricing

regulations shape firms' investment decisions. Our paper is related to De Mooij and Liu (2020) and Buettner et al. (2018), which explore the effect of transfer pricing rules and investment decision of firms. Buettner et al. (2018) find that transfer pricing rules exert no significant effects on countries Foreign Direct Investment (FDI). De Mooij and Liu (2020) focus on the introduction and strictness of transfer pricing regulation across countries and examine the effect of transfer pricing rules on MNEs investment. They find multinational corporations affiliates reduce their investment following the introduction of transfer pricing regulations. In contrast, we focus on uncertainties resulting from changes in transfer pricing regulations in 38 countries. Although the introduction and strictness of transfer pricing regulations are crucial factors in firms' investment decisions, MNEs could obtain information about the documentation requirements and enforcement, learn the procedure, and comply with the regulations. But in case of frequent changes in transfer pricing rules, MNEs face significant uncertainty about how tax authorities view the documentation requirement, the transfer price, and the transaction. Therefore, our study offers a new perspective on the role of transfer pricing in shaping investment decisions.

Given the recent policy changes triggered by the OECD BEPS Action Plans, exploring the role of changes in transfer pricing regulations and their unintended consequences is crucial. Understanding the uncertainty associated with changes in transfer pricing regulations in shaping real investment decisions is an essential prerequisite for informed policy debates and the efficiency of tax policy. Our findings affirm the survey results of IMF and OECD (2017) that reduced frequency of changes in the tax legislation improves tax certainty. Nevertheless, our findings indicate that the changes in transfer pricing regulations in developing countries can promote the investment of MNEs in those countries by reducing uncertainty. This finding is particularly important for developing countries.

## **2. Background and Hypothesis Development**

### ***2.1. Overview of Transfer Pricing Regulations***

Transfer pricing is considered to be one of the key channels of profit shifting in prior literature (Heckemeyer & Overesch, 2017). MNEs shift profit from high-tax to low-tax jurisdictions to take advantage of tax rate differential through transfer pricing by manipulating the intra-firm transactions. Consequently, many countries adopt and enforce transfer pricing rules mainly based on guidelines prepared by OECD, which are based on the arm's length principle.

The OECD first introduced and published the practical guidance for transfer pricing in 1979, which served as a basis for transfer pricing guidelines in 1995. Countries introduced transfer pricing regulations at different times. The USA was the first country to introduce transfer pricing regulations in 1968, followed by other large economies such as Germany, Australia, and Japan (Zinn et al., 2014). By increasing the number of firms operating in several countries, which led to a significant increase in the number of transactions between multinational firms, tax authorities started to pay particular attention to profit shifting via transfer pricing. Therefore, international attempts to cope with transfer pricing for tax purposes have accelerated. The OECD issued several reports regarding the transfer pricing rules, such as the issuance of a report on cost contribution arrangements in 1997 and the report on attribution of profit to permanent establishments in 2006. In addition, the OECD reviewed the application of the arm's length principle in 2010 to consider the guidance on comparability and profit methods. In 2013, OECD's Action Plan on BEPS proposed a thorough review of transfer pricing guidelines. The Action Plan includes four Actions related to transfer pricing. The transfer pricing guidelines were reviewed in 2017 regarding the Report on Action 8-10 of BEPS, which was approved in 2015. Given the transfer pricing changes triggered by the OECD Guidelines, the number of countries issuing detailed transfer pricing guidelines has grown substantially in recent years (Marques & Pinho, 2016).

Determining different aspects of transfer pricing frameworks in various countries is difficult because it depends on subjective attributes. However, prior studies aim to analyze the main characteristics of transfer pricing regulations in different countries (Lohse & Riedel, 2013; Marques & Pinho, 2016; Mescall & Klassen, 2018; Zinn et al., 2014). Zinn et al. (2014) analyze the development of transfer pricing regulations in 44 countries between 2001 and 2009, and provide a descriptive comparison of transfer pricing provisions through a six-level measure of strictness of national transfer pricing regulations. The six categories for strictness of transfer pricing rules are mainly based on the transfer pricing documentation requirements in the national tax legislation; however, additional factors such as the definition of related parties, the deadline for documenting transfer pricing, the limitation period and the penalties are also considered. Relatedly, Lohse and Riedel (2013) investigate the effectiveness of transfer pricing rules in restricting profit-shifting behavior for a sample of 26 countries from 1999 to 2009. For this purpose, they categorize countries based on transfer pricing rules into three categories based on the scope and evolution of transfer price documentation requirements, and also take into consideration other issues such as existence of specific penalties and availability of APAs. Marques and Pinho (2016) developed a transfer pricing strictness index based on two pillars: rules on transfer pricing (legal rules and documentation requirements) and law enforcement mechanisms (issues related to sanctions, transfer pricing audit, and penalty aspects.). Relatedly, Mescall and Klassen (2018) developed a measure that uses 16 features of countries' transfer pricing rules and enforcement and weights them according to an extensive survey of 76 transfer pricing practitioner experts based in 33 countries. Their measure includes not only the detailed aspects of documentation requirements (for example, features related to the data used by tax authorities and foreign comparables) but also enforcement aspects (features related to penalty and enforcement). Yet, Rathke et al. (2020) examine the characteristics of transfer pricing rules across countries and cluster countries into four categories regarding the consistency of transfer

pricing rules with the OECD Transfer Pricing Guidelines. Based on their analysis, the most relevant differences in transfer pricing characteristics among countries include the priority of transfer pricing methods, APA, and the effectiveness of competent authority procedures.

To sum up, despite the difficulty of determining the different features of transfer pricing rules among countries, the characteristics of transfer pricing rules according to the prior literature can be divided into five general categories: the existence and applicability of transfer pricing rules, the priority of methods, documentation requirements, APA, and penalties.

### ***2.2. Relevant Literature and Hypothesis Development***

Understanding the role of anti-avoidance rules on MNEs' behavior is essential to navigate how MNEs shape their real investment decisions. Both the effectiveness of anti-tax avoidance rules in restricting international income shifting (Klassen & Laplante, 2012; Lohse & Riedel, 2013; Saunders-Scott, 2013), and their consequences on investment and capital structure decisions are confirmed by prior research (e.g., Branzoli & Caiumi, 2020; Buettner et al., 2018; Eberhartinger et al., 2020; Egger & Wamser, 2015). For example, a strand of literature documents the effect of Controlled Foreign Corporation (CFC) rules on investment and capital structure of firms (Branzoli & Caiumi, 2020; Clifford, 2019; Egger & Wamser, 2015; Hebous & Ruf, 2017). Clifford (2019) examines the change in the financial and locational structure of MNEs in response to CFC rules, and shows that CFC rules cause MNEs to locate fewer subsidiaries in low-tax countries. Buettner et al. (2018) inquire the sensitivity of FDI of German multinationals' affiliates to tax rates and interaction with the strictness of anti-profit shifting rules. They find that thin capitalization rules increase the sensitivity of investment to tax rates and result in lower investment by MNEs in higher tax countries.

Turning to the transfer pricing rules, they have real consequences on investment decisions of firms since they increase the cost of tax avoidance (Buettner et al., 2018; Jacob, 2022). With stricter regulations, the cost of tax avoidance increases, thereby firms engage in less tax

avoidance activities. De Mooij and Liu (2020) argue that transfer pricing regulations make profit shifting costlier for MNEs, and reduce the optimal supply of intermediate inputs, thereby reducing the return on investment in the foreign affiliates. Consistent with this prediction, they find that the introduction of transfer pricing regulations dampens MNEs' investment in their affiliates, but this effect is significantly weaker for firms that heavily rely on intangibles. In comparison, Buettner et al. (2018) find no significant result regarding the effect of transfer pricing rules on FDI.

While the prior literature document the ambiguous effect of the strictness of transfer pricing rules on the investment decisions of MNEs, our study focuses on changes in transfer pricing rules across countries, including changes that lead to stricter or more lenient transfer pricing regulations. Apart from the introduction or strictness of transfer pricing rules, understanding the effect of changes in these rules on MNEs' behavior is crucial, as transfer pricing rules are currently under continuous changes around the globe. These frequent changes in transfer pricing regulations might have a positive or negative impact on MNEs' investment.

We investigate several potential explanations for how changes in transfer pricing regulations could affect the compliance cost and economic activity of MNEs. On the one hand, many countries continue to expand and change transfer pricing documentation requirements, transparency initiatives, and audits, which can increase uncertainty and risk in MNEs' transfer pricing positions. Mescall and Klassen (2018) define transfer pricing risk as the risk of a transfer pricing position being discovered and denied and the risk of penalties. The features of transfer pricing regulations in a country that increase transfer pricing risk, based on Mescall and Klassen (2018), including using secret comparables by tax authorities, precluding foreign comparables, precluding cost contribution arrangements, requiring concurrent documentation, and having uncertainty over penalties (Mescall & Klassen, 2018). For example, in 2010, the Italian government introduced the transfer pricing documentation requirements in the national law, and Greece

increased the transfer pricing penalties. On the other hand, other features in transfer pricing regulations, such as APA and availability of benchmark data to determine transfer price to taxpayers, reduce transfer pricing risk.

Moreover, some changes in transfer pricing regulations, especially in developing countries such as Russia, India, and Brazil, could lead to a more uniform global standard, which reduces the transfer pricing uncertainty. For instance, Brazil's approach to transfer pricing legislation was notoriously different from that of the OECD, and this caused obvious compliance issues for corporations. Another example is Indian transfer pricing rules which were unique in the sense that they required the computation of a single arm's length instead of a range. Limiting the transfer pricing uncertainty by harmonizing transfer pricing rules could foster the economic activity of firms and reduce their challenges stemming from different rules.

Changes in transfer pricing regulations could affect firms' perception of uncertainty of the transfer pricing framework of countries. Depending on the level of uncertainty perceived by firms, both negative and positive effects of changes in transfer pricing regulations on MNEs' affiliate investment are possible.

First, changes in transfer pricing regulations could reduce investment if the change leads to more uncertainty in the transfer pricing position of MNEs, which may reduce cash flow. This effect could be observed particularly in the first years following a change when there is high uncertainty regarding the implementation and enforcement of the rules. Prior literature documented the effect of uncertainty on investment. Julio and Yook (2012) focus on political uncertainty and examine cycles in corporate investment in the context of national elections across the world. They find that firm investment expenditure declines by an average of 4.8% during election years. Prior research also indicates that country-level risk factors can influence the impact of taxes on corporate risk-taking. For instance, Osswald and Sureth-Sloane (2020) provide evidence that tax-specific inefficiencies in tax administrations and tight fiscal budgets

mitigate the incentivizing effect of loss-offset provisions on corporate risk-taking. Theoretical literature document the ambiguous effect of tax uncertainty on investment decisions (Niemann, 2004, 2011). Yet, there seems to be a consensus in the empirical studies that tax uncertainty is harmful to investment (Edmiston, 2004; Jacob et al., 2022). Relatedly, Gallemore et al. (2021) suggest that expectation and uncertainty about tax policy could potentially affect the efficiency of tax policy changes and shape investment decisions.

Second, some firms are likely insensitive to change or may even increase their investment due to more uncertainty. The uncertainty resulting from changes in transfer pricing regulations could potentially lead to considerable benefits and create opportunities for some firms. Firms could exploit the uncertainty inherent in transfer pricing rules (for example, firms with a high share of intangibles) in their favour to avoid more taxes and increase the benefit from shifting profit internationally. Therefore, they may increase their investment in countries with more transfer pricing uncertainty.

Third, changes in transfer pricing regulations might increase investment if changes reduce or eliminate transfer pricing uncertainty. Diller et al. (2017) use advance tax rulings as an instrument to mitigate tax uncertainty and investigate under which circumstances investors have an incentive to request advance tax rulings to offset uncertainty. They show that advance tax rulings could potentially foster investment. Consequently, changes in transfer pricing regulations could also promote investment by reducing transfer pricing uncertainty and potentially benefit tax authorities as well as firms.

Taken together, firms assess the risk and uncertainty of tax burden and future cash flows when making an investment decision. MNEs are expected to reduce their capital investment when dealing with higher uncertainty sourcing from the change in transfer pricing regulation in the affiliates' countries. Alternatively, some changes in transfer pricing regulations could reduce the uncertainty, thereby leading to more investment. Moreover, some firms might benefit from

the uncertainty stemming from changes in the regulations, to avoid more taxes, and increase their investment in countries with more changes in transfer pricing regulations. We expect the impact of changes in transfer pricing regulations on investment decisions of foreign affiliates of MNEs to be highly dependent on the level of uncertainty and risks perceived by firms related to the transfer pricing framework in the country following the change in these regulations. Thus, it is an empirical question whether and to what extent MNEs change their capital investment in foreign affiliates following a change in transfer pricing regulations in their country. Therefore, we hypothesize the following:

*Change in transfer pricing regulations is negatively correlated with the investment level of MNE's subsidiaries.*

### **3. Research Design and Sample Selection**

#### ***3.1. Changes in Transfer Pricing Regulations***

Our empirical analysis focuses on changes in transfer pricing regulations. We employ the country-year transfer pricing measure developed by Mescall and Klassen (2018) to capture the changes in various aspects of transfer pricing regulations and enforcement. To develop a time-varying proxy for transfer pricing, they employ country-level transfer pricing regulations and enforcement using expert assessments.<sup>9</sup> They capture 16 aspects of transfer pricing regulations and enforcement in countries and estimate a country-year model for the strictness of the transfer pricing system in countries and label it as transfer pricing risk.<sup>10</sup>

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<sup>9</sup> Transfer pricing experts were asked in the survey whether specific transfer pricing regulations increase, decrease or have no effect on the transfer pricing risk.

<sup>10</sup> The 16 characteristics of transfer pricing regulations and enforcement are age of rules, whether tax authority allows APAs, whether benchmark data are available to taxpayer; whether tax authority requires contemporaneous documentation, whether tax authority allows cost contribution arrangements, whether tax authority precludes commissionaire arrangements, whether tax authority allows foreign comparables for estimating the transfer price, if tax authority allows related party setoffs, if taxpayers have to pay the tax assessment before going to competent authority, if there is a priority of methods, whether tax authority requires disclosure on the tax return concerning related party transactions, whether tax authority allows a self-initiated adjustment, if the tax authority has rules for transfer pricing documentation, whether there is provision related to reduction of penalty, whether tax authority

The Mescall and Klassen measure includes some features of transfer pricing regulations that reduce the transfer pricing risk, such as APAs, reduction of penalty, availability of benchmark data to taxpayers, and some features that increase the transfer pricing risk, such as ambiguity of transfer pricing enforcement and acceptability of foreign comparables by tax authorities. Using this measure helps our empirical analysis in different ways. First, compared to other available measures, which mainly focus on documentation requirements, this measure encompasses various aspects of transfer pricing regulations in countries, such as documentation requirements, the strictness of enforcement, acceptance of cost contribution and commissionaire arrangements. Second, this measure enables us to exploit changes in transfer pricing regulations in a cross-country setting. Third, the time window of the measure is large, enabling us to track the changes in transfer pricing rules from 2007 to 2015. Lastly, we are able to capture the changes that increase and decrease the transfer pricing risk.

To proxy for *change*, we first calculate the difference between the current and previous year's transfer pricing measure, and define *change* as a dummy variable equal to one if the change in the country-year transfer pricing measure is greater or less than the standard deviation of all the changes in the sample. Table 1 provides an overview of the *change* in transfer pricing regulations in our sample countries.

As discussed before, some transfer pricing changes help with reducing uncertainty in the transfer pricing framework in the country. For example, a change in transfer pricing regulations in 2012 in Russia led to less uncertainty. Although the general transfer pricing regulations were introduced in Russia before 2012, the documentation requirements were not legally required, but in practice, the Russian tax authority asked for documentation requirements. Therefore, there was a high uncertainty about the transfer pricing rules in Russia before 2012. The new

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uses proprietary tax data to calculate a “revised” transfer price, and the level of transfer pricing enforcement in country.

**Table 1.** Overview of change in transfer pricing regulations

Notes: This table presents the specific years that a change in the transfer pricing rule occurs across our sample countries. Change in transfer pricing (*TP Change*) is an indicator variable equal to one if the change in country-year transfer pricing measure based on Mescall and Klassen (2018) is greater or less than the standard deviation of all transfer pricing changes in the sample.

**Panel A: Countries with changes between 2007-2015**

<b>Country</b>	<b>Year</b>	<b>Country</b>	<b>Year</b>
Argentina	2008, 2010, 2011, 2013	Italy	2008, 2009
Australia	2007, 2008, 2011	Mexico	2010, 2012
Austria	2008, 2010, 2011	New Zealand	2013
Belgium	2013	Philippines	2010
Brazil	2007, 2011	Poland	2011, 2012
Chile	2007, 2011, 2013	Portugal	2007, 2009
China	2007, 2008, 2010	Romania	2011
Colombia	2007, 2008, 2010, 2012	Russia	2007, 2010, 2011, 2012, 2013
Czech Republic	2010	Spain	2007, 2009, 2012
Denmark	2007	Sweden	2007, 2010
Ecuador	2007, 2010	Switzerland	2011, 2012
Finland	2007, 2008, 2013	Thailand	2011
France	2008	Uruguay	2011, 2012
Greece	2012, 2014		
Hungary	2007, 2011		
India	2009, 2011		

**Panel B: Countries without change between 2007-2015**

<b>Country</b>
Germany
Japan
Korea
Luxembourg
Netherlands
Norway
Peru
Slovakia
United States

Russian transfer pricing rules became effective in January 2012, in which cost contribution arrangements, APA, and commissionaire arrangements were allowed by the tax authority and the taxpayers had to prepare contemporaneous documentation. The new regulations also accepted the foreign comparables for estimating the transfer price and whether taxpayers were

allowed to make adjustments to the tax base. As a result of these changes, the transfer pricing measure decreased from 3.47 to 2.94 in 2012. Another example is Austria, which revised its transfer pricing guideline in 2010. This change in transfer pricing regulations caused substantial changes regarding transfer pricing rules; for example, changes in the priority of methods, the availability of benchmarking data for taxpayers, and the acceptance of foreign comparables. Consequently, the transfer pricing measure increased from 1.9 to 2.9 in 2010. Later in 2011, there was a formal procedure for obtaining unilateral APAs in Austria; thereby, the transfer pricing measure decreased.

Our sample includes countries with no substantial changes in transfer pricing regulations between 2007 and 2015, such as Germany, Japan, and the USA, as well as countries with multiple changes, for instance, Argentina, Australia, and Colombia. Figure 1 provides an overview of the frequency of change in transfer pricing rules in our sample countries.

### 3.2. Empirical Specification

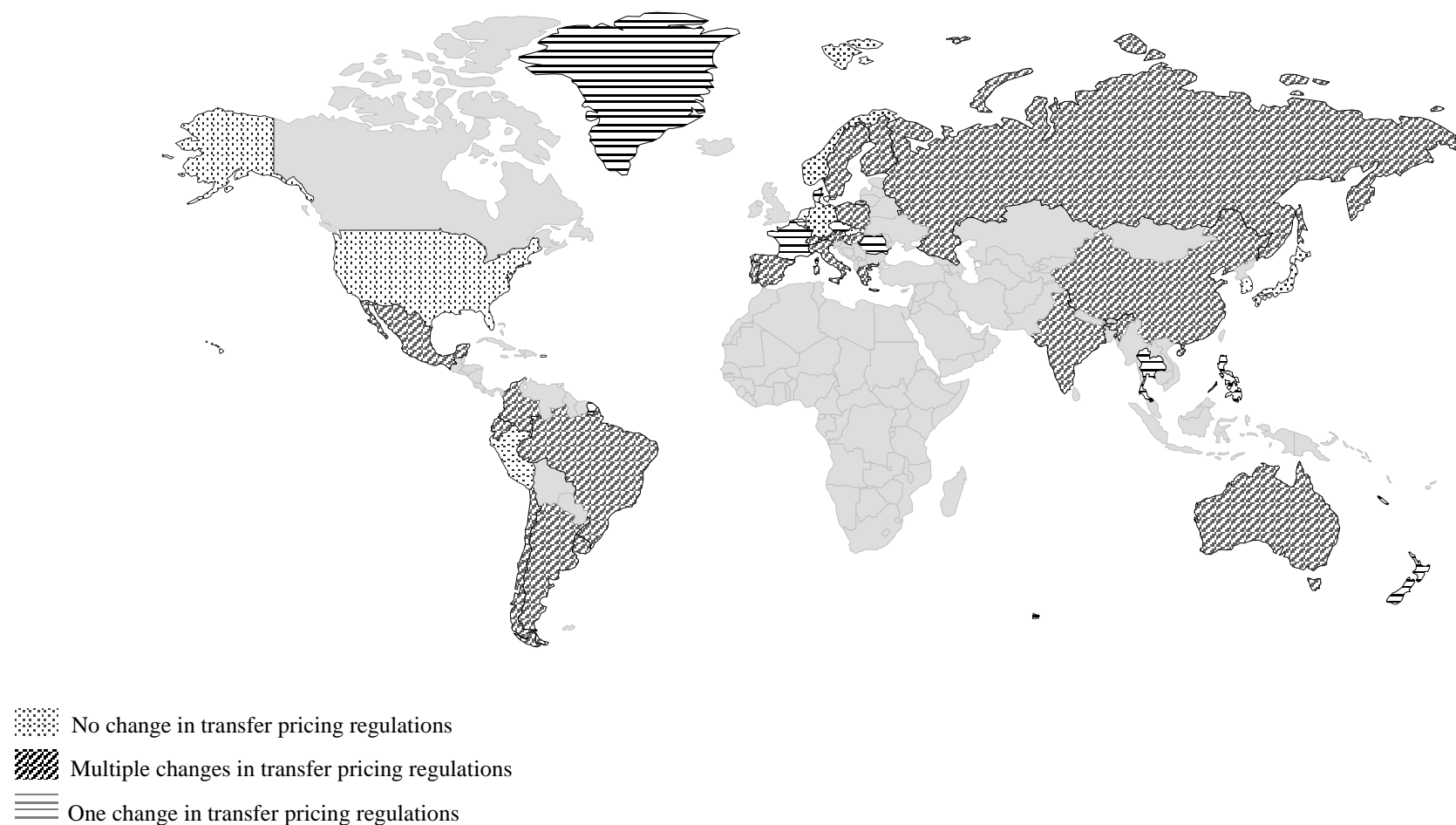
To examine the effect of uncertainty arising from changes in transfer pricing regulations on firms' investment decisions, we test the following first-difference regression:

$$\Delta K_{ijt} = \beta_0 + \beta_1 TP\ Change_{jt-1} + \beta_2 \Delta \theta_{jt} + \beta_3 \Delta \chi_{it} + \varepsilon_{ijt} \quad (1)$$

Where  $i$ ,  $j$ , and  $t$  denote subsidiary, subsidiary country, and year; and  $\Delta$  is the first-difference operator. The dependent variable  $\Delta K$  represents the subsidiary's annual change in net fixed assets scaled by lagged total assets, winsorized at the first and 99<sup>th</sup> percentiles. The variable  $TP\ Change_{jt-1}$  is an indicator variable equal to one when the change in country-year transfer pricing measure by Mescall and Klassen (2018) is greater or less than the standard deviation of all the changes in the sample countries. We also include a set of country-level controls to account for the subsidiaries' country characteristics.

**Figure 1.** Frequency of change in transfer pricing regulations across countries

Notes: This figure presents the frequency of change in transfer pricing regulations in our sample countries between 2007 and 2015. The transfer pricing data is taken from Mescall and Klassen (2018). The transfer pricing measure of Mescall and Klassen (2018) includes 16 features of countries' transfer pricing rules and enforcement. Change in transfer pricing (*TP Change*) is an indicator variable equal to one if the change (the difference between the current and previous year's transfer pricing measure) in country-year transfer pricing measure is greater or less than the standard deviation of all changes in the sample.



We include statutory corporate tax rates to control for the potential confounding effect of taxation on investment (Becker & Riedel, 2012). Moreover, country controls such as *GDP per Capita*, *GDP Growth*, and unemployment rate as proxies for market size and overall economic activity are included in the model. We include *Openness*, measured as the sum of imports and exports divided by GDP, to control for the dependence of the economy on foreign trade (Jacob & Vosseb rger, 2022). Furthermore, following Osswald and Sureth-Sloane (2020), we use the Worldwide Governance Indicators (WGI) to proxy for political risk by measuring governance and political stability.

$X_{i,t}$  denotes a set of time-varying firm control variables. We control for changes in leverage ( $\Delta Leverage$ ), return on assets ( $\Delta ROA$ ), and size following prior investment literature (e.g., Baker et al., 2003; Shroff, 2017). We employ the first-difference approach, which removes unobserved time-invariant firm characteristics and, unlike a level specification with firm fixed effect, can easily accommodate multiple transfer pricing changes per country. We further include industry-country-year fixed effects in all regressions.<sup>11</sup> Lastly, standard errors are clustered at the country-industry level following He et al. (2022). All variables are defined in Appendix A.

### 3.3. Data and Sample

The subsidiary-level unconsolidated financial data for this study is collected from Bureau van Dijk's (Bvd) Orbis database from 2007 to 2015. We use ownership information available in Orbis to re-construct MNEs' holding structure and determine directly and indirectly held subsidiaries.<sup>12</sup> We require a total participation of more than 50 percent by a parent in a single subsidiary to include that subsidiary in our sample (Amberger et al., 2021). We further require

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<sup>11</sup> Industry-country-year fixed effects consist of 2-digit NACE code, the year and country.

<sup>12</sup> The ownership information is time-invariant in Orbis data, meaning the group ownership structure in our sample is defined at the time of the download of the data (Dec 2021). Despite this limitation, the ORBIS is the most comprehensive financial dataset which is extensively has been used in academic and policy research.

MNEs to have at least two subsidiaries as our research question explores the change in the investment pattern of MNEs in their subsidiaries resulting from changes in the affiliates' local country transfer pricing regulations. Following the previous literature and based on the industry classification code, we drop observations in the financial sector because of their unique investment patterns (Badertscher et al., 2013). All observations with the missing industry classification code are discarded. Moreover, we require subsidiaries with non-missing values for total assets, operating revenue, fixed assets, or cash and cash equivalents. Following Bethmann et al. (2018), we exclude subsidiaries with total or fixed assets of less than US\$100,000. See Appendix B for a more detailed overview of the sample selection process.

The change in transfer pricing regulations is constructed based on the measure of transfer pricing developed and provided by Mescall and Klassen (2018), as explained in detail before. We collect data on country-level control variables such as *GDP*, *GDP growth*, *Openness*, *Unemployment* and *Political Risk* from the World Bank. The data on statutory tax rates are obtained from KPMG Corporate Tax Rates Table<sup>13</sup>.

We exploit changes in transfer pricing regulations. Our sample consists of 240,656 affiliate-year observations that include 63 significant changes in transfer pricing regulations in 38 countries. Table 2 presents the number of subsidiary-year observations in our sample by country. Our sample comprises both developed and developing countries. We observe that 21.5 percent of the total subsidiaries are located in France, followed by Italy (12.26 percent), Spain (9.46 percent) and the largest number of parents residing in large, developed countries such as France (16.87 percent), Germany (12.13 percent), and Italy (8.01 percent).

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<sup>13</sup> See KPMG Corporate Tax Rates Table, <https://home.kpmg/it/it/home/services/tax/tax-tools-and-resources/tax-rates-online/corporate-tax-rates-table.html>.

**Table 2.** Distribution of subsidiary-year observations by country

Notes: This table presents the number of affiliate-year observations per country in our sample over the period from 2007 to 2015.

Subsidiary-Year			Subsidiary-Year		
Country	N	%	Country	N	%
Argentina	3	0.00	Luxembourg	963	0.4
Australia	148	0.06	Mexico	6	0.00
Austria	4,975	2.07	Netherlands	1,260	0.52
Belgium	12,725	5.29	New Zealand	511	0.21
Brazil	24	0.01	Norway	8,120	3.37
Chile	70	0.03	Peru	47	0.02
China	10,789	4.48	Philippines	996	0.41
Colombia	1,703	0.71	Poland	16,336	6.79
Czech Republic	12,116	5.03	Portugal	5,588	2.32
Denmark	1	0.00	Romania	3,062	1.27
Ecuador	31	0.01	Russia	1	0.00
Finland	3,775	1.57	Slovakia	3,894	1.62
France	51,966	21.59	Spain	22,773	9.46
Germany	18,971	7.88	Sweden	11,850	4.92
Greece	1,432	0.60	Switzerland	42	0.02
Hungary	2,462	1.02	Thailand	12	0.00
India	2,104	0.87	United States	1	0.00
Italy	29,510	12.26	Uruguay	17	0.01
Japan	8,863	3.68			
Korea	3,509	1.46			
Total				240,656	100

Table 3 presents the descriptive statistics for our sample.<sup>14</sup> We winsorize all firm-level and country variables at the 1 percent and 99 percent levels following (De Simone et al., 2022). Our dependent variable is the subsidiary's annual change in net fixed assets scaled by lagged total assets (*Investment*). The mean annual change in fixed assets amounts to 0.9 percent of total assets. On average, subsidiaries report leverages of 9.1 percent and a return on assets of 3.3 percent. The average (median) corporate tax rate is 28.5 (30) percent. The average (median) for *Unemployment* and *Political Risk* are 9.633 (8.725) and 5.676 (6.598), respectively.

<sup>14</sup> Appendix C displays the Pearson correlations for the variables used to test our hypothesis.

**Table 3.** Descriptive statistics

Notes: This table describes the sample and summary statistics for the cross-country sample of our main variables for 240,565 affiliate-year observations from 2007 to 2015 used in the empirical tests. All continuous variables are winsorized at the 1st and 99th percentiles.

Variable	Mean	SD	p25	p50	p75
<i>Investment</i>	0.009	0.171	-0.047	-0.009	0.019
<i>Leverage</i>	0.091	0.191	0.000	0.000	0.077
<i>ROA</i>	0.033	0.128	-0.005	0.032	0.088
<i>Size</i>	16.757	1.631	15.590	16.605	17.776
<i>Str</i>	0.285	0.054	0.250	0.300	0.333
<i>Ln (GDP per capita)</i>	10.133	0.714	9.789	10.405	10.539
<i>GDP Growth</i>	1.792	2.726	0.418	1.343	2.809
<i>Openness</i>	77.339	35.045	55.655	61.996	85.791
<i>Unemployment</i>	9.633	5.286	6.117	8.725	10.975
<i>Political Risk</i>	5.676	3.67	4.364	6.598	8.139
<i>FixedInv</i>	0.091	0.843	-0.182	-0.072	0.072
<i>TP Vol</i>	0.402	0.213	0.187	0.339	0.576

## 4. Empirical Results

### 4.1. Baseline

Our baseline regression results are presented in Table 4. We estimate equation (1) to test the effect of changes in transfer pricing regulations on the investment decisions of multinational firms. Columns (1) and (3) present the results without parent country fixed effects, and columns (2) and (4) present the results with parent country fixed effects to control for the parent country characteristics such as legal or regulatory factors that might affect investment behavior of subsidiaries. The coefficients of *TP Change* in columns (1) to (4) indicate that the capital investment of subsidiaries is influenced following a change in transfer pricing regulation. The results hold when parent country fixed effects are included (Columns 2 and 4). All the *TP Change* variables are significant at the 1% level. The coefficient estimate -0.008 in column (2) indicates that following a change in transfer pricing regulations in the subsidiary country, MNEs reduce their investment in the respective country by 0.8 percentage points on average ( $p < 0.001$ ). We also find that the effect of change in transfer pricing regulations on capital investments increases

over two periods as the coefficient of *TP Change t-2* is larger than the coefficient of *TP Change t-1*, showing that MNEs even further decrease their investment levels after two periods (*TP Change t-1* = -0.008 and *TP Change t-2* = -0.017). Regarding the timing of investments, Columns (1) to (4) reveal a delayed investment response a year later, which is consistent with the notion that MNEs need time to respond to the tax policy and changing the investment may take some time.<sup>15</sup> The baseline results suggest that changes in transfer pricing regulations matter for the MNEs' investment decisions, as the change is associated with uncertainty about their tax positions, future cash flow and potential penalty.

The results for control variables are generally consistent with our expectations. That is, the level of investment increases in the subsidiary's *ROA*, *Leverage*, and *Size*. Moreover, consistent with prior literature (Becker & Riedel, 2012; Giroud & Rauh, 2019), we find that higher corporate taxes reduce investments, although the results are not statistically significant.

Thus, consistent with our hypothesis, we find that affiliates reduced their level of investment following a change in transfer pricing rules due to a more uncertain transfer pricing environment. This result is consistent with the notion that the uncertainties surrounding transfer pricing regulations are significant for MNEs to consider in their investment decision.

### **4.2. Supplementary Analysis**

#### *Increase versus Decrease in Transfer Pricing Risk*

We further examine whether MNEs respond differently to change in transfer pricing regulations which leads to higher or lower transfer pricing risk. The first intuition could be that firms perceive a change in transfer pricing rules as uncertain, regardless of whether the change leads to higher or lower transfer pricing risk. Particularly, this effect could be observed in the first years after a change, when there is high uncertainty regarding the enforcement of the rule, even if the

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<sup>15</sup> We also test for the anticipatory investment effects, i.e., we would expect that investments in  $t$  do not respond to changes in transfer pricing in  $t+1$  and  $t+2$ . Consistent with our expectations, the results are insignificant.

change in the rule aims to create more certainty for the MNEs, such as the APA. On the contrary, MNEs might respond differently to transfer pricing changes when they perceive that the change leads to higher risk or lower risk of transfer pricing, for example, if a change in transfer pricing rules preclude the commissionaire arrangements or require contemporaneous documentation.

**Table 4.** Changes in transfer pricing rules and capital investment

Notes: This table presents the results of equation (1). The dependent variable is *Investment*, measured as the subsidiary's annual change in net fixed assets scaled by lagged total assets. Our main variable of interest, *TP Change*, is an indicator variable equal to one if the change (the difference between the current and previous year's transfer pricing measure) in country-year transfer pricing measure based on Mescall and Klassen (2018) is greater or less than the standard deviation of changes in the sample. All continuous variables are winsorized at the 1% and 99% levels. All variables are measured as in first differences. Variables are defined in Appendix A. Industry-year-country fixed effects are included in all regressions. We report robust standard errors clustered at the country–industry level in parentheses. \*, \*\*, and \*\*\* denote significance at the 10%, 5%, and 1% levels, respectively.

VARIABLES	(1) Investment	(2) Investment	(3) Investment	(4) Investment
<i>TP Change</i> <sub><i>t-1</i></sub>	-0.008*** (0.002)	-0.008*** (0.002)		
<i>TP. Change</i> <sub><i>t-2</i></sub>			-0.017*** (0.002)	-0.016*** (0.002)
<i>ΔLeverage</i>	0.048*** (0.008)	0.047*** (0.008)	0.047*** (0.008)	0.047*** (0.008)
<i>ΔROA</i>	0.036*** (0.008)	0.036*** (0.008)	0.035*** (0.008)	0.035*** (0.008)
<i>ΔSize</i>	0.250*** (0.005)	0.251*** (0.005)	0.250*** (0.005)	0.251*** (0.005)
<i>ΔSTR</i>	-0.017 (0.060)	-0.036 (0.062)	0.065 (0.059)	0.054 (0.061)
<i>ΔGDP per Capita</i>	-0.251*** (0.043)	-0.101** (0.049)	-0.239*** (0.038)	-0.095** (0.044)
<i>ΔGDP Growth</i>	-0.003*** (0.000)	-0.003*** (0.000)	-0.003*** (0.000)	-0.003*** (0.000)
<i>ΔOpenness</i>	0.002*** (0.000)	0.001*** (0.000)	0.002*** (0.000)	0.001*** (0.000)
<i>Δ Unemployment</i>	-0.004*** (0.001)	-0.003*** (0.001)	-0.005*** (0.001)	-0.003*** (0.001)
<i>Δ Political Risk</i>	-0.051*** (0.013)	-0.053*** (0.014)	-0.060*** (0.014)	-0.062*** (0.014)
<i>Constant</i>	-0.004*** (0.001)	-0.012*** (0.003)	-0.002 (0.001)	-0.003 (0.003)
Observations	240,656	240,636	240,656	240,636
R-squared	0.109	0.110	0.109	0.110
Industry_year_country FE	Yes	Yes	Yes	Yes
Parent FE	No	Yes	No	Yes

We thus create a dummy for the *TP Change-lower risk* equals one if the country-year *TP Change* variable equals one and the change in transfer pricing measure is decreasing. The *TP Change-higher risk* denotes a dummy variable equal to one if the country-year *TP Change* variable is equal to one and the change in transfer pricing measure is increasing. We then use these dummy variables in our baseline regression.

Table 5 shows results of the regressions separately for changes in the rules that lead to decrease and increase in the risk of transfer pricing. The results in columns (1) to (4) are generally consistent with the notion that MNEs reduce their investment in the subsidiary country following a change that leads to higher risk of transfer pricings and slightly increase their investment in the subsidiaries when the changes in regulations leads to lower risk of transfer pricing.

#### *Frequency of Change in Transfer Pricing Regulations*

We further examine the association between frequent changes in transfer pricing regulations in countries and investment of MNE's subsidiaries. Frequent changes in transfer pricing regulations makes it difficult for firms to process the information about the regulations and implementation, leading to unintentional mistakes, non-compliance, and even litigation and penalties. MNEs require more time to adopt to changes in countries where the changes in transfer pricing rules are frequent, because of the difficulties in understanding and incorporating the changes in the rules in their compliance system. Moreover, when MNE's perceive that there were frequent changes in transfer pricing regulations in the past years, the uncertainty created as a result about the future of transfer pricing system in respective countries, is expected to reduce MNE's investment in those countries.

In Columns (5) and (6) of Table 5, we include the volatility in change in transfer pricing regulations (*TP Vol*) among countries to compare the investment of subsidiaries in countries with more and less frequent changes. Intuitively, frequent changes in transfer pricing rules would increase the uncertainty in these rules, and there is a substantial variation in tax uncertainty

among countries. We use the standard deviation of transfer pricing measure per country to measure the transfer pricing uncertainty, denoted by *TP Vol*. The results in columns (5) and (6) of Table 5 indicate that frequent changes in the transfer pricing regulations in a country is associated with lower investments of MNE's subsidiaries in that country.

**Table 5.** Increase and decrease in transfer pricing risk

*TP Change-lower risk* equals one if the country-year *TP Change* equals one and the change in transfer pricing measure is negative. *TP Change-higher risk* denotes a dummy variable equal to one if the country-year *TP Change* is equal to one and the change in transfer pricing measure is positive. *TP Vol* is the standard deviation of transfer pricing measure per country. All continuous variables are winsorized at the 1% and 99% levels. All variables are measured as first differences from the lagged values. Variables are defined in Appendix A. Industry-year-country fixed effects are included in all regressions. We report robust standard errors clustered at the country–industry level in parentheses. \*, \*\*, and \*\*\* denote significance at the 10%, 5%, and 1% levels, respectively.

Variables	(1) Investment	(2) Investment	(3) Investment	(4) Investment	(5) Investment	(6) Investment
<i>TP Change-lower risk</i> <sub><i>t-1</i></sub>	0.006** (0.003)	0.007** (0.003)				
<i>TP Change-higher risk</i> <sub><i>t-1</i></sub>			-0.022*** (0.003)	-0.022*** (0.003)		
<i>TP Vol</i>					-0.005* (0.003)	-0.002* (0.003)
Observations	240,656	240,636	240,656	240,636	240,656	240,636
R-squared	0.108	0.109	0.109	0.110	0.109	0.109
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry_year_country FE	Yes	Yes	Yes	Yes	Yes	Yes
Parent FE	No	Yes	No	Yes	No	Yes

#### 4.3. Heterogeneous Country Characteristics

Next, we investigate whether the negative association estimated in Table 4 might vary across heterogeneous country characteristics. To obtain more insights into the responses of firms concerning country characteristics, we first focus on subsidiaries in low and high-tax countries. Since transfer pricing regulations aim to retrain firms from cross-border profit shifting, higher uncertainties associated with changes in transfer pricing regulations in high-tax countries likely have a stronger effect on respective subsidiaries since the risk and cost of profit shifting in these countries become higher. In order to test the potential heterogeneous impacts of low and high-

tax countries, we split the sample based on statutory tax rates. *Low Tax* denotes the firms in countries at the 25<sup>th</sup> statutory tax rate percentile and *High Tax* represents the firms in countries at the 75<sup>th</sup> percentile. We run separate regressions for the subsamples of high versus low tax. The results are shown in Table 6. Columns (1) and (2) present results of *TP Change* for observations, where the corporate tax rate in the subsidiary country is low (column (1)) versus high (column (2)). Consistent with our expectation, we find stronger association between the changes in transfer pricing regulations and investment in subsidiaries located in high-tax countries.

The association between changes in transfer pricing regulations and investment of subsidiaries may differ also across countries with different developmental levels. The spectrum of transfer pricing advances across developed countries and developing countries is vast and also ranges from the introduction of transfer pricing regulations and alignment with the OECD to issuing landmark rulings. While the trend of changes in transfer pricing regulations in developed countries is toward more strict regulations, developing countries have increased focus on aligning the rules with the OECD standards (UN, 2021). Relatedly, Rathke et al. (2020) classify countries for the period 2010-2016 based on the consistency of transfer pricing regulations with the OECD guidelines. The largest group in their samples comprises of mainly developed countries<sup>16</sup> that adopted the OECD guidelines into their domestic legal system with few complementary domestic provisions. In comparison, they show that countries such as Chile, Colombia, and Ecuador have domestic transfer pricing provisions that differ substantially from the OECD baseline standards. The major differences between countries in Rathke et al. (2020) study is related to the priority of TP methods and the availability of APA, which reduces the transfer pricing uncertainty for the firms. Therefore, harmonizing the transfer pricing regulations with the OECD standard in developing countries creates certainty for MNEs to boost their activities

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<sup>16</sup> The countries in this group are: Australia, Austria, Belgium, Canada, China, Denmark, France, Germany, Greece, India, Indonesia, Ireland, Italy, Japan, Malaysia, Mexico, Netherlands, Poland, Portugal, Slovak Republic, Spain, Sweden, United Kingdom, United States.

and increase their investment.

To test the effect of transfer pricing changes on the investment of MNEs in subsidiaries in developing countries, we first use the International Monetary Fund's (IMF's) classification for developed and developing countries.<sup>17</sup> The database lists forty countries as developing countries.<sup>18</sup> Thus, we create a dummy variable that is equal to one if the countries in our sample belong to the list of developing countries from the IMF database and zero otherwise. Columns (3) and (4) of Table 6 represent the two subgroups' results. Results indicate that *TP Change* in developing countries increases the investment of MNEs in those countries, whereas the coefficient for the *TP change* is still negative and significant for the subsidiaries in other countries. We find consistent results when splitting the sample by *GDP per capita* in columns (5) and (6). To test whether this association is related to changes that lead to higher or lower transfer pricing risk, in Columns (7) and (8), we include *TP Change-higher risk* and *TP Change-lower risk* and re-estimate the baseline regression for developing countries. We performed F-tests for the differences in coefficients of Columns (1) and (2), Columns (3) and (4), Columns (5) and (6), and Columns (7) and (8); our results report statistical significance in all the cases.

Interestingly, the results in Columns (7) and (8) of Table 6 indicate that subsidiaries located in developing countries do not respond to a change that leads to higher transfer pricing risk (the coefficient is not statistically significant, although it is negative), but they increase their investment in these countries after a change that reduces transfer pricing risk. This result shows that in the case of developing countries, changes in transfer pricing regulations that eliminates uncertainty of transfer pricing framework could promote investment of the MNEs in the subsidiaries located in those countries. This result highlights that resolving uncertainties and

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<sup>17</sup> There are two classifications based on IMF: developed and emerging markets and middle-income economies. We denote emerging markets and middle-income economies as developing countries. See <https://www.imf.org/external/datamapper/datasets/FMEconGroup.xlsx>

<sup>18</sup> From our sample countries, Argentina, Brazil, Chile, Ecuador, Hungary, India, Mexico, Peru, Philippines, Poland, Romania, Russia, Thailand and Uruguay are among the emerging markets and middle-income economies based on IMF classification.

peculiarities in transfer pricing regulations in developing countries could foster economic activity and attract MNEs' investment. In line with our findings, the report of the joint project on transfer pricing between OECD and Receita Federal do Brasil implies that divergences and gaps in transfer pricing regulations in Brazil are harmful to its economy, as many taxpayers avoid Brazil as the destination of their investments due to the inherent double taxation risk and high compliance cost (OECD/Receita Federal do Brasil, 2019). The report indicates that Brazil could attract more foreign investment by aligning the transfer pricing rules with international standards.<sup>19</sup>

### **4.4. Robustness Tests**

To test the robustness of our baseline findings, Table 7 presents regressions from alternative specifications. In column (1), we present results using an alternative investment measure. The investment measure in this specification is the change of the natural logarithm of fixed assets from  $t-1$  to  $t$ . We continue to observe a negative and significant coefficient for change in transfer pricing rules. Moreover, to control for the potential heterogeneity that MNEs have performed differently during the Great Recession, we limit the sample period to the years after 2009 in column (2). The results indicate that controlling for the potential differential influence of the Great Recession on MNEs investment does not substantially change our main variable of interest, *TP Change*. In column (3), we assess the robustness of our results to alternative fixed effects structures. The result shows that the coefficient estimates for *TP Change* remain unchanged.

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<sup>19</sup> This anecdotal evidence could be observed in other developing countries as well. For instance, in 2008, KPMG in India called for comprehensive changes to India's transfer pricing rules in its submission to the union government. The reason for this call was inconsistencies in the interpretation and application of the transfer pricing rules by authorities in India, which were solved with a set of rules and guidelines in several transfer pricing issues. See <https://www.internationaltaxreview.com/article/b1fyfxynm8bymn/kpmg-india-calls-for-new-transfer-pricing-guidelines>. Another example is Russia's transfer pricing law change in 2010 that includes many of the features of international systems, such as contemporaneous documentation, guidance on the use of new methods, and advance pricing agreements.

**Table 6.** Heterogenous country characteristics

Notes: This table presents the heterogeneity in investment responses to transfer pricing changes based on country characteristics. The dependent variable is *Investment*, measured as the subsidiary's annual change in net fixed assets scaled by lagged total assets. Our main variable of interest, *TP Change*, is an indicator variable equal to one if the change in country-year transfer pricing measure based on Mescall and Klassen (2018) is greater or less than the standard deviation of changes in the sample. Columns (1) and (2) show results for different effects of *TP Change* on investment in low- and high-tax countries. Countries are denoted as low tax if the subsidiary's country tax rate belongs to the bottom quantile of statutory tax rates in our sample. We further divide the sample based on countries' developmental levels. Columns (3) and (4) show results for different effects of *TP Change* on investment in developed and developing countries. This classification is based on IMF's classification for developed countries and developing countries. Columns (5) and (6) present the results for splitting the sample by *GDP per capita*. Columns (7) and (8) report the results for the *TP Change-higher risk* and *-lower risk* in developing countries. *TP Change-higher risk* denotes a dummy variable equal to one if the country-year *TP Change* is equal to one and the change in transfer pricing measure is positive. All continuous variables are winsorized at the 1% and 99% levels. Variables are defined in Appendix A. Industry, year, and country fixed effects are included in all regressions. We report robust standard errors clustered at the country–industry level in parentheses. \*, \*\*, and \*\*\* denote significance at the 10%, 5%, and 1% levels, respectively.

Variables	(1) Investment	(2) Investment	(3) Investment	(4) Investment	(5) Investment	(6) Investment	(7) Investment	(8) Investment
	Corporate Tax Rates in the Subsidiary Country		Developed and Developing Countries		GDP per capita of Subsidiary Country		Developing Countries	
	Low Tax	High Tax	Developing	Developed	Low GDP	High GDP	Higher risk	Lower risk
<i>TP Change</i> <sub><i>t-1</i></sub>	-0.003* (0.003)	-0.014*** (0.005)	0.011*** (0.004)	-0.012*** (0.002)	0.005* (0.002)	-0.032*** (0.003)		
<i>TP Change-higher risk</i> <sub><i>t-1</i></sub>							-0.007 (0.005)	
<i>TP Change-lower risk</i> <sub><i>t-1</i></sub>								0.053*** (0.009)
Observations	81,671	76,440	37,663	202,973	77,923	84,588	37,663	37,663
R-squared	0.103	0.113	0.146	0.102	0.129	0.102	0.146	0.148
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry_year_country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Parent FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

**Table 7.** Robustness tests

Notes: This table presents the alternative estimations of the baseline regression (Table 4). Our main variable of interest, *TP Change*, is an indicator variable equal to one if the change in country-year transfer pricing measure based on Mescall and Klassen (2018) is greater or less than the standard deviation of changes in the sample. In column (1), results for alternative investment measure is reported. Investment alternatively is measured as the change of the natural logarithm of fixed assets. In column (2), we report results for limiting the sample to the years after 2009 to eliminate the effect of the Great Recession. In column (3), we report results using alternative fixed effects structures. Column (4), presents results using an alternative proxy for changes in transfer pricing rules to estimate equation (1). *TP Change\** is an indicator variable that is equal to one if the global transfer pricing guidelines report a change in transfer pricing rules in a given country in a given year. All continuous variables are winsorized at the 1% and 99% levels. All variables are measured as first differences from the lagged values. Variables are defined in Appendix A. We report robust standard errors clustered at the country–industry level in parentheses. \*, \*\*, and \*\*\* denote significance at the 10%, 5%, and 1% levels, respectively.

VARIABLES	(1) Investment FixedInv	(2) Investment after 2009	(3) Investment Alternative FE	(4) Investment- TPchange
<i>TP Change<sub>MK</sub></i>	-0.038*** (0.008)	-0.006*** (0.002)	-0.008*** (0.002)	
<i>TP Change*</i>				-0.026*** (0.002)
<i>ΔLeverage</i>	0.102*** (0.029)	0.049*** (0.008)	0.047*** (0.008)	0.048*** (0.008)
<i>ΔROA</i>	-0.110*** (0.033)	0.039*** (0.008)	0.036*** (0.008)	0.036*** (0.008)
<i>ΔSize</i>	0.662*** (0.022)	0.249*** (0.005)	0.251*** (0.005)	0.251*** (0.005)
Observations	232,188	233,947	240,636	239,009
R-squared	0.028	0.109	0.110	0.111
Country controls	Yes	Yes	Yes	Yes
Industry_year_country FE	Yes	Yes	No	Yes
Parent FE	Yes	Yes	Yes	Yes
Industry_year FE	No	No	Yes	No
Country_year FE	No	No	Yes	No

In our last test, to validate the robustness of our results, we re-estimate equation (1) using an alternative proxy for changes in transfer pricing rules, using *TP Change\**. To capture the objective changes in transfer pricing rules, we gather data from Deloitte, EY, PwC, and KPMG Global Transfer Pricing Guidelines. *TP Change\** is an indicator variable equal to one if the global transfer pricing guidelines report a change in transfer pricing rules in a given country in a given year. We continue to observe a negative and significant relation between the change in transfer pricing rules and the level of investment of the subsidiaries.

### 5. Conclusion

In this study, we focus on changes in transfer pricing regulations across countries and investigate to what extent these changes affect the investment of MNEs. Using a sample of subsidiaries in 38 countries, we find that the level of investment in affiliates is reduced following a change in transfer pricing regulations. The measure of transfer pricing from Mescall and Klassen (2018) provides cross-country variation in transfer pricing regulations and enforcement from 2007 to 2015, thereby enables us to capture changes in these regulations for our sample countries.

Considering cross-country variations, our results present crucial differences regarding the response of firms to transfer pricing changes across countries. The negative effect of changes in transfer pricing regulations on subsidiaries' investments is more pronounced for the subsidiaries located in high-tax countries. Our results also indicate that the impact of changes in transfer pricing differs across countries with different developmental levels. The attempts of developing countries to align with global transfer pricing standards and resolve the transfer pricing peculiarities will reduce the uncertainty for firms and, therefore, increase investment level in these countries.

The global legislative framework on transfer pricing has undergone several changes during the past years in the wake of international guidelines. Our results indicate that changes in transfer pricing regulations increase uncertainty about the transfer pricing framework and induce less investment, and this association is higher in the countries that have frequent changes. As frequent changes in transfer pricing regulations in the past cause firms in general to distrust the transfer pricing framework and also expect more changes in the future. Moreover, international organizations such as OECD and UN highlight the importance of harmonizing the rules and inclusion of developing countries to address transfer pricing regulations mismatches and seeking to reduce compliance costs and the risk of double taxation (UN, 2021). Our findings provide insights for policymakers and tax administrations globally. Our results provide evidence that

developing countries could attract and boost MNEs' investment in their countries by reducing transfer pricing uncertainty through eliminating the peculiarities and aligning the transfer pricing regulations with global standards.

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**Appendix A.** Variable descriptions

<b>Firm and Country Variables</b>		
Variable	Definitions	Source
<i>Investment</i>	Fixed assets of subsidiary <i>i</i> in year <i>t</i> less fixed assets of subsidiary <i>i</i> in year <i>t-1</i> scaled by total assets of subsidiary <i>i</i> in year <i>t-1</i>	Bureau van Dijk's Orbis
<i>Leverage</i>	The sum of long-term and short-term debt of subsidiary <i>i</i> in year <i>t</i> scaled by total assets of subsidiary <i>i</i> in year <i>t</i>	Bureau van Dijk's Orbis
<i>RoA</i>	Profit after tax of subsidiary <i>i</i> in year <i>t</i> scaled by total assets of subsidiary <i>i</i> in year <i>t</i>	Bureau van Dijk's Orbis
<i>Size</i>	Natural logarithm of total assets of subsidiary <i>i</i> in year <i>t</i>	Bureau van Dijk's Orbis
<i>TP Change</i>	An indicator variable equals one if the change (the difference between the current and previous year's transfer pricing measure) in the country-year measure of transfer pricing in Mescall and Klassen (2018) is above the standard deviation of change in the sample.	Mescall and Klassen (2018)
<i>TP Vol</i>	Standard deviation of transfer pricing measure per country	Mescall and Klassen (2018)
<i>TP Change-lower risk</i>	An indicator variable equals one if the country-year <i>TP Change</i> equals one and the change in transfer pricing measure is negative.	
<i>TP Change-higher risk</i>	An indicator variable equal to one if the country-year <i>TP Change</i> is equal to one and the change in transfer pricing measure is positive.	
<i>Statutory tax rate</i>	The average statutory corporate income tax rate in the country at year <i>t</i>	KPMG
<i>Ln (GDP per capita)</i>	Natural logarithm of per-capita GDP in constant 2010 USD	World Bank
<i>GDP Growth</i>	The percentage change in GDP in a country from year <i>t-1</i> to <i>t</i>	World Bank
<i>Openness</i>	Sum of import and export divided by GDP	World Bank
<i>Political Risk</i>	Sum of governance index of a country's WGI indicators: Voice and Accountability, Political Stability, Government Effectiveness, Regulatory Quality, Rule of Law, Control of Corruption. Following Osswald and Sureth-sloane (2021) to facilitate interpretation, we standardize the variable over the sample period and multiply it by -1, so a higher value indicates higher political risk	World Bank Worldwide Governance Indicators (WGI)
<i>Corruption</i>	A yearly estimate of perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption.	World Bank Worldwide Governance Indicators (WGI)

## Changes in Transfer Pricing Regulations and Corporate Investment Decisions

<i>Voice and Accountability</i>	A yearly estimate of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media.	World Bank Worldwide Governance Indicators (WGI)
<i>Political Stability</i>	A yearly estimate of citizens perception of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including politically motivated violence and terrorism.	World Bank Worldwide Governance Indicators (WGI)
<i>Government Effectiveness</i>	A yearly estimate 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.	World Bank Worldwide Governance Indicators (WGI)
<i>Regulatory Quality</i>	Yearly estimate which captures the perception of the ability of the government to formulate and implement policies and regulations.	World Bank Worldwide Governance Indicators (WGI)
<i>Rule of Law</i>	Yearly estimate which captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence.	World Bank Worldwide Governance Indicators (WGI)
<i>Unemployment</i>	Unemployment rate in the country	World Bank

**Appendix B. Sample selection**

Sample Selection	Observations (subsidiary-years)
Data obtained from Bureau van Dijk's Orbis data base after dropping observations with only local subsidiaries and subsidiaries where the parent holds a total participation $\leq 50$ percent	2,717,202
After dropping subsidiaries with missing country-level variables	1,037,581
After dropping subsidiaries in the financial sector (NACE 6400-6899) and missing NACE code	997,366
After dropping observations with missing or negative values for total assets, fixed assets, cash	957,718
After dropping observations with total assets and fixed assets < US\$100,000	720,773
After dropping observations for countries with insufficient tax data	554,333
After dropping observations without sufficient data for variables	240,656

**Appendix C. Correlations**

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) <i>Investment</i>	1.000								
(2) <i>Leverage</i>	0.033*	1.000							
(3) <i>ROA</i>	0.044*	-0.160*	1.000						
(4) <i>Size</i>	0.051*	-0.003	0.100*	1.000					
(5) <i>Ln (GDP per capita)</i>	-0.046*	0.025*	0.015*	-0.004*	1.000				
(6) <i>GDP Growth</i>	0.009*	-0.053*	0.040*	0.083*	-0.439*	1.000			
(7) <i>STR</i>	-0.015*	-0.035*	-0.042*	0.017*	0.284*	-0.204*	1.000		
(8) <i>Openness</i>	-0.004*	0.005*	0.013*	-0.031*	0.228*	0.056*	-0.228*	1.000	
(9) <i>Political Risk</i>	-0.024*	0.016*	0.029*	-0.008*	0.830*	-0.269*	0.194*	0.320*	1.000

\* shows significance at the .05 level

## **B) Transfer Pricing Rules for Intangibles: Implementation and Practical Challenges**

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**Abstract:** This study analyzes the main characteristics of transfer pricing rules related to intangible assets based on OECD Transfer Pricing Guidelines. I examine the definition of intangibles under OECD Guidelines, explain value-adding functions, and elucidate how profits can be distributed among entities of multinational firms based on these functions. Furthermore, I describe the OECD approach for hard-to-value intangibles (HTVI). I exploit data on the implementation of the main characteristics of OECD transfer pricing rules related to intangibles in 58 countries and elaborate on regulatory differences. The analysis illustrates that inconsistencies can be observed in the implementation of OECD Transfer Pricing Guidelines for intangibles across countries. Furthermore, developed and developing countries exhibit a similar pattern in implementing transfer pricing rules related to intangibles in their domestic legislation. Additionally, practical challenges regarding the adoption of the OECD Transfer Pricing Guidelines for intangibles are outlined. Among other practical issues, onerous documentation requirements, the risk of disputes, and double taxation are the main challenges in implementing transfer pricing rules for intangibles.

**Keywords:** Transfer pricing, Intangibles, MNE

Acknowledgements: I am grateful for the valuable comments from Mehrzad Azmi, Daniel Dyck, Henning Giese, Vanessa Heinemann-Heile, and Caren Sureth-Sloane. I gratefully acknowledge financial support from the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) – Collaborative Research Center (SFB/TRR) Project-ID 403041268 – TRR 266 Accounting for Transparency.

### 1. Introduction

This study reviews the main characteristics of transfer pricing rules related to intangibles based on the OECD Transfer Pricing Guidelines. In particular, I analyze the implementation of transfer pricing rules for transactions involving intangibles across countries and elaborate on the practical challenges of implementing these rules. Closely observing the magnitude of disputes in publicized international tax disputes demonstrates the crucial role of intangible assets (e.g., Apple, Starbucks, Nike, Amazon, and Coca-Cola).<sup>20</sup> This role stems from the fact that multinational enterprises (MNE) can move intangibles and their associated income to low-tax countries, thereby significantly reducing their tax burden (Dischinger & Riedel, 2011; Griffith et al., 2014; Grubert, 2003). Additionally, Taylor et al. (2015) provide evidence for this behavior by firms, identifying an association between multinationalism, the use of tax havens, and intangible assets with firms' transfer pricing aggressiveness.

In response to tax revenue loss triggered by MNEs' tax planning strategies, recent tax policy initiatives, such as the OECD Action Plan on Base Erosion and Profit Shifting (BEPS) and the Platform for Collaboration on Tax (IMF, OECD, UN, WBG, 2017) address key issues related to the shifting of intangibles. These initiatives provide guidance to align and strengthen the link between economic activity and value creation to ensure that profits are taxed where economic activities occur (OECD, 2013).

The core concept of the OECD Transfer Pricing Guidelines for the appropriate pricing of transactions between related affiliates is the arm's length principle, which is legally reflected in several national tax laws and double tax treaties (Article 9 of the OECD Model Tax Convention). This principle requires that the transfer price between related affiliates be the same as that unrelated affiliates would agree upon under comparable conditions (OECD, 2017). Determining

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<sup>20</sup> A recent case is the state aid challenge by the European Commission against Apple. The European Commission appealed the General Court's judgment on Apple's state aid case in Ireland on 25 September 2020. The amount challenged by the European Commission is more than \$13 billion (Chee, 2019); see also White (2021).

the transfer price requires comparable information for assessing the MNEs transfer price. However, considering that intangible assets are firm-specific in nature, and comparable transactions are often unavailable for these transactions, determining an appropriate arm's length price is challenging (Desai et al., 2006).

The legal framework for determining transfer pricing related to intangibles is provided in Chapter VI of the OECD Transfer Pricing Guidelines for Multinational Enterprises and Tax Administration (OECD, 2022b). The OECD has undertaken substantial efforts to align transfer pricing outcomes with value creation in the area of intangibles and has provided supplemental guidance for determining arm's length conditions for transactions involving intangibles, which are followed by numerous countries. However, significant differences exist across countries pertaining to the implementation of these transfer pricing guidelines for intangibles. Understanding the implications of differences in transfer pricing rules across countries is important to fight base erosion and profit shifting and to reduce the risk of double taxation.

The objective of this study is, in a first step, to present and provide an overview of the three main characteristics of OECD Transfer Pricing Guidelines regarding intangible assets. First, I discuss what is understood by the concept of intangibles according to OECD Transfer Pricing Guidelines. Furthermore, I examine the role of legal ownership by considering the importance of functions, assets, and risks in the allocation of profits based on Development, Enhancement, Maintenance, Protection, and Exploitation (DEMPE) functions. According to the OECD, the legal ownership of intangibles is no longer sufficient to allocate a substantial amount, or even the group's residual profit, to the legal owner. To allocate a risk-bearing profit to the legal owner of intangible assets, the so-called DEMPE functions of intangibles are crucial, wherein a distinction is made between the legal and economic ownership of intangibles from a transfer pricing perspective. Finally, the HTVI approach adopted by the OECD in the Transfer Pricing Guidelines in 2017 is described. This approach addresses the negative effects of information

asymmetry by providing tax administrations with a useful tool when assessing transactions involving intangibles for which the valuation is highly uncertain (Rodríguez Peña, 2020).

In a second step, this study exploits data on the implementation of the main characteristics of transfer pricing rules related to intangibles in 58 countries and discusses the differences in regulatory characteristics as well as the heterogeneity in the implementation of these rules. Furthermore, this study provides an overview of the implementation of transfer pricing rules for intangibles in developed and developing countries since the OECD and UN emphasize the importance of the inclusion of developing countries for the consistency of transfer pricing rules and to avoid a multiplicity of approaches, which can lead to compliance burdens and the risk of unrelieved double taxation. Finally, practical challenges concerning the adoption of OECD Guidelines regarding the transfer-pricing aspect of intangibles are elaborated.

The analysis reveals that approximately 27 countries in the sample implemented transfer pricing rules for intangible assets in their domestic legislation, while only 11 countries adopted the HTVI approach in their domestic legislation. Nevertheless, most countries in the sample follow the DEMPE approach for allocating intangible returns to multinational firm entities. The supplementary analysis suggests a significant variation in the implementation of transfer pricing rules for intangibles across countries. While some developed countries, such as Germany and the USA, have fully adopted the main features of OECD transfer pricing rules in their domestic legislation, other countries, such as Brazil, Switzerland, and Panama, have not yet implemented any features of transfer pricing rules for intangibles in their domestic legislation. Moreover, developed and developing countries exhibit a similar pattern in implementing transfer pricing rules regarding intangibles in their domestic regulations and aligning themselves to OECD Transfer Pricing Guidelines with support from various initiatives under the OECD and the UN. However, major concerns regarding the adoption of transfer pricing rules for intangibles in developing countries are the unavailability of data and lack of expert skills (UN, 2021).

Furthermore, inconsistencies in the implementation of intangible aspects of transfer pricing rules can be observed. The first issue relates to the definition of intangibles in countries' domestic legislation. Some countries clearly define intangible assets for transfer pricing purposes (e.g., the UK, USA); however, others do not precisely define intangible assets and do not clearly explain whether the definition of intangibles differs from the legal and accounting definitions for transfer pricing (e.g., France, the Netherlands). The second issue concerns the peculiarities of transfer pricing rules related to intangibles in some countries. For example, Chinese tax authorities conduct a six-function (DEMPEP) analysis instead of DEMPE when assessing the profit allocation of intangible income, which include a final "P" for promotion (Chi et al., 2015). Inconsistencies in transfer pricing rules related to intangibles may decrease the expected tax liabilities for taxpayers who engage in substantial income shifting, and in turn, they can cause more aggressive auditing by tax authorities (De Waegenaere et al., 2006). However, inconsistencies do not affect countries uniformly. The theoretical work by Diller et al. (2021) suggests that low-tax countries benefit from consistency under specific conditions, whereas high-tax countries benefit from inconsistency. Additionally, inconsistencies can increase tax disputes, which incur significant costs for tax authorities and taxpayers (UN, 2021).

This study also addresses practical issues related to the implementation of transfer pricing rules for intangibles. The practical issues concerning the DEMPE functions of intangibles discussed in the literature include the complexity of identifying contributors to DEMPE functions when several departments of an MNE in several countries are engaged in DEMPE functions (Greinert et al., 2020; Paumier, 2020; Verlinden et al., 2019), onerous documentation requirements to support functional analysis (Austin et al., 2021; Chand & Lembo, 2020; Verlinden et al., 2019), and the risk of transfer pricing disputes between taxpayers and tax authorities and the risk of double taxation (Greinert et al., 2020; Heggmaier, 2017; Musselli, 2017). These issues are particularly challenging for the pharmaceutical industry because the development of a new drug

usually requires the involvement of several group companies and third parties (Vallat, 2020). The main issue concerning HTVI, addressed in prior literature, is the incompatibility of the HTVI approach with the arm's length principle (Hagelin, 2019; Penelle, 2017; Rodríguez Peña, 2020). The underlying reasons for this incompatibility with the arm's length principle are the use of hindsight by tax authorities, transactional adjustment if the taxpayer cannot rebut the presumptive evidence, and shifting of the burden of proof to taxpayers.

This study's contribution to the literature on transfer pricing rules is twofold. First, I build on previous studies that examine the key differences in transfer pricing rules across countries (Marques & Pinho, 2016; Rathke et al., 2020; Zinn et al., 2014) and comprehensively analyze the implementation of transfer pricing rules related to intangibles across countries. Furthermore, existing studies examining the association between transfer pricing rules and profit-shifting activities of MNEs via intangibles find limited or no effect of transfer pricing rules on the profit-shifting of intangibles (Baumann et al., 2020; Beer & Loeprick, 2015; Marques & Pinho, 2016). These studies neglect the role of transfer-pricing rules for intangible assets. For example, Beer and Loeprick (2015) considered introduction of the documentation requirement for transfer pricing at the national level as a measure for enforcing transfer pricing provisions. Further, Baumann et al. (2020) employed the transfer pricing measure of Mescall and Klassen (2018), which does not include any component related explicitly to the transfer pricing of intangibles. To investigate the effect of transfer pricing rules on the profit-shifting activities of MNEs via intangibles, including transfer pricing rules related to intangibles is necessary for obtaining reliable results.

Second, I contribute to the literature on transfer pricing inconsistencies (De Waegenare et al., 2006; Diller et al., 2021) by examining the implementation of transfer pricing rules for intangibility across countries to identify the inconsistencies and their implications for firms. Moreover, I offer practical implications by solving regulatory mismatches and eliminating blind spots in

transfer-pricing rules regarding intangibles.

## **2. Background and Development of Transfer Pricing Rules**

### ***2.1. Tax Planning Strategies and Intangibles***

The changing nature of the global economy and digitalization draws attention to the novel role of intangible capital as a new source of growth and innovation. Intangibles are critical for productivity and economic growth (e.g., Pece et al., 2015; Thum-Thysen et al., 2017). For example, the contribution of total intangible assets to output growth in the EU-15 is one to three times higher than that of tangible assets (Thum-Thysen et al., 2017). The business models of multinational firms have changed significantly and rely heavily on intangible assets. Figure 1 illustrates the investment and capital by assets in the 40 countries from 2011 to 2021 to depict the main drivers of GDP and productivity growth. The Figure 1 reveals that the average investment in intangible assets grows faster than in tangible assets.<sup>21</sup>

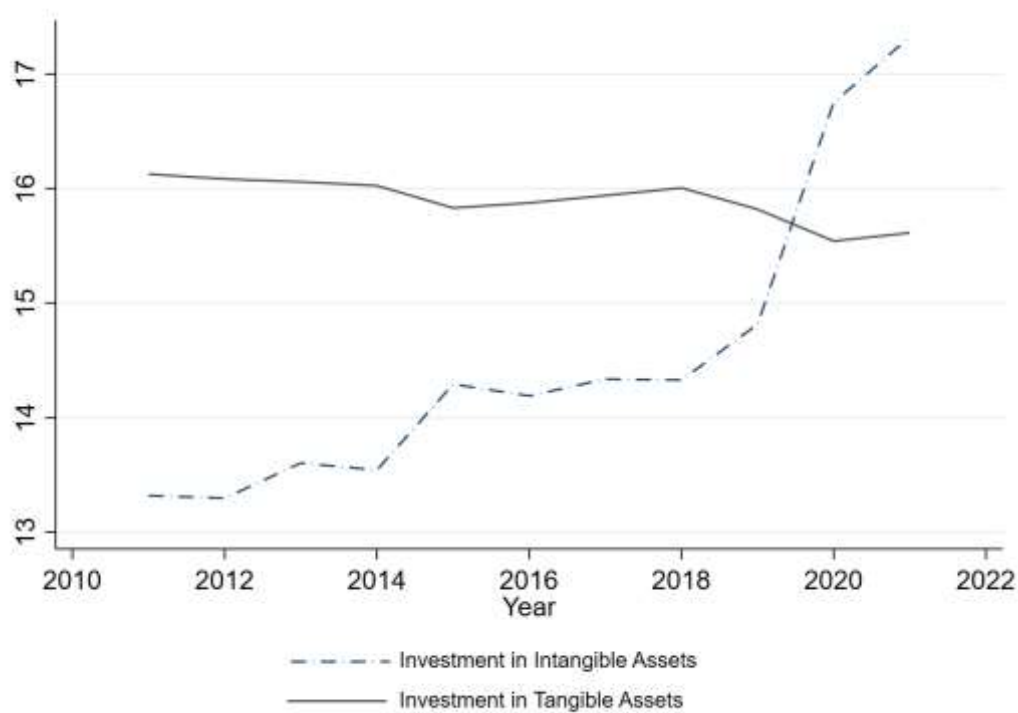
Prior literature has unambiguously documented an association between firms' intellectual property and profit-shifting behavior from high-tax jurisdictions to low-tax jurisdictions (Dischinger & Riedel, 2011; Griffith et al., 2014; Grubert, 2003). For example, Dischinger and Riedel (2011) and Karkinsky and Riedel (2012) demonstrate that the location of intangibles is biased toward low-tax affiliates, and a high corporate tax rate negatively impacts intangible investment as well as the number of patent applications. Similarly, Griffith et al. (2014) find that MNEs strategically locate patents in low-tax rate jurisdictions. De Simone et al. (2019) use IRS data to construct a measure of income shifting and indicate that firms in high-tech industries shift income out of the United States more successfully than firms in other industries. Consistent

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<sup>21</sup> The data is derived from OECD (2022a), and assets type in the indicator include dwellings (excluding land); other buildings and structures (roads, bridges, airfields, dams, etc.); transport equipment (ships, trains, aircraft, etc.); cultivated biological resources (managed forests, livestock raised for milk production, etc.); and intellectual property products (such as R&D, mineral exploration, software and databases, and literary and artistic originals, etc.); and information and communication technology (ICT) equipment (computer software and databases, telecommunications equipment and computer hardware). The intangible assets contain intellectual property products and ICT. The other four assets type are coded as tangible assets.

with these findings, Amberger and Osswald (2020) find, using detailed data on patent owners, that patent concentration is positively related to tax-motivated income shifting. This relation stems from increasing asymmetric information between the MNEs and local tax authority by reducing comparable information available to the tax authorities.

**Figure 1.** Investment by asset (2011 – 2021)



Notes: This figure illustrates investment by assets in 40 countries from 2011 to 2021. The data are derived from OECD (2022a), and assets type in the indicator include dwellings (excluding land); other buildings and structures (e.g., roads, bridges, airfields, and dams), transport equipment (e.g., ships, trains, and aircraft), cultivated biological resources (e.g., managed forests and livestock raised for milk production), intellectual property products (e.g., R&D, mineral exploration, software and databases, and literary and artistic originals), and information and communication technology equipment (e.g., computer software and databases, telecommunications equipment, and computer hardware). Each asset is measured as the percentage of the total gross fixed capital formation. The intangible assets contain intellectual property products, information, and communication technologies. The other four asset types were coded as tangible assets.

The role of transfer pricing as a dominant channel for profit shifting has been highlighted in the literature (e.g., Heckemeyer & Overesch, 2017). The use of intangibles creates opportunities for strategic mispricing of intra-firm trade because intangible assets are firm-specific in nature, and thus, the arm's length principle is difficult to obtain (see, e.g., Desai et al., 2006; Grubert,

2003). Several empirical studies' findings have supported this notion. Liu et al. (2017) report that tax-motivated transfer mispricing is increasing for R&D-intensive firms. Hebous and Johannesen (2021) use unique firm-level data on multinational firms in Germany and provide evidence that tax-induced mispricing of trade in services is related to intellectual property.

While transfer pricing rules effectively reduce firms' income-shifting activities (e.g., Beer & Loeprick, 2015; Lohse & Riedel, 2013; Marques & Pinho, 2016), recent research suggests that they exert no damping effect on shifting activities related to intangibles. For instance, Beer and Loeprick (2015) investigate the impact of transfer pricing documentation requirements on firms' profit-shifting activities using a sample of firms from 2006 to 2011. They illustrate that profit shifting among subsidiaries is significantly reduced after the introduction of transfer pricing documentation, whereas it exerts no significant negative impact on subsidiaries with a high intangible endowment. Baumann et al. (2020) explored the effectiveness of anti-avoidance legislation (CFC rules and transfer pricing rules) in restricting income shifting through patent locations. Their findings reveal that CFC laws can hinder patent holdings in tax-haven economies; however, transfer pricing rules exhibit a relatively weak impact on the location of patent ownership. The sketched findings are in line with De Mooij and Liu (2020), who demonstrate that the introduction of transfer pricing rules reduces MNEs affiliates' investment; however, the investment response decreases in the share of the intangible assets of affiliates.

As outlined above, on the one hand, intangible assets are associated with the profit-shifting behavior of firms. However, the role of transfer pricing rules for intangible assets in the literature related to the profit-shifting activity of firms via intangibles is neglected. For instance, Beer and Loeprick (2015) considered the introduction of the documentation requirement for transfer pricing at the national level as a measure for enforcing transfer pricing provisions. Their sample includes the introduction of documentation requirements across countries by 2011, while the transfer pricing aspects of intangible assets were not comprehensively incorporated into transfer

pricing rules until 2011. Baumann et al. (2020) employ the transfer pricing measure of Mescall and Klassen (2018), which includes 16 features of transfer pricing rules (e.g., the existence of transfer price documentation rules, the age of transfer price regulations, and the availability of advanced pricing agreements) as a measure of the strictness of transfer pricing rules. Although this measure contains several characteristics of transfer pricing rules in a country, it does not include any components explicitly related to the transfer pricing of intangibles. Neglecting rules related to intangibles might be a potential reason why the effect of transfer pricing rules on the shifting of intangibles is not observed in the literature.

### ***2.2. Development of Transfer Pricing Rules***

The OECD first issued practical guidance for transfer pricing in 1979 under title Transfer Pricing and Multinational Enterprises, which served as a basis for the transfer pricing guidelines in 1995. In 1996, the OECD introduced Chapter VI, Special Considerations for Intangible, which envisages intangible assets and intragroup services. Other guidance regarding intangibles can be found in Chapter VIII on Cost Contribution Arrangements, issued in 1997.

The application of the arm's length principle was revised substantially in 2010 to consider guidance on comparability and profit methods. Chapter IX was introduced into the OECD Transfer Pricing Guidelines in 2010 for dealing with corporate restructuring, and some guidance was provided in Chapter VI on how dependent parties deal with transactions involving intangibles for which valuation is highly uncertain. The discussion related to intangibles started in July 2010 with the invitation of the OECD to submit comments during the revision of the guidance on intangibles to address the issues that were not considered in the transfer pricing guidance in 1996 and 1997. Hence, in 2013, the OECD Action Plan on BEPS proposed a thorough review of transfer pricing guidelines and, notably, a revision of Chapter VI on intangibles. The report on Addressing Base Erosion and Profit Shifting highlighted the key pressure areas related to shifting risks and intangibles (OECD, 2013). BEPS actions were introduced in 2015 by the

OECD and G20 and were reviewed substantially in 2017 (OECD, 2017). Actions 8–10, titled “Aligning Transfer Pricing Outcomes with Value Creation,” aimed to align and strengthen the link between economic activities and profits. The guidelines for HTVI were incorporated into OECD Guidelines in 2017. The guidelines also contain substantial revisions to Action 13 (transfer-pricing documentation and CbC reporting).

The 2017 guidelines expand the discussion on comparability analysis, which has been changed to “accurately delineating the actual transaction,” determining whether a controlled transaction has economic substances, and includes more detailed functional and risk analysis than the 2010 guidelines. In 2018, the OECD released “Additional Guidance on the Attribution of Profits to a Permanent Establishment under BEPS Action 7”; and in 2020, issued a report on financial transactions.<sup>22</sup> The latest edition of the transfer pricing guidelines was released in 2022 by the OECD and did not provide any new features but predominantly reflects the consolidation of a number of reports from the BEPS projects in 2017.

Simultaneously, in 2017, a new subcommittee on Article 9 of transfer pricing, was formed to update the UN’s practical transfer pricing for developing countries. This results in the second edition of the UN manual, similar to the 2013 edition, providing detailed guidance on applying the arm’s-length principle for developing countries, with the objective of addressing base erosion risks and issues (UN, 2013). The revisions incorporate aspects of the changes to the OECD Transfer Pricing Guidelines following the BEPS project in 2015 and are intended to strengthen the consistency of international tax rules and facilitate the inclusion of developing countries. Although the UN manual mirrors the guidance and approaches of the OECD Guidelines, slight differences exist between them in some areas. Additionally, the UN issued a handbook in 2017 (second edition) criticizing the work of the OECD related to issues involving intangibles and payments for intangibles and affirming that several developing countries still face substantial

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<sup>22</sup> Transfer Pricing Guidance on Financial Transactions.

base erosion through payments for rent and royalty. The handbook underlines the exchange of information and the identification of abusive practices to tackle BEPS and highlights its administrative burden.

### **3. Transfer Pricing Rules for Intangibles**

This section presents the outcomes of the revision of Chapter VI of the OECD Guidelines for Multinational Enterprises and Tax Administrations regarding intangibles (OECD, 2022b). First, I discuss the definition of intangibles for transfer pricing purposes based on the OECD Transfer Pricing Guidelines. Furthermore, I present the DEMPE approach for the allocation of returns derived from the exploitation of intangibles in MNEs, wherein the importance of the legal ownership of intangibles is replaced by an assessment of functional ownership, and review the OECD guidance on HTVI.

Transactions involving intangibles are challenging from the transfer pricing perspective because of the lack of comparability between controlled and uncontrolled transactions and issues concerning the ownership of intangibles (OECD, 2022b). Therefore, paragraph 6.34 of the OECD Guidelines provides a six-step analytical framework to perform a transfer pricing analysis concerning intangibles transactions (OECD, 2022b). The six steps are as follows:

- 1) Identify the intangibles and economically significant risks associated with the DEMPE of the intangibles.
- 2) Identify the full contractual arrangements and determine the legal ownership of intangibles based on the terms and conditions of legal arrangements.
- 3) Identify the parties performing functions through a detailed functional analysis, using assets, and managing risks related to DEMPE.
- 4) Determine the consistency between the terms of the relevant contractual arrangements and the conduct of the parties (including control over the risk and financial capacity for

the risk).

- 5) Identify and delineate the actual controlled transactions related to the DEMPE of intangibles in light of the legal ownership of intangibles, other contractual arrangements, and conduct of the parties—including functions performed, assets used, and risk allocation.
- 6) Where possible, determine arm's length prices for these transactions consistent with each party's contributions, including preformed functions, assets used, and risk assumed.

These steps include identifying the intangibles and the specific economically significant risks associated with the DEMPE functions. Additionally, these steps concern identifying the contractual arrangements and, in particular, determining the legal ownership of intangible parties performing DEMPE activities. Furthermore, consistency between the terms of the relevant contractual arrangements and the parties' actual conduct needs to be confirmed when assessing transactions involving intangibles. Therefore, first determining the constituents of an intangible entity according to OECD Guidelines is important.

### ***3.1. Definition of Intangibles***

A significant part of Chapter VI addresses the accurate delineation of transactions involving intangibles. In light of the conceptual framework, the importance of determining intangibles for analyzing transactions related to intangibles between associated enterprises is considered. Therefore, the starting point for transfer pricing analysis regarding intangibles is the definition of intangibles. Paragraph 6.6 of the OECD Guidelines defines an intangible asset as follows:

*Something that is not a physical asset or a financial asset, and which is capable of being owned or controlled for use in commercial activities, and whose use or transfer would be compensated had it occurred in a transaction between independent parties in comparable circumstances. (OECD, 2022b, p. 247)*

Notably, per the OECD Guidelines, intangibles recognized for transfer pricing purposes may not necessarily be recognized for accounting purposes. It is, therefore, not an accounting or legal definition but rather determined based on conditions that third parties would also agree on in comparable situations.

Furthermore, the OECD Guidelines contain illustrations to clarify the definition of intangibles (paragraphs 6.18–6.31). The illustrations consider patents, know-how, trade secrets, trademarks, trade names and brands, rights under contracts and government licenses, and licenses and similar limited rights as intangibles. Although goodwill and ongoing concern are also discussed in OECD illustrations, the status of goodwill and ongoing concern is a point of debate, and the determination of their compensation is contentious. The OECD Guidelines neither define these two items as intangibles nor explicitly state that goodwill and ongoing concerns are intangible. However, the guidelines indicate that for transfer pricing, it is not invariably relevant to provide a precise definition of goodwill, but recognizing this in the context of a total or partial transfer of assets of an operating business is important. Goodwill often represents a significant part of monetary remuneration in a transfer between unrelated parties. Consequently, while goodwill and ongoing concerns are not considered intangible, they should be considered when pricing intangible transactions at arm's length. Based on Article 9 of the OECD Model Tax Convention, the key consideration is whether a transaction conveys economic value in a related-party transaction. Similar to goodwill and ongoing concern, specific local market advantages, group synergies, and an assembled workforce are not considered intangibles because they cannot be owned or controlled and are not intangibles for transfer pricing purposes. Table 1 provides an overview of the definition and illustration of intangibles by the OECD.

Three important factors should be considered in the context of transfer pricing analysis based on OECD Guidelines (OECD, 2022b). First, the thrust of a transfer pricing analysis for intangibles should be the determination of the conditions that would be agreed upon between

independent parties for a comparable transaction; therefore, the definition of intangible for transfer pricing purposes may not always be considered as such for legal or accounting purposes because the transfer pricing concept surpasses legal labeling (Screpante, 2019). For example, patent law generally requires the registration of intangibles, whereas such registration is not needed for an intangible to be recognized as such for transfer pricing purposes. Second, while the protection and registration of intangibles might help determine the existence of intangible assets and could affect their value, it is not a necessary condition for transfer pricing analysis. For instance, know-how and trade secrets contribute to a firm's commercial activity, but a firm may choose not to register them.

**Table 1.** Definition of intangibles based on OECD Transfer Pricing Guidelines

<b>“... something that is not a physical asset or a financial asset, and which is capable of being owned or controlled for use in commercial activities” (para. 6.6 OECD Guidelines)</b>	
Patents	Intangibles (paragraph 6.19)
Know-how and trade secrets	Intangibles (paragraph 6.20)
Trademarks, trade names, and brands	Intangibles (paragraphs 6.20–6.23)
Rights under contracts and government licenses	Intangibles (paragraphs 6.24–6.25)
Licenses and similar limited rights in intangibles	Intangibles (paragraph 6.26)
Goodwill and ongoing concern value	Not intangibles initially, but paragraphs 6.28 and 6.29 should be considered
Group synergies	Not intangibles, but relevant for TP (paragraph 6.30)
Market-specific characteristics	Not intangibles, but relevant for TP (paragraph 6.31)

Source: OECD (2022b)

In this case, know-how or trade secrets could still be considered intangible assets for transfer pricing purposes, and their value and return might be affected by their protection level (Dziwinski, 2022).<sup>23</sup> Finally, separate transferability is not a necessary condition for an item to be denoted as intangible for transfer pricing purposes, as some intangibles may be determined separately and transferred on a separate basis, and other intangibles may be transferred solely in combination with other business assets (OECD, 2022b, paragraph 6.8).

Notably, several business consultations occurred during the OECD project for Transfer Pricing Aspects of Intangibles. An important aspect of this project was the definitional aspect of intangibles, in which some commentators suggested the use of definitions drawn from other sources—such as accounting, financial valuation, and intellectual property law—to provide legal certainty. However, from the perspective of countries represented in the OECD, this would not capture all valuable intangibles that are remunerated between independent parties (Silberstein, 2011). Therefore, an intangible asset for transfer pricing purposes surpasses accounting or legal labeling, but overlaps exist in the definitions.<sup>24</sup> For example, in numerous cases, intangibles might not be recorded on the balance sheet (as required by accounting law) of firms because they are developed internally, but they will be used in the firm and generate significant profits; therefore, they must be considered for transfer pricing purposes (Lang et al., 2019).

### ***3.2. Ownership of Intangibles and DEMPE Analysis***

A primary suggestion related to intangibles in the OECD Guidelines is that the legal ownership of intangibles does not guarantee that the legal owner is entitled to full returns from exploiting the intangibles (OECD 2022b, paragraph 6.42). In transfer pricing analysis, legal rights and contractual arrangements should be considered from the starting point based on written contracts, public records, or other correspondence and communications among the parties. The

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<sup>23</sup> Paragraph 6.8 of OECD Transfer Pricing Guidelines.

<sup>24</sup> Noteworthy, the broad definition of intangibles for transfer pricing purposes creates large uncertainties for taxpayers (Lang et al, 2019).

OECD guidance highlights active functional involvement when elaborating on substance requirements concerning the transfer pricing of intangibles.

According to paragraph 6.71 of the OECD Transfer Pricing Guidelines, entitlement to the full return from intangible assets only exists from a transfer pricing perspective if the legal owner performs all the functions related to DEMPE, considering the assets used and the risk assumed. Other group members should be compensated for their contribution at the arm's length price; that is, they should be remunerated based on their performed functions, assets, and risk in the DEMPE functions of intangibles, which should be determined based on comparability analysis leading to the most appropriate price selection. DEMPE functions include important activities related to the development, enhancement, maintenance, protection, and exploitation of intangible assets. The OECD Guidelines provide some examples of important functions, such as decisions regarding the defense and protection of intangibles and ongoing quality control over functions performed by independent or associated enterprises that may exhibit a material effect on the intangible's value (OECD, 2022b, paragraph 6.56). Furthermore, the risk analysis framework indicated in chapter I of the OECD Guidelines for the accurate delineation of actual transactions should be considered.

In summary, paragraphs 6.51 and 6.71 of the OECD Guidelines clearly state that the legal owner of an intangible will be entitled to all the returns derived from the exploitation of an intangible only if the owner (i) performs and controls all the DEMPE functions; (ii) provides all assets, including funding; and (iii) assumes all the risks.

Moreover, the UN manual provides detailed guidance regarding the transfer pricing of intangibles, which primarily corresponds to OECD Guidelines; however, the UN manual slightly modifies the OECD approach to DAEMPE, wherein the additional "A" stands for the acquisition of intangibles (UN, 2021). This highlights the importance of developing or acquiring intangibles from third parties and their enhancement, maintenance, protection, and exploitation. The

inclusion of “acquisition” only clarifies that an MNE group can acquire intangibles through (self)-development activities or an outright acquisition from a third party.

### ***3.3. Hard-to-Value Intangibles***

Action 8 of the BEPS directed the development of transfer pricing rules for the transfer of HTVI and incorporated the new guidance for HTVI into the 2017 OECD Guidelines in Section D.4 of Chapter VI (OECD, 2017). In 2018, the OECD provided additional guidance on the application of the HTVI approach for tax administrations to create a common understanding among tax administrations, improve consistency, and reduce the risk of double taxation.

The OECD Transfer Pricing Guidelines describe the HTVI as intangibles for which, at the time of its transfer between group entities, (i) no reliable comparables exist; and (ii) the projections of future cash flows attributable to the transferred intangible or the assumptions used in valuing the intangible are highly uncertain, precipitating complications in predicting the ultimate success of the (right in the) intangible at the time of the transfer. The OECD provides six features wherein transactions involving HTVI exhibit one or more of these.<sup>25</sup>

According to OECD, appropriately valuing transactions involving intangibles is crucial. However, the asymmetry of information between taxpayers and tax administrations makes it difficult for tax administrations to evaluate transactions involving HTVI because of a lack of data and information and to determine the transfer price until the ex-post outcomes of the transaction are known. This impedes the ability of tax administrations to use ex-post realization as evidence against ex-ante valuation and, thereby, determines the appropriate arm’s length price. Furthermore, the uncertainty level is a major problem in estimating the outcome of a transaction

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<sup>25</sup> The features of HTVI include the following: 1) the intangible only being partially developed at the time of the transfer; 2) the intangible not being expected to be exploited commercially until several years after the transaction; 3) the intangible being integral to the development or enhancement of other hard-to-value; 4) the intangible being exploited in a novel manner, making reliable projections from past developments unavailable; 5) the intangible being transferred for a lump-sum payment; and 6) the intangible being used and/or developed under a cost contribution or cost-sharing arrangement.

involving HTVI. Neither the taxpayer nor the tax administration can anticipate developments that may affect the market situation over a certain period. Consequently, the OECD balances information asymmetry by allowing tax authorities to rely on ex-post outcomes as presumptive evidence to assess whether pricing was based on the arm's length principle.

The OECD's HTVI approach extends the powers of the tax authorities, and taxpayers bear the burden of proof of the reliability of an ex-ante projection once an ex-post outcome deviates from the projections (Konings & Morren, 2021). According to paragraph 6.193 of the OECD Guidelines, tax authorities are not allowed to use the ex-post outcomes to challenge the ex-ante price setting under all circumstances when at least one of the following exemptions applies: (i) The taxpayer can rebut the presumptive evidence by demonstrating the reliability of the information used at the time of the transfer. (ii) The difference between the financial projections and actual outcome is lower than 20%. (iii) The HTVI is covered by a bilateral or multilateral advance pricing arrangement, and a commercialization period of five years has passed following the year in which the HTVI is first generated.

## **4. Regional Differences and Practical Challenges**

### ***4.1. Main Characteristics***

Despite the OECD Transfer Pricing Guidelines regarding intangibles in Chapter VI, countries maintain unilateral rules and include specific provisions according to their regulatory background. Therefore, in this section, I focus on the main characteristics of the transfer pricing aspects of intangible assets in the OECD Transfer Pricing Guidelines and elaborate on differences in the implementation of transfer pricing rules related to intangibles in 58 countries.

I summarize the transfer pricing rules in each country with respect to (a) whether there is domestic legislation or regulations containing guidance specific to the pricing of transactions involving intangibles, (b) whether there is domestic legislation or regulation for transfer pricing

rules or special measures regarding HTVI and (c) whether the DEMPE approach is used for the appropriate remuneration and entitlement of the multinational group to profit or loss. Regarding the implementation of the DEMPE approach, three main features are considered, as follows: 1) appropriate remuneration according to DEMPE functions; 2) assumption of all risks related to DEMPE activities and control over risk; and 3) entitlement of any member of the MNE group to profit or loss related to the risks and DEMPE functions. An overview of the main characteristics of transfer pricing rules related to intangibles is illustrated in Table 2.

**Table 2.** Overview of main characteristics of transfer pricing rules related to intangibles

Item	Rating
a) Whether there is domestic legislation or regulations containing guidance specific to the pricing of controlled transactions involving intangibles	0 – No   1 – Yes
b) Whether there is domestic legislation or regulation for transfer pricing rules or special measures regarding hard-to-value intangibles (HTVI)	0 – No   1 – Yes
c) Whether the DEMPE approach is used for the appropriate remuneration and entitlement of the MNE group to profit or loss	0 – No   1 – Yes

Notes: This table presents the main characteristics of the transfer pricing rules for intangibles across countries. The data on the domestic legislation of transfer pricing for intangibles and HTVI are gathered from the OECD Transfer Pricing Country Profiles, and the data for implementation of the DEMPE approach are gathered from IBFD-BEPS Country Monitor Tables.

## 4.2. Sample and Data

The data on domestic legislation or the regulation of intangibles and HTVI are derived from the *OECD Transfer Pricing Country Profiles*.<sup>26</sup> Information on the DEMPE approach is derived from the *International Bureau of Fiscal Documentation (IBFD) - BEPS Country Monitor*

<sup>26</sup> OECD publishes jurisdiction-specific information on the implementation of key transfer pricing principles, including the intangible property and HTVI approach. For more information, see <https://www.oecd.org/tax/transfer-pricing/transfer-pricing-country-profiles.htm#tpcountryprofiles>

Tables<sup>27</sup>. The *OECD transfer pricing Country Profiles* data and *IBFD - BEPS Country Monitor* data are updated in 2022, implying that the data are cumulative and include data on the implementation of transfer pricing in 2022 and previous years. Therefore, the descriptive analysis in this study is based on the implementation of transfer-pricing rules related to intangibles in different countries until July 2022. Table 3 presents the implementation of the main characteristics of the transfer pricing rules related to intangibles across countries. I started with 73 countries from OECD transfer pricing country profiles and dropped the countries for which no data are available from the IBFD country monitor tables. The final sample comprises 58 countries with 31 developed countries and 27 developing countries.

### **4.3. Implementation**

Figure 2 presents the implementation of transfer-pricing rules related to intangibles across countries. Of the 58 countries in the sample, 27 implemented transfer pricing rules for intangibles in their domestic legislation, including developed and developing countries. While some countries, such as the UK, Austria, Colombia, Egypt, and Saudi Arabia, adopted the OECD Transfer Pricing Guidelines related to intangibles in their domestic legislation<sup>28</sup>, others, such as Australia, Switzerland, France, and Italy, have not implemented the transfer pricing rules for intangibles in domestic legislation. For example, Colombia's domestic secondary legislation contains specific guidance for transactions involving intangible and general transfer pricing rules contained in Colombian CIT, and intangible property is defined specifically under Colombian regulations on documentation according to BEPS Action 8 (Colombia Ministry of Justice and Law, 2016).

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<sup>27</sup> The IBFD BEPS Country Monitor Table provides an overview of the implementation of BEPS actions in 88 countries. The information about the DEMPE analysis is provided under “8. Aligning Transfer Pricing Outcomes with Value Creation (Intangibles)” in tables for each country. The three main features of the DEMPE approach in this paper are based on IBFD - BEPS Country Monitor Table.

<sup>28</sup> Countries that have implemented transfer pricing rules for intangibles are Argentina, Austria, China, Colombia, Denmark, Estonia, Egypt, Germany, Ireland, Japan, South Korea, Lithuania, Netherlands, Portugal, Singapore, Slovenia, United Kingdom, United States, Indonesia, Malaysia, Nigeria, Peru, Romania, Saudi Arabia, Turkey, Ukraine, and South Africa.

**Table 3.** Implementation of main characteristics of transfer pricing rules for intangibles across countries (1= Yes, 0 = No)

	Intangible	HTVI	DEMPE
<b>Developed Countries</b>			
Australia	0	0	1
Austria	1	1	1
Belgium	0	0	1
Canada	0	0	1
Czech Republic	0	0	1
Denmark	1	1	1
Estonia	1	0	1
Finland	0	0	1
France	0	0	0
Germany	1	1	1
Greece	0	0	0
Iceland	0	0	1
Ireland	1	1	1
Israel	0	0	1
Italy	0	0	0
Japan	1	1	1
Latvia	0	0	0
Lithuania	1	1	1
Luxembourg	0	0	1
Netherlands	1	1	1
Norway	0	0	1
Portugal	1	0	1
Singapore	1	0	1
Slovak Republic	0	0	0
Slovenia	1	0	0
South Korea	1	1	1
Spain	0	0	1
Sweden	0	0	1
Switzerland	0	0	0
United Kingdom	1	1	1
United States	1	1	1
<b>Developing Countries</b>			
Argentina	1	0	1
Brazil	0	0	0
Chile	0	0	1
China	1	0	1
Colombia	1	0	1
Costa Rica	0	0	0
Egypt	1	0	1
Georgia	0	0	0
Hungary	0	0	1
India	0	0	1
Indonesia	1	0	1
Kenya	0	0	1
Malaysia	1	0	1
Mexico	0	0	1
Nigeria	1	0	1
Panama	0	0	0
Peru	1	0	0
Poland	0	1	1
Romania	1	0	1
Russia	0	0	1
Saudi Arabia	1	0	1
South Africa	1	0	1

Sri Lanka	0	0	1
Tunisia	0	0	0
Turkey	1	0	0
Ukraine	1	0	1
Uruguay	0	0	1

Notes: This table presents the implementation of the main characteristics of transfer-pricing rules for intangibles across countries. Intangible is an indicator variable equal to one if a country reports the existence of domestic legislation of transfer pricing rules for intangibles based on OECD Transfer Pricing Country Profiles. HTVI is an indicator variable equal to one if a country documents the existence of domestic legislation for HTVI of transfer based on OECD transfer-pricing country profiles. DEMPE is an indicator variable equal to one if a country reports using the DEMPE approach for the entitlement of profit of intangibles—per the IBFD - BEPS Country Monitor Tables.

Another example is the Netherlands, where, despite adopting transfer pricing rules, the Dutch tax law does not define intangible (Netherlands Ministry of Finance, 2018). In some cases, such as Switzerland, Costa Rica, Latvia, the Slovak Republic, Greece, Italy, and Panama, although domestic legislation does not contain specific guidance on the pricing of controlled transactions involving intangibles, they rely on the OECD Transfer Pricing Guidelines as a source of interpretation as well as in the audit process. Italy does not have any domestic transfer pricing legislation regarding intangibles, whereas references to the OECD Transfer Pricing Guidelines for intangibles are presented in Italy's patent box regime law (Alessandro & Monga, 2021)<sup>29</sup>. In the case of Brazil, Brazilian transfer pricing rules do not provide guidance focused on intangibles and explicitly exclude royalties from their scope (Brazil Ministry of Finance, 1958). However, the Brazilian Tax Authority and OECD discussed Brazil's proposal for a transfer pricing system that aligns with OECD's Transfer Pricing Guidelines (EY, 2022; OECD/Receita Federal do Brasil, 2019). Among other changes, the new transfer pricing system contains the definition of intangible for transfer pricing purpose.

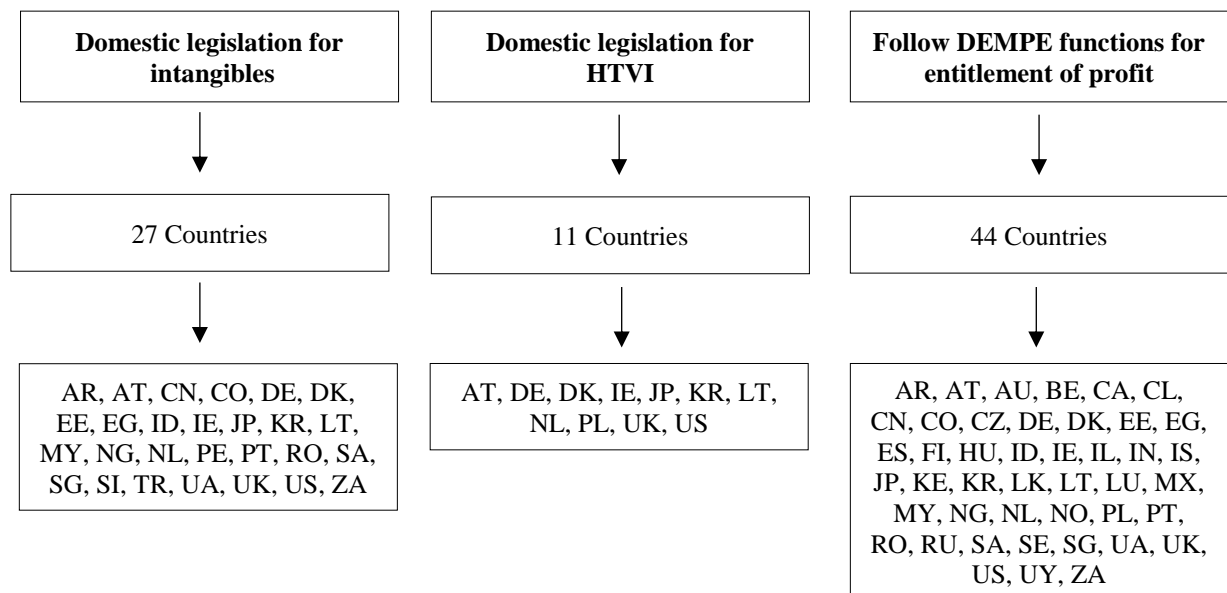
Only 11 countries in the sample, mostly developed, have implemented HTVI in their domestic legislation. For example, in 2019, Japan passed a tax reform that amended its transfer pricing rules to comply with the OECD's HTVI approach (Hagelin & Muto, 2019). Japan has adopted

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<sup>29</sup> Ministerial Decree of 14 May 2018 refers in the preamble to the Final Report on Actions 8-10 of the OECD/G20 BEPS Project and to the OECD Guidelines approved by the OECD Council on 10 July 2017.

price adjustment measures pertaining to HTVI assets, which are largely identical to the BEPS Action 8 Final Report definition. Additionally, under Section 482 of the US Internal Revenue Code, the HTVI approach corresponds to the commensurate with income standards, which states that if an intangible is transferred under an arrangement that covers more than one year, the consideration charged in each taxable year may be adjusted to ensure that it is commensurate with the income attributable to the intangibles (IRS, 2015).

**Figure 2.** Transfer pricing rules for intangibles across countries



Notes: This figure presents the implementation of the main characteristics of the transfer pricing rules for intangibles across countries in 2022. The data on the domestic legislation of transfer pricing for intangibles and HTVI are gathered from the OECD Transfer Pricing Country Profiles, and the data for the implementation of the DEMPE approach are gathered from IBFD-BEPS Country Monitor Tables. The three main characteristics of the transfer pricing rules related to intangibles are listed in Table 2.

Moreover, Figure 2 illustrates that 44 of 58 countries in the sample follow the DEMPE approach for the remuneration and entitlement of profit or loss of intangible assets, indicating a high level of acceptance of the DEMPE approach across countries. Countries such as Germany and Australia focus on analyzing critical functions, using assets, and managing the risk associated with the DEMPE functions. Other countries such as France, Italy, Latvia, Slovenia, and Switzerland

do not employ DEMPE analysis. For instance, legal ownership is recognized more than economic ownership in French transfer pricing rules (Official Bulletin of Public Finance, 2014). Chinese tax authorities apply the concept of “economic ownership,” especially in the case of marketing intangibles and intangibles resulting from R&D activities in China. Additionally, Chinese tax authorities conduct a six-function (DEMPEP) analysis of the intangible’s transaction, where “P” denotes promotion and is considered an important value-creating factor when determining profit allocation of intangible-related income (PwC, 2017). This is yet another approach for dealing with value creation in transfer pricing, next to the OECD and UN.

#### ***4.4. Heterogeneity in Implementation***

Significant variation exists across countries in the implementation of transfer pricing rules for transactions involving intangible assets. Figure 3 illustrates the variation in the implementation of transfer pricing rules for intangibles across the 58 countries in the sample. Ten countries, such as Austria, Germany, the UK, Denmark, Japan, and the USA<sup>30</sup>, have fully adopted all three main characteristics of OECD Transfer Pricing Guidelines related to intangibles in their domestic legal system. Notably, all of these countries are developed; among them, the United States, Germany, and Japan had the highest number of submitted patents to the European Patent Office in 2017.<sup>31</sup> This suggests that developed countries are protecting their tax bases on intangibles from profit shifting by implementing and tightening transfer pricing rules for intangibles.

Interestingly, Figure 3 illustrates that Poland is the only country that has not implemented the transfer pricing rules for intangibles into domestic legislation but has implemented the OECD HTVI approach into domestic legislation. However, to assess the transfer pricing of transactions involving intangibles, Poland relies on the OECD Transfer Pricing Guidelines and requires

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<sup>30</sup> The countries that fully implemented the transfer pricing rules related to intangibles are Austria, Germany, Denmark, Ireland, Japan, Lithuania, Netherlands, South Korea, the United Kingdom, United States.

<sup>31</sup> The data on the number of patent applications to the European patent office is publicly available from OECD.Stat under: [https://stats.oecd.org/Index.aspx?DataSetCode=PATS\\_IPC](https://stats.oecd.org/Index.aspx?DataSetCode=PATS_IPC)

transfer pricing documentation (master file) for intangibles (Poland Minister of Finance, 2018).

The HTVI approach is elucidated in paragraph 8 of the ordinance of Minister of Finance on transfer pricing in terms of corporate income tax (Poland Minister of Finance, 2018), and the definition and conditions are aligned with the OECD Transfer Pricing Guidelines.

Among the sample countries, 19 countries, including Australia, Belgium, Finland, and Russia, although they have not implemented specific rules for intangibles and HTVI in their domestic legislation, they follow the OECD DEMPE approach for the remuneration and entitlement of profit to the group members.

There are 11 countries, such as Brazil, Switzerland, and Panama, in a sample that has not implemented any of the main characteristics of transfer pricing rules for intangibles in domestic transfer pricing legislation.<sup>32</sup> In Brazil, the change proposed in the new transfer pricing system includes also the DEMPE approach for profit allocation.

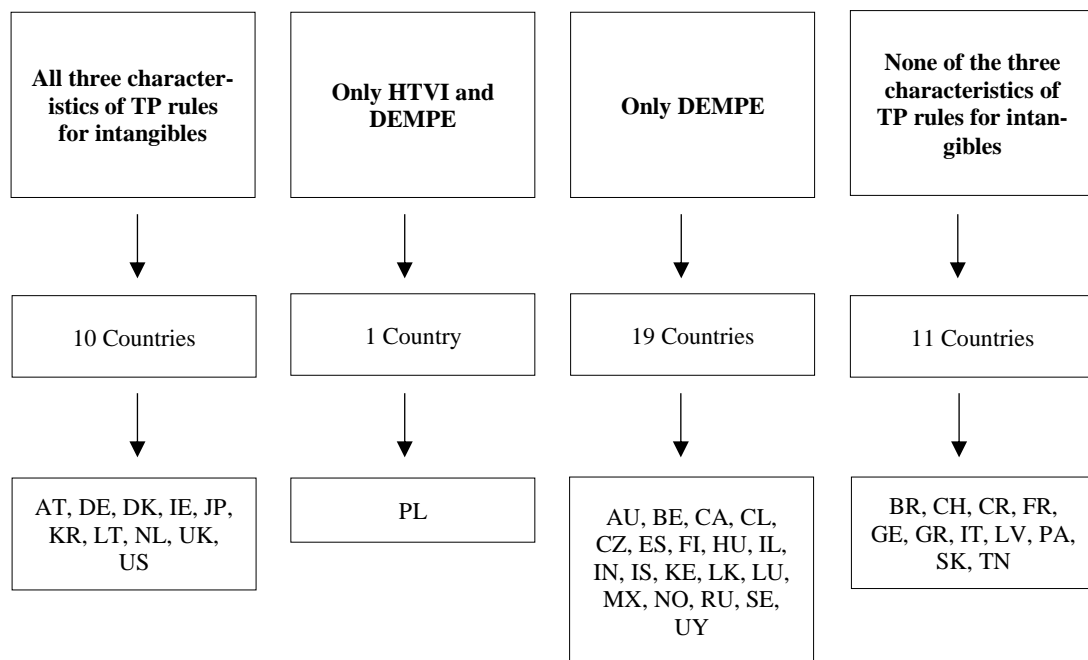
Overall, inconsistencies exist in the implementation of the OECD Transfer Pricing Guidelines on intangibles across countries. A primary issue is related to the definition of intangibles. While some countries clearly define intangibles for transfer pricing purposes (e.g., Germany, the UK, the USA, China, and Colombia), other countries do not define the constituents of intangibles for transfer pricing purposes (e.g., France, Italy, the Netherlands, and Saudi Arabia). Furthermore, although the OECD transfer pricing rules for intangibles are not adopted in domestic regulations in some countries, such as Chile, Luxembourg, Norway, and Finland, the context of OECD Transfer Pricing Guidelines for intangibles could be applied in the audit process by tax authorities. This precipitates uncertainty regarding how tax authorities interpret the rules as well as audit risks and penalties. A notable example is Iceland, which provides no regulation or guidance for transactions involving intangibles. Yet, Article 8 of regulation on documentation

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<sup>32</sup> The countries that do not implement any characteristics of OECD Transfer Pricing Guidelines for intangibles in their domestic legislation are Brazil, Costa Rica, France, Georgia, Italy, Latvia, Slovak Republic, Switzerland, Greece, Panama, and Tunisia.

and transfer pricing states that a party subject to documentation needs to declare all intangible assets within a group and the information regarding the DEMPE must be documented (Iceland Ministry of Finance and Economy, 2014).

**Figure 3.** Heterogeneity in transfer pricing rules for intangibles across countries



Notes: This figure presents the implementation of the main characteristics of the transfer pricing rules for intangibles across countries in 2022. The data on the domestic legislation of transfer pricing for intangibles and HTVI are gathered from the OECD Transfer Pricing Country Profiles, and the data for the implementation of the DEMPE approach are gathered from IBFD-BEPS Country Monitor Tables. The three main characteristics of the transfer pricing rules related to intangibles are listed in Table 2.

On the one hand, the inconsistencies observed in transfer pricing rules related to intangibles across countries create more opportunities for profit shifting; on the other hand, leave room for interpretation by tax administrations, thus precipitating double taxation (Gupta, 2019). The theoretical work by De Waegenaere et al. (2006) suggests that inconsistencies in transfer pricing rules across countries can decrease expected tax liabilities when taxpayers engage in substantial income shifting. Moreover, they find that an increase in the likelihood of transfer price rule inconsistency causes more aggressive auditing by tax authorities. In the same vein, the UN

(2013) states that inconsistencies in international tax could increase the tax burden for taxpayers even when no tax avoidance or evasion exists because the inconsistencies in transfer pricing rules could increase tax disputes, which incur significant costs for tax authorities and taxpayers. Nevertheless, inconsistencies do not affect countries uniformly. Diller et al. (2021) investigate the strategic tax transfer pricing of MNEs and tax authorities and find that consistent transfer pricing rules indirectly reduce tax avoidance in high-tax countries and prevent tax avoidance in low-tax countries. Their theoretical analysis also suggests that under specific conditions, the low-tax country benefits—in terms of net tax revenue—from consistency, whereas the high-tax country benefits from inconsistency.

### ***4.5. Developed versus Developing Countries***

MNEs in developed countries often have superior technology to create intangibles, whereas the rapidly growing market in developing countries and the participation of subsidiaries in these countries are needed to expand the market and monetize the value of such intangible assets (UN, 2021). Hence, intangibles are a critical topic for developing and developed countries, and deterring the shifting of profits related to intangible assets via transfer pricing is critical for both developed and developing countries. Therefore, for the analysis in this section, I divide the countries into developed and developing countries. According to the International Monetary Fund's Fiscal Monitor Database, countries were classified as developed and developed.<sup>33</sup>

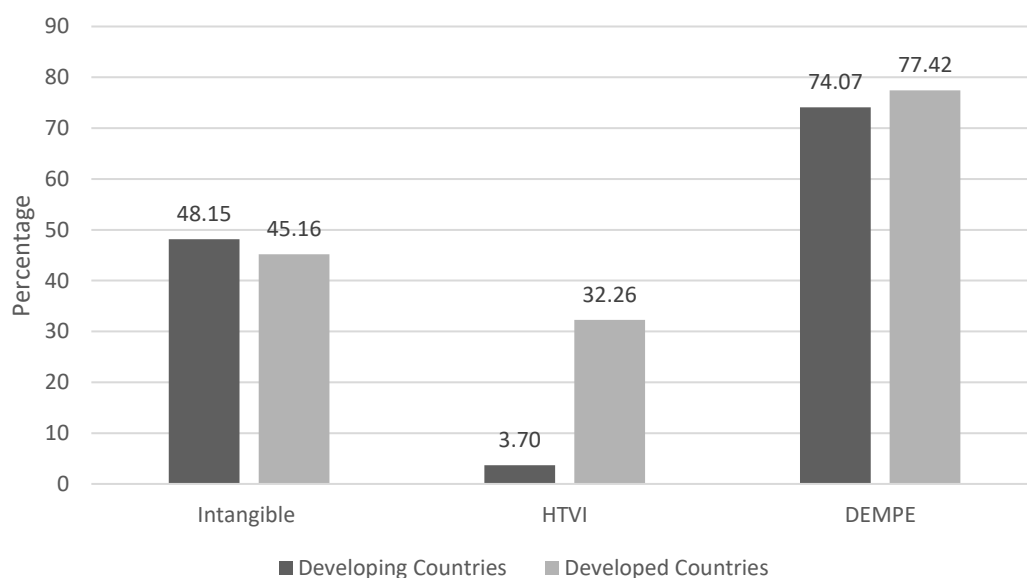
Figure 4 reveals that nearly 45% of developed countries and 48% of developing countries in the sample have implemented transfer pricing rules related to intangibles in their domestic regulations. Among the developed countries, nearly 32.26% have adopted the HTVI approach into domestic law, while only 3.7% of developing countries implemented the HTVI in their domestic legislation. This may be because these rules were introduced recently and were first

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<sup>33</sup> For more information, see <https://www.imf.org>

implemented by developed countries. Hence, developing countries need time to recognize the issue of HTVI and align themselves with the rules. Regarding the DEMPE approach, approximately 77% of developed countries and 74% of developing countries in the sample follow the DEMPE approach, though differences exist in DEMPE analysis among these countries. The analysis indicates that developed and developing countries exhibit a relatively similar pattern in adopting transfer pricing rules related to intangible assets in their domestic regulations. This could be the result of the various initiatives from the OECD and the UN (such as the UN Manual on transfer pricing) for developing countries to embrace compliance with transfer pricing in a global environment.

**Figure 4.** Differences in transfer pricing rules for intangibles in developed and developing countries



Notes: This figure presents the implementation of the main characteristics of transfer-pricing rules for intangibles in developed and developing countries in 2022. The data on the domestic legislation of transfer pricing for intangibles and HTVI are gathered from the OECD Transfer Pricing Country Profiles, and the data for the implementation of the DEMPE approach are gathered from IBFD-BEPS Country Monitor Tables. The three main characteristics of the transfer pricing rules related to intangibles are listed in Table 2.

The UN Practical discusses that major concerns regarding the implementation of transfer pricing rules in developing countries are the availability of data and expert skills, which pose special

difficulties for those countries (UN, 2021). Data availability is particularly crucial for comparability analysis, and the databases for transfer pricing analysis tend to focus on developed countries, which leads to difficulties in determining the arm's length price for MNEs in developing countries. The absence of data and information on comparables is also a major problem in transfer pricing assessment in Latin America and the Caribbean (Arias Esteban, 2021). Moreover, the UN (2021) emphasizes that transfer pricing analysis and documentation require expert skills in both tax administrations and MNEs, and training in such a specialized area is not readily available because of scarce resources in developing countries (UN, 2021). Nonetheless, this problem has also been addressed in the literature for developed countries (e.g., Bornemann et al., 2021). Notwithstanding these difficulties, numerous developing countries have made significant progress in constructing the necessary skills and capacity (UN, 2021).

### ***4.6. Practical Challenges***

Several countries have implemented transfer pricing rules related to intangibles in their domestic regulations and tightened their transfer pricing legislation to prevent firms' BEPS activity via intangible assets. With the introduction of the DEMPE approach, multinationals should be able to align their entities' functional and risk profiles with their profitability. However, practical challenges to implementing the DEMPE approach exist. The first practical issue regarding DEMPE functions addressed in some studies is the complexity of the effective identification and analysis of DEMPE functions in practice (Austin et al., 2021; Chand & Lembo, 2020; Greinert et al., 2020; Paumier, 2020; Verlinden et al., 2019). Verlinden et al. (2019) and Greinert et al. (2020) argue that identifying the contributors to the DEMPE functions and the analysis of the level of contribution is very complex in practice when several departments in the MNEs control the risks associated with the DEMPE functions of several intangibles. For example, some departments may focus mainly on R&D, whereas others may manage other intangibles, such as trademarks or brands. Therefore, DEMPE functions may be controlled by

several departments, and the decision-making process is spread over different units of MNEs. Hence, there will be a certain level of uncertainty in practice regarding whether—and how much—income should be reallocated from the legal owner to other group members for their respective contributions and how it should be specified (Austin et al., 2021). Further, Verlinden et al. (2019) discuss that to assess the DEMPE functions, MNEs should arrange a continuous and transparent exchange of information on the value creation and management of intangibles from the beginning. The analysis and documentation of IP creation are particularly difficult when contributors are located in different locations and departments (Paumier, 2020). Consequently, identifying and remunerating DEMPE functions in the presence of several intangibles and several departments contributing to different DEMPE functions is challenging (Chand & Lembo, 2020).

The second important practical challenge related to DEMPE that is highlighted in these studies is the documentation requirements to ensure that the functional analysis and comparability analysis fully reflect the DEMPE functions and are accurate (Austin et al., 2021; Chand & Lembo, 2020; Verlinden et al., 2019). Verlinden et al. (2019) and Chand and Lembo (2020) discuss the documentation of DEMPE analysis in the master file and pointed out that considering the level of information and detail for assessing the DEMPE functions, the documentation might be burdensome. Furthermore, Austin et al. (2021) state that additional documentation requirements are considered in some countries, and the level of documentation expected in tax audits significantly surpasses the usual documentation.

Another issue regarding the analysis of DEMPE functions discussed in the literature is the risk of transfer pricing disputes between taxpayers and tax authorities and double taxation (Greinert et al., 2020; Heggmaier, 2017; Musselli, 2017). Heggmaier (2017) argues that assessing various DEMPE functions is highly subjective and leads to different conclusions by different tax authorities, resulting in high legal uncertainty for MNEs. A crucial factor for tax authorities to

properly evaluate DEMPE functions is the sufficient number of transfer pricing specialists for an in-depth understanding of business models. Musselli (2017) remarks that it is likely that countries with better economic and political power may have more qualified economists and transfer pricing specialists and, thereby, be more likely to claim higher profits from MNEs. Greinert et al. (2020) discuss the complex structures of numerous DEMPE functions, numerous group units that perform DEMPE functions, and the different evaluations of DEMPE functions that increase transfer pricing disputes with tax authorities and the risk of double taxation.

Turning to the HTVI approach, this approach aims to deal with the information asymmetry between taxpayers and tax administration and gives tax administrations the possibility of using the ex-post outcomes of the transfer of an intangible as presumptive evidence that the associated parties did not consider the events or developments foreseeable at the time of the transaction. The practical experience regarding the HTVI approach is limited because numerous countries are still integrating this approach into their transfer pricing rules. However, the main issue addressed in the prior literature regarding the HTVI approach is its incompatibility with the arm's length principle (Hagelin, 2019; Penelle, 2017; Rodríguez Peña, 2020). Rodríguez Peña (2020) discussed three underlying reasons for the HTVI approach's incompatibility with the arm's length principle. More specifically, the use of hindsight by tax authorities, transactional adjustments if the taxpayer cannot rebut the presumptive evidence, and the reversal of the burden of proof on the taxpayer are considered the main reasons for the incompatibility of the HTVI approach with the arm's length principle. Further, Hagelin (2019) remarked that the HTVI approach might impose an increased burden on taxpayers as they should ensure that the ex-ante valuations of related-party HTVI transactions are correct and that any possible deviations are due to unforeseen developments. More specifically, the taxpayer bears the burden of proof of the reliability of the ex-ante projection if the ex-post outcome deviates from the projection. Penelle (2017) argues that HTVI can be abused as ex-post results will always differ from ex-

ante projections because ex-post outcomes reflect a single realization of all possible risk outcomes, while ex-ante projections reflect the average of all possible risk outcomes. This study addresses the level of subjectivity in the HTVI approach and discusses how allowing tax authorities to make HTVI adjustments based solely on the size of the spread between the average risk outcome, and the actual risk might lead to significant adjustments that may be difficult for taxpayers to contest. Overall, the incompatibility of HTVI with the arms' length principle could be a major issue in adopting the HTVI approach, thereby causing more disputes among countries.

Overall, considering the pace of business evolution and the value contributed to intangibles, these assets have become an increasing focus for tax authorities. On the one hand, any lack of clarity in identifying the intangibles and place of value creation may lead to costs of non-compliance for firms. On the other hand, uncertainties concerning transfer pricing for intangibles still exist, and inconsistencies in rules could be observed among countries. As advanced price agreements and mutual agreement procedures are important tools to provide certainty for the tax treatment of intercompany transactions, it would be worthwhile to examine whether and how these tools would be beneficial, especially for DEMPE and HTVI analysis.

## 5. Conclusion

Using intangibles to shift profits from the location of value creation to low-tax jurisdictions was addressed by the OECD and the G20 through the BEPS project as a critical area for deterring tax-base erosion practices arising from the existence of loopholes and mismatches in the interaction of domestic tax laws. Hence, tax authorities and international organizations have noticed the transfer pricing challenges related to intangibles, and multilateral efforts have been exerted to coordinate and tighten the anti-profit shifting rules concerning intangibles. This study presents the OECD Transfer Pricing Guidelines regarding intangible assets, analyzes the

implementation of transfer pricing rules for transactions involving intangibles across countries, and elaborates on the practical challenges of implementing these rules.

Numerous countries have implemented transfer pricing rules related to intangibles in their domestic legislation and tightened their transfer pricing legislation to prevent the BEPS activity of firms via intangible assets. Nevertheless, some inconsistencies could be observed in the implementation of transfer pricing for intangibles among countries.

While some countries have implemented the three main characteristics of transfer pricing rules for intangibles in their domestic legislation, others have not implemented any rules related to intangibles. Among other reasons, the non-uniform definition of intangibles for transfer pricing purposes—even among countries that have adopted these rules—is considered a source of uncertainty and inconsistency.

In the course of the analysis, practical challenges related to the main characteristics of OECD Transfer Pricing Guidelines for intangibles are outlined. The complexity of identifying DEMPE functions, onerous documentation requirements, transfer pricing disputes, and the risk of double taxation is reported as the most important practical challenge for DEMPE analysis in the literature. Regarding the HTVI approach, the problem of incompatibility with the arm's length principle is considered the most practical challenge; therefore, countries should carefully consider this before implementing the HTVI approach.

Having discussed the OECD Transfer Pricing Guidelines and BEPS project regarding intangibles to allocate profits in accordance with value creation, clearly, multinationals should be able to better align the functional and risk profiles of their entities with their profitability. This implies that if more substance exists in a jurisdiction, more profits should be attributed, and more taxes should be paid. Thus, shifting the intangibles' return to a multinational entity that performs no functions, uses no assets, and assumes no risks will no longer (at least partially) be possible. However, multinational firms can now shift (intentionally or unintentionally) substances by

relocating functions performed, assets used, and risks assumed in low-tax countries. This should be of high importance for countries such as Japan, the USA, and Germany, which, on the one hand, are the residents of most of the patents registered in the world and, on the other hand, has fully adopted the rules for intangibles to their domestic legislation. Eventually, profit shifting may be replaced by shifting functions of multinational firms in these countries.

This study provides a valuable contribution to the existing academic literature and paves the way for future studies on transfer-pricing rules and intangibles. The implementation of the main characteristics of transfer pricing rules discussed in this study can be used to develop a measure for transfer pricing rules for intangibles. Moreover, future studies can use data on the implementation of transfer pricing rules for intangibles across countries and examine the association of inconsistencies in these rules and transfer pricing disputes among countries.

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### **C) Is Risk Profiling in Tax Audit Case Selection Rewarded?**

#### **An Analysis of Corporate Tax Avoidance**

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**Abstract:** This study examines the relation between tax audit case selection based on risk profiling and corporate tax avoidance. We exploit the International Survey on Revenue Administration (ISORA) data on risk profiling in tax administrations from 2014 to 2017 to investigate whether the implementation of risk profiling has an incremental effect on firms' tax avoidance. Controlling for tax enforcement, firm-specific, and country-specific factors, our results suggest that the use of risk profiling is associated with lower tax avoidance. Risk profiling seems to be an effective tool to curb tax avoidance across firms of all sizes, but the effect is more pronounced for large firms. However, risk profiling seems only effective in countries where risk profiling experts support the tax administration, and where tax administrations employ a larger number of tax auditors. Additional tests with country-level data on tax administration performance imply that risk profiling improves tax administrations' performance. Overall, our findings point towards risk profiling as an audit case selection tool, appropriately staffed, incrementally attenuates firms' tax avoidance and increases tax revenues. Experts for a thorough design and execution of risk profiling and sufficient staffing of the subsequent audits of high-risk taxpayers are necessary.

**Keywords:** tax audits, tax avoidance, tax compliance, tax enforcement, tax risk

**Acknowledgements:** We are grateful for valuable comments by Harald Amberger, Elisa Casi (discussant), Paul Deméré (discussant), Kris Hardies (discussant), Jeffrey Hoopes, Martin Jacob, Peter Krenn, Dirk Schindler, Thorsten Sellhorn, the participants of the 15. arqus-Jahrestagung 2019, DIBT Research Seminar at WU Vienna 2019, Paderborn University TAF Brown Bag Seminar 2019, WHU Brown Bag Seminar 2019, Seventh Annual Mannheim Taxation Conference 2020, EIASM 8th Workshop On Audit Quality 2020, National Tax Association the 113th Annual Conference on Taxation (NTA) 2020, the 8th Annual Conference of the Tax Administration Research Centre (TARC) 2020, European Accounting Association 2021 Virtual Congress, IOTA-OECD workshop ISORA: Survey completion and data usage. We additionally thank Vegard Holmedahl, Jonathan Leigh Pemberton, Oliver Petzold, Richard Stern for providing general institutional knowledge regarding risk profiling around the world and Lars Andersen, Christina Dimitropoulou, Caroline Dupae, Ignacio Corral Guadaño, Marcio Henrique Sales Parada for providing country-specific tax administration information. We thank Kim Schulz for excellent research assistance. Safaei, Sureth-Sloane, and Wu gratefully acknowledge financial support from the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) – Collaborative Research Center (SFB/TRR) Project-ID 403041268 – TRR 266 Accounting for Transparency. Eberhartinger, Sureth-Sloane and Wu gratefully acknowledge financial support from the Austrian Science Fund (FWF): W 1235-G16, DIBT Doctoral Program in International Business Taxation.

## 1. Introduction

We examine the relation between risk profiling in tax audit case selection and corporate tax avoidance. Increasingly over the past decade, and in line with their digitalization, tax administrations worldwide employ risk profiling to target high-risk taxpayers. Risk profiling describes the process of using comprehensive data on taxpayers' characteristics such as information from tax returns, historical audits, and third-party information and employing advanced analytical techniques to this data to identify high-tax risk taxpayers. As a result, risk profiling helps to conduct targeted scrutiny and improve the identification of high-risk taxpayers. Tax administrations expect higher taxpayer compliance, lower tax avoidance, and higher tax revenues with less intrusion and costs after implementing risk profiling because taxpayers anticipate higher audit effectivity.

If harnessed properly, risk profiling can help tax administrations adapt to ever-changing tax and tax risk environments, closing the tax gap<sup>34</sup> and increasing tax administration efficiency. Single-component selection strategies such as random audits, or selection by size only, seem less effective as they do not reflect the complexity of the drivers of taxpayers' compliance behavior and the heterogeneity across taxpayers (Jackson & Milliron, 1986; Jimenez & Iyer, 2016; Slemrod, 2019). Furthermore, as tax administration resources are limited, risk profiling improves audit-cost-effectiveness by devoting the resources with higher potential for detecting non-compliance to high-risk taxpayers.<sup>35</sup> For instance, since 2016, Canada has spent C\$1.1 billion on a risk-based audit strategy to help target non-compliance cases (Anderson et al., 2019). However, not all tax administrations employ risk profiling yet. Budgetary or political constraints, or

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<sup>34</sup> For example, the U.S. Internal Revenue Service (IRS) estimated the average annual gross tax gap for all the tax types (i.e., the difference between taxes owed and taxes paid) of \$441 billion for the tax years 2011 to 2013 (IRS, 2019).

<sup>35</sup> Risk classification is typically based on a combination of non-compliance factors: (1) firms' inherent risk as a function of size, complexity, nature of business and prior compliance behavior, and (2) firms' actions, attitude, as well as their internal control systems and processes to mitigate tax risk (HM Revenue & Customs, 2016). See HM Revenue & Customs 2016, retrieved from <https://www.gov.uk/hmrc-internal-manuals/tax-compliance-risk-management>.

algorithm aversion of individual decision-makers may deter investment in IT and risk-profiling expertise (Burton et al., 2020; Eynon & Dutton, 2007).

Risk profiling as a tax audit case selection strategy affects audit probability and audit effectiveness, not only in theory, but also as perceived and anticipated by corporate taxpayers (Fischer et al., 1992; Hashimzade & Myles, 2017). Corporations may revise their tax avoidance behavior in the face of upcoming changes in audit probability and audit effectiveness. Therefore, they may reduce risky tax behaviors, abstain from rather aggressive tax avoidance strategies, implement better internal tax control systems, and become more diligent in their tax assessment when risk profiling is implemented.

However, the possible benefits from risk profiling in tax audit case selection may not materialize, or risk profiling may even incline corporations to increase their tax avoidance behavior. Although the use of risk-based audits, including risk profiling, is associated with more compliance for *individual* taxpayers, application of these results seems to be complex for *corporate* taxpayers for three reasons. First, data availability for corporate taxpayers may not be sufficient for risk profiling. The organizational form of corporations asks for multi-layer data, which often makes the employment and matching of different data resources impractical. Second, the risk profiling models used for corporations may not be sufficiently advanced, and thereby not include many aspects of tax avoidance (for example, the models do not cover transfer pricing). Lastly, the available models can potentially estimate the tax risk of corporate taxpayers at large, but not necessarily identify specifically risky areas or practices in the corporation. Firms may be aware of such restrictions in the effectiveness of risk profiling, and therefore not perceive a change in their individual audit probability.

Rather than reducing tax avoidance, risk profiling may encourage corporations to enhance their tax risk management. On this basis, corporations can opt for riskier tax avoidance strategies to maintain or extend their level of tax avoidance. Corporations or tax intermediaries can

strategically use actual or assumed audit case selection criteria to circumvent classification as ‘high-risk’ and thus avoid tax audits while continuing or extending their level of tax avoidance. Additionally, corporations that are already aware of their high risk because of their past behavior may increase tax avoidance and choose an aggressive starting point for negotiations with the tax administration to reduce their ultimate tax liability (Gleason & Mills, 2011; Hanlon et al., 2007). Thus, corporations may have incentives to decrease or increase their tax avoidance behavior. We therefore explore whether and to what extent the employment of risk profiling in tax audit case selection is associated with corporate tax avoidance.

We analyze the effect of risk profiling and examine cross-country panel data of 16,492 firms from 54 countries from 2014 to 2017 to investigate the incremental effect of risk profiling implementation on corporate tax avoidance. The data on countries’ use of risk profiling is publicly available from the ISORA portal and includes joint survey data collected from national and federal tax administrations.<sup>36</sup> The ISORA data comprises 19 items for audit case selection in tax administrations. Two of these items refer explicitly to risk profiling (based on business rules and predictive modeling). We construct a binary measure depending on whether the tax administration explicitly reports that they employ either form of risk profiling<sup>37</sup> (business rules or predictive modeling) in their audit case selection.

We follow Atwood et al. (2012) and measure corporate tax avoidance by the difference between taxes calculated at the statutory tax rate and taxes actually paid. To test the incremental effect of risk profiling, we control for the level of enforcement, measured as the number of employees in tax administration, and for other country-level controls and firm-specific variables that might

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<sup>36</sup> The ISORA is a joint survey about tax administration operations and other characteristics according to the common questions and definitions agreed by the CIAT (Inter-American Center of Tax Administrations), International Monetary Fund (IMF), Intra-European Organisation of Tax Administrations (IOTA), and OECD. Tax experts in these organizations jointly design the survey questions.

<sup>37</sup> Risk profiling is the result of risk assessment for each taxpayer, which involves identifying, analyzing, and prioritizing the risk presented by taxpayers using statistics. For example, HMRC employs software that conducts a search engine and research tool, and enables analysts to trace and review complex cases (Khawaja et al., 2011).

affect tax avoidance.

Consistent with tax administrations' expectation of improving the identification of high-risk taxpayers by advanced analytical techniques,<sup>38</sup> we hypothesize and find evidence that risk profiling is associated with a lower level of tax avoidance. In cross-sectional tests, we further explore under which circumstances countries that implemented risk profiling show lower levels of tax avoidance. In line with our theory, our findings suggest that the effectiveness of risk profiling to reduce tax avoidance heavily relies on the availability of specific expertise and sufficient workforce in tax administrations. Particularly, our results show that implementing risk profiling is associated with lower tax avoidance solely in countries where tax administrations have a comparatively higher number of tax auditors available to focus on audits of high-risk taxpayers. Further, risk profiling is significantly associated with lower tax avoidance only in countries where tax administrations employ data scientists, behavioral scientists, and computer systems analysts, thus maintaining a high level of expertise in data and IT needed for risk profiling.

Further, we investigate the timing of the reduction of tax avoidance behavior. We neither expect nor find an anticipatory effect in the two years prior to the implementation of risk profiling. Early announcements of later implementation do not take place, or do not induce firms to change their tax behavior. This also partially mitigates the concern of reverse causality. However, we expect and find an association in the year of implementation of risk profiling. The association persists, and becomes stronger, during the subsequent years, in line with firms needing time to adjust their tax planning strategies.

We expect that firms' tax behavior differs conditional on their perceived audit probability and specifically on firm size. We find that the deterrence effect of risk profiling holds for firms of all sizes and is more pronounced for large firms, even though they may be subject to permanent

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<sup>38</sup> See anecdotal evidence for selected countries in Appendix 1.

audit or scrutiny already. The stronger effect for large firms may be due to the fact that in some countries, risk profiling has been initiated for large taxpayers only. Large taxpayers likely have more sophisticated tax functions, which are more aware, and respond more effectively to the information related to how tax administrations employ risk profiling. We thus determine that risk profiling makes it more difficult for firms to respond strategically by actively managing the key indicators that risk profiling would identify below the threshold that triggers an audit. In supplementary analysis, we investigate the association between risk profiling and the performance of tax administrations in different countries. We use two measures from the United States Agency for International Development's (USAID) Collecting Taxes Database (CTD) to proxy performance. We use the ratio of the total annual tax administration expenditures to the net tax revenue collected by the tax administration. We also use actual tax revenue as a percent of GDP to their potential tax capacity. These measures indicate how effective a country's tax administration is in raising revenue. Our findings suggest that employing risk profiling for audit case selection reduces the cost of tax collection, increases tax revenue, and thus improves the performance of tax administrations.

We contribute to the literature in two ways. First, we examine the incremental effect of risk profiling for corporations and extend the literature, which so far focuses on the effect of risk-based tax audits on individuals. We build on previous single-country studies on individuals (Alm & McClellan, 2012; Beer et al., 2020; Hashimzade & Myles, 2017; Loyland et al., 2019) and study corporations in a cross-country setting instead. The cross-country setting helps us to alleviate generalizability concerns. As evidence for individuals may not apply to firms, it is necessary to study the latter. Not only is risk profiling for firms more complicated to implement than for individuals, but the effect of risk profiling may also be very different for firms (Hoopes et al., 2012), which may be more or less sensitive to tax audit strategies. Firms may respond differently to audits than individuals due to different social norms and networks (Hasan et al.,

2017), different costs of non-compliance (Hanlon et al., 2007; Hanlon & Slemrod, 2009; Jacob et al., 2021), and different risk-taking patterns in their tax behavior (Armstrong et al., 2019). Additionally, firms face a trade-off between financial and tax reporting decisions (Hanlon & Heitzman, 2010). Publicly traded firms that are exposed to capital market pressure may value accounting earnings more than tax payments and thus give up tax avoidance opportunities to inflate financial earnings, with the extreme ones paying taxes on allegedly fraudulent earnings (Erickson et al., 2004).

Second, we contribute to the extant literature regarding the effect of enforcement on corporate tax behavior (Atwood et al., 2012; DeBacker et al., 2015; Gupta & Lynch, 2016) by examining the incremental effect of additional enforcement resources, namely risk-profiling. While the effect of general enforcement through adjustments of audit levels and penalties has been studied intensively, we investigate how risk profiling (e.g., one step *before* tax audit) would incrementally affect firms' tax avoidance, given the enforcement level. In addition, our study adds to prior research as it includes firms' *perception* of possible audit strategies and their specific perceived audit probability (instead of materialized audit strategies and audit probabilities as in e.g., DeBacker et al., 2015 and Finley, 2019). Moreover, we examine how the effect of risk profiling is related to country characteristics. By doing so, we aim to explore the determinants of the effectiveness of risk profiling, as suggested by Slemrod (2019).

Our findings have significant implications for the growing use of risk profiling by tax administrations. To them, understanding the prerequisites of effective risk profiling is important, because an appropriate implementation is very costly. Our results indicate that the use of risk profiling is related to lower tax avoidance. However, this relation strongly depends on the quality of risk profiling implemented by the tax administration. First, our findings suggest that risk profiling effectively reduces tax avoidance only in countries with a high risk profiling expertise that assures an adequate design and execution. Second, consistent with anecdotal evidence, we

find risk profiling is only effective in countries with sufficient employees in audits and verification. These findings imply that risk profiling is complementary to actual audits, and for an effective outcome, both expertise and sufficient staffing must be coordinated. Furthermore, we find that employing risk profiling is associated with higher performance of tax administrations, meaning that the cost of tax collection is lower, and the actual collected tax is closer to the tax potentially collectible (reduction of tax gap). Taken together and consistent with Slemrod et al. (2001), our findings suggest that risk profiling contributes to a more efficient allocation of the limited resources in tax administrations to high-risk areas with the highest potential outcome.<sup>39</sup> Therefore, we also contribute to analyses on the effectiveness of intervention activities (Keen & Slemrod, 2017) and answer the call for a re-examination of tax enforcement from DeBacker et al. (2015).

Our results are also informative for other settings where regulators use risk profiling approaches to select suspicious candidates. For instance, PCAOB uses a risk-based approach to select audits for inspection,<sup>40</sup> and the SEC flags firms for earnings management.<sup>41</sup> Future research may study the effect of risk profiling in audits and supervision on corporate behavior.

## **2. Conceptual Framework**

### ***2.1. Prior Research: Tax Audits***

The economics of crime model (Becker, 1968) argues that the deterrence effect of enforcement is shaped by both audit probability and penalty (Allingham & Sandmo, 1972; Lee & McCrary, 2017). Accordingly, a rational individual weighs the expected benefit of tax evasion against the

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<sup>39</sup> As Slemrod and Yitzhaki (1987) point out, the optimal audit strategy is not the same as the revenue-maximizing strategy, so administrative costs of tax audits should also be taken into consideration. Slemrod et al. (2001) argue that resources should be allocated differently across taxpayers with different risk levels.

<sup>40</sup> See <https://pcaobus.org/oversight/inspections/inspection-procedures>.

<sup>41</sup> In the US Securities and Exchange Commission's (SEC) quarterly earnings per share (EPS) initiative, the Division of Enforcement uses risk-based data analytics to red flag firms for investigation and "uncover accounting and disclosure violations caused by, among other things, earnings management practices to mask unexpectedly weak performance" (SEC, 2020).

expected probability of detection, post-audit adjustments, and penalties. In recent years, the academic and policy interest in the relation between enforcement and taxpayer behavior has increased as enforcement is a crucial component to ensure tax compliance and combat evasion behavior (Slemrod, 2019).

Accordingly, a large part of prior research focuses on individual taxpayers' behavior after audits (e.g., Guala & Mittone, 2005; Mittone, 2006). For example, Gemmell and Ratto (2012) and Beer et al. (2020) report evidence that audits increase the compliance of previously non-compliant individual taxpayers but decrease the compliance of previously compliant taxpayers. Kasper and Alm (2022) find that audit effectiveness is an important determinant of the specific deterrent effect of audits for individual taxpayers.

For corporate taxpayers, prior research uses data on actual tax audits (e.g., Advani et al., 2021; Finley, 2019; Hoopes et al., 2012), and has demonstrated the link between the strategic behavior of taxpayers and tax administrations. However, the results are mixed. Some studies show that real tax audits lead to less tax avoidance, i.e., an increase in reported tax liabilities (Advani et al., 2021) or an increase in reported wages (DeBacker et al., 2018). Similarly, Gupta and Lynch (2016) and Nessa et al. (2020) provide evidence that increased tax enforcement resources improve tax collection. Hoopes et al. (2012) find that high audit probability leads to less tax avoidance, in line with the prior theoretical framework (Kahneman & Tversky, 1979; Von Neumann & Morgenstern, 1947). Some studies, however, point to the opposite effect. DeBacker et al. (2015) and Finley (2019) find evidence that tax audits and tax settlements, respectively, may increase tax avoidance for corporate taxpayers.

While audit probability and audit incidence are well-studied in the literature, our study focuses on the probability of being audited, as perceived by firms. This perception is determined by a firm's self-assessment of how the tax administration or its algorithm will characterize "high-risk" tax behavior, and hence the firm's tax behavior, and is conditioned on the perception of

the administration's risk profiling effectiveness. Thus, we investigate ex-ante expectations of firms on their subjective audit probability. In contrast to prior literature, which investigates ex-post reactions to tax audits that have been carried out, we take an ex-ante perspective. Further, while Atwood et al. (2012) use a country-specific tax evasion index to proxy for tax enforcement, we use data on tax administrations' risk profiling in 54 countries.

Even though risk-based audit strategies, including risk profiling, are increasingly implemented, little is known about their effects on tax avoidance, compliance, and tax revenues, especially for corporations. Prior literature indicates that the use of risk-based tax audits is associated with more compliance for individual taxpayers (Alm & McKee, 2004; Beer et al., 2020; Loyland et al., 2019). Results for individual taxpayers do not necessarily hold for corporate taxpayers. Anecdotal evidence from our informal interviews with administration officials suggests three reasons for this difference. First, risk profiling for corporations requires data from multiple sources, which – if available at all – are often hard to match due to the lack of IT interfaces or lack of data warehouses. Also, data protection concerns, even within the tax administration, or internal firewalls may hinder data matching. Second, available models can potentially estimate the tax risk of corporate taxpayers at large but may not be sufficiently granular to identify specific risky topics. Third, the data and models might not cover complex tax avoidance channels, such as transfer pricing, comprehensively. Firms might be aware of such restrictions in risk profiling, and therefore not expect a change in audit probability.

There are only a few studies on the effect of risk-based tax audits, and these all focus on individual tax avoidance. Alm and McKee (2004) use an experimental approach to study individual tax behavior and find that the combination of risk-based and random audits is the most effective and sustainable mechanism in deterring individual tax evasion. Using administrative tax data of self-employed US taxpayers, Beer et al. (2020) find evidence that improved targeting audits toward non-compliant individual taxpayers increases current and future compliance. Further,

Hashimzade et al. (2016) and Loyland et al. (2019) explore the features of specific methods of risk-based tax audits (predictive modeling, risk profiling, and data mining) and their implications for tax revenues and individual taxpayer responses. Using an agent-based model and simulation analysis for individual behavior, Hashimzade et al. (2016) suggest that predictive analytics for audit selection yield more revenue over random audits. Loyland et al. (2019) use Norwegian administrative data and empirically explore the individual behavioral responses of high-risk wage earners to audits. They find that the compliance effect of audits based on risk scores (predicted by machine learning) increases significantly with the individual taxpayer's risk score. To the best of our knowledge it is only Hsu et al. (2015), who study the effect of risk-based audits on corporations. They investigate corporations in Minnesota and find evidence that the application of data mining in tax audits increases efficiency in the audit selection process.

Summing up, risk profiling in tax audit case selection is used to better identify high-risk taxpayers. In this study we examine how risk profiling (a step *before* actual audits) in different countries affects the perceived audit probability and perceived audit effectiveness by corporate taxpayers and, in turn, whether and how risk profiling relates to firms' tax avoidance.

## **2.2. Hypothesis Development**

Firms consider and weigh the marginal benefits of their tax planning activities against the expected costs. They anticipate potential tax audit costs in the form of adjustment costs, fines, penalties, and interest payments upon post-audit adjustments. For their cost-benefit analysis, firms estimate the probability of an audit based on available information and adjust their behavior accordingly. The employment of risk profiling in tax audit case selection could change corporate taxpayers' perception of audit probability and audit effectiveness. Depending on their perception, from a theoretical point of view, both negative and positive effects of risk profiling on tax avoidance are possible.

The implementation of risk profiling could be negatively associated with tax avoidance in three ways. First, the enhanced expected audit effectiveness might lead to less tax avoidance. Equipped with risk profiling tools, tax auditors are more likely to challenge tax declarations and detect those tax avoidance activities that they consider as violating the tax code. As a consequence of this enhanced audit effectiveness and the identification of overly aggressive tax avoidance strategies, taxpayers anticipate respective tax adjustments. Consequently, taxpayers are likely to abstain from overly aggressive tax avoidance strategies. This prediction is in line with the results of Gemmell and Ratto (2012), who find that the specific deterrent effect of audits depends on the audit outcome and audit effectiveness.

Second, the uncertainty about the outcome of risk assessment via risk profiling for their corporation in relation to their peers might reduce tax avoidance. The uncertainty about their peers' tax risk increases the uncertainty about their own risk profiling outcome. Hence, uncertainty-adverse firms will prefer safer choices and reduce tax avoidance. Thus, we expect herding tax avoidance behavior to reduce tax avoidance and thus the risk of future audits (Tan & Yim, 2014). This reasoning is also consistent with Lediga et al. (2020), who find that audits have a positive effect on tax reporting of non-audited neighbor firms.

Third, the implementation of risk profiling may foster enhanced tax risk management systems and thereby indirectly reduce tax avoidance. In some countries, tax administrations incorporate the existence or design of firms' tax control framework in their risk profiling. Firms that expect to be identified as "high-risk" may respond by enhancing their tax risk management system and thereby signal lower risk, inducing both lower audit probabilities and lower tax avoidance (Chen et al., 2020). Enhanced tax risk management systems may also make tax issues more salient within the firms as they learn more about tax risks and their management. Consequently, firms react to the additional information on risky tax issues provided by this internal system and take actions to attenuate these tax risks when making corporate decisions.

By contrast, risk profiling might exert no or a positive effect on tax avoidance for reasons at the tax administration or firm level. For tax administrations, risk profiling relies heavily on quality data on both previous and current taxpayer attributes and on IT systems, including hardware, software, and training, to process the data and provide reliable risk scores (Khwaja et al., 2011). As a result, risk profiling may lead to false positives that occupy the auditors' time and attention if not designed and used appropriately. Second, the use of risk profiling changes the way in which audits are conducted, and auditors may be tempted to over-rely on automated risk profiling. They may compromise professional judgment (Dowling & Leech, 2014) or reduce audit quality (Austin et al., 2021). Auditors may rely on the results mechanically and neglect to develop their own experience-based expertise. Consequently, they might fail to consider factors and detect risks not explicitly identified with data analytics in case selection. Conversely, auditors may be "algorithm averse", and not attribute sufficient weight to the risk-based audit case selection (Koreff et al., 2021). In both cases, distrust in the tax auditors and tax administration may arise, which may cause a backfiring effect from enforcement (Mendoza et al., 2017). Third, tax administrations may face weaknesses or shortages in staff skills. This could seriously impede the tax administration's ability to deal with high-risk taxpayers even if risk profiling could effectively recognize risky taxpayers. Hence, the employment of risk profiling may not necessarily lead to the expected enhanced audit outcome.

Firms may not change their level of tax avoidance, or even avoid more tax, when informed about the implementation of risk profiling. They may anticipate key parameters of risk profiling, based on their own, their peers' or tax experts' experience. Firms might infer that they individually are unlikely to be targeted and thus maintain their level of tax avoidance, or even feel sufficiently safe to increase their level of tax avoidance. Firms might further be able to strategically circumvent targeted tax avoidance strategies and use other non-targeted tax avoidance strategies. For example, they could employ experienced tax professionals (Daoust &

Malsch, 2020) and take advantage of their data analytics skills, including artificial intelligence-based analyses with trend analyses and the timely detection of potential errors, risks, or abnormal conditions.<sup>42</sup>

Tax enforcement may also increase the likelihood of firms changing tax preparers (Belnap et al., 2022). Some firms may switch to more aggressive tax preparers in the face of risk profiling. Additionally, tax avoidance might not decrease, or may even increase, because firms intentionally file very risky tax positions to create mass for future negotiations with the tax auditor. Despite the role of risk profiling to identify high-risk firms and predict non-compliance, firms may not perceive the tax audit as sufficiently costly, because the negotiation process between the taxpayers and tax administration is assumed (Beck & Jung, 1989; Dyck et al., 2022; Eberhartinger et al., 2022; Gleason & Mills, 2011; Slemrod et al., 2001). Thus, for some taxpayers, it may be beneficial to choose an aggressive starting point for negotiations with the tax administration, which creates leeway to give up some positions and still ultimately reduce their tax liability. Consistently, there is evidence that the US. Internal Revenue Service often settles for less than the initially proposed deficiency after the negotiation with firms (Gleason & Mills, 2011; Hanlon et al., 2007).

This discussion on the association of risk profiling and the level of tax avoidance by firms being likely, but not necessarily, negative is consistent with prior literature on individual taxpayers. Thus, it is an empirical question whether, how, and to what extent risk profiling affects tax avoidance. We expect that the use of risk profiling has a strong deterrent effect on corporate taxpayers by signaling the specific ability of tax administration to identify risky taxpayers and

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<sup>42</sup> Firms can obtain information about the risk assessment criteria and how they are employed in general. information provided by tax administrations to the taxpayers, their own experience, and their interaction with peer firms. This information can also be diffused through social networks in the business process: for example, via financial analysts, auditors (Lim et al., 2018), boards of directors, banks (Gallemore et al., 2019), or via supply chains (Cen et al., 2017, 2022), labor markets (Barrios & Gallemore, 2021), or networks. The behavior of taxpayers may change appertaining to the communication and learning from the audit experience of other taxpayers and their peers.

devote the resource more efficiently. Therefore, we test:

*H1: The employment of risk profiling in tax audit case selection is associated with a decrease in tax avoidance.*

Next, we explore the heterogeneity in the effect of risk profiling on tax avoidance. It is often stated in the prior literature that tax audit case selection is based on the size and complexity of the firms (Ayers et al., 2019; Bachas et al., 2019). Risk profiling uses various factors from diversified data sources beyond size and complexity and is thus often assumed to be more effective. However, it is unclear whether the deterrence effect of risk profiling on tax avoidance will hold for firms of all sizes.

Even though size has played a major role in risk profiling case selection, it is unclear whether larger firms assume a higher audit probability under risk profiling. On the one hand, large corporations are under permanent audit in many countries, so risk profiling could barely have a deterrence effect for large firms, which might imply no adjustments in tax avoidance activities. Relatedly, Ayers et al. (2019) investigate the reporting behavior of the largest firms in the USA, which are assigned to the IRS Coordinated Industry Case (CIC) program with an audit probability of 100 percent. They find that the tax payments of firms do not change after entering the CIC program. On the other hand, the majority of tax administrations in advanced economies manage their largest taxpayers in Large Taxpayer Units (LTUs) (OECD, 2017), and risk profiling has been initiated in many tax administrations by large taxpayers (IOTA, 2012).<sup>43</sup> Therefore, risk profiling might have a stronger deterrence effect for larger firms as the risk profiling model could be more advanced for large taxpayers (more data is available for large taxpayers). Additionally, large taxpayers have more sophisticated tax functions that are more aware and respond more effectively to the information related to employing risk profiling by tax administrations. To avoid the costs related to tax audits, larger firms try to avoid tax audits; thereby,

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<sup>43</sup> For more information see: [https://www.iota-tax.org/system/files/risk\\_analysis\\_0.pdf](https://www.iota-tax.org/system/files/risk_analysis_0.pdf).

the effect might be more pronounced for larger taxpayers.

In contrast, small businesses may pay limited attention to tax audit strategies, may not perceive or ill-perceive information on risk profiling, and may not be able to draw differentiated conclusions from this information. Further, some firms might also increase the tax avoidance level to have more positions for negotiations with tax administrations. This effect may be particularly pronounced for large firms, as they use professional tax assistance for negotiation. This argument is in line with Slemrod et al. (2001), finding that high-income taxpayers claimed more tax benefits to create a more aggressive starting point for negotiation with tax administrations.

Ultimately, we conjecture that employing risk profiling is more promising to attenuate tax avoidance in larger firms.

*H2: The association between risk profiling in tax audit case selection and tax avoidance is stronger for larger firms.*

### **3. Data and Research Methodology**

#### ***3.1. Measuring Risk Profiling***

Most tax administrations worldwide use advanced analytics as a means of risk profiling to determine their tax audit cases, combined with random selection.<sup>44</sup> In a separate study in 2017, one-half of 53<sup>45</sup> tax administrations reported the use of advanced analytics in risk profiling, to improve the match of audits and taxpayers' specific risks (OECD, 2017). Countries disclose general information on their risk-based tax audit strategies on their tax administrations' websites. However, the exact details on their audit case selection strategy and the risk criteria are often confidential to prevent taxpayers from acting strategically (Khwaja et al., 2011).

To identify countries that apply risk profiling, we exploit information on audit case selection from the ISORA database, which collects tax administration data from national and federal

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<sup>44</sup> See selected anecdotal evidence on tax administrations' incentive to implement risk profiling in Appendix 1.

<sup>45</sup> This study is distinct from our sample size of 54.

administrations. ISORA is a joint survey about tax administration operations and other characteristics according to the common questions and definitions agreed by the CIAT (Inter-American Center of Tax Administrations), International Monetary Fund (IMF), Intra-European Organisation of Tax Administrations (IOTA), and OECD.<sup>46</sup> Survey questions are designed jointly by tax experts in these organizations. Before answering the survey, respondents from tax administrations all over the world had the opportunity to ask questions and provide comments.

ISORA reports 19 items for tax audit case selection, from which we choose two items that represent the risk evaluation procedure using rule-based data analytics, or automated machine-learning techniques for risk profiling (Khwaja et al., 2011; OECD, 2004, 2017, 2019). For details on case selection methods reported by the tax administrations, see Table 1.

Our binary measure for risk profiling equals one if the respective tax administration explicitly reports that they employ at least one of the two, ‘risk profiling – business rules’ (item 7) or ‘risk profiling – predictive modeling’ (item 8), in their audit case selection criteria. Other items from ISORA data either serve as inputs for risk profiling (such as data) or represent specific rules or procedures (see Figure 1 for details). We use a binary indicator variable because it allows clear-cut interpretations, and we avoid double counting. Although there is no information available on which kind of taxes these reported methods are used, we assume that tax administrations at least partially use these methods for corporate income taxes.

To validate our measure on risk profiling, we compare our measure from the ISORA data with tax administrations’ websites, PwC summaries, and the World Bank website. Our additional search confirms the information in the ISORA database for most countries. In the few cases with disparities, we gathered more information from tax administrations’ websites, checked studies and reports written by officials from tax administrations or other insiders, and talked to

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<sup>46</sup> For details, see <https://data.rafit.org>.

tax officers and other experts such as tax advisors. After gathering the details of a country's audit case selection strategy, we modify the ISORA data for six countries.<sup>47</sup>

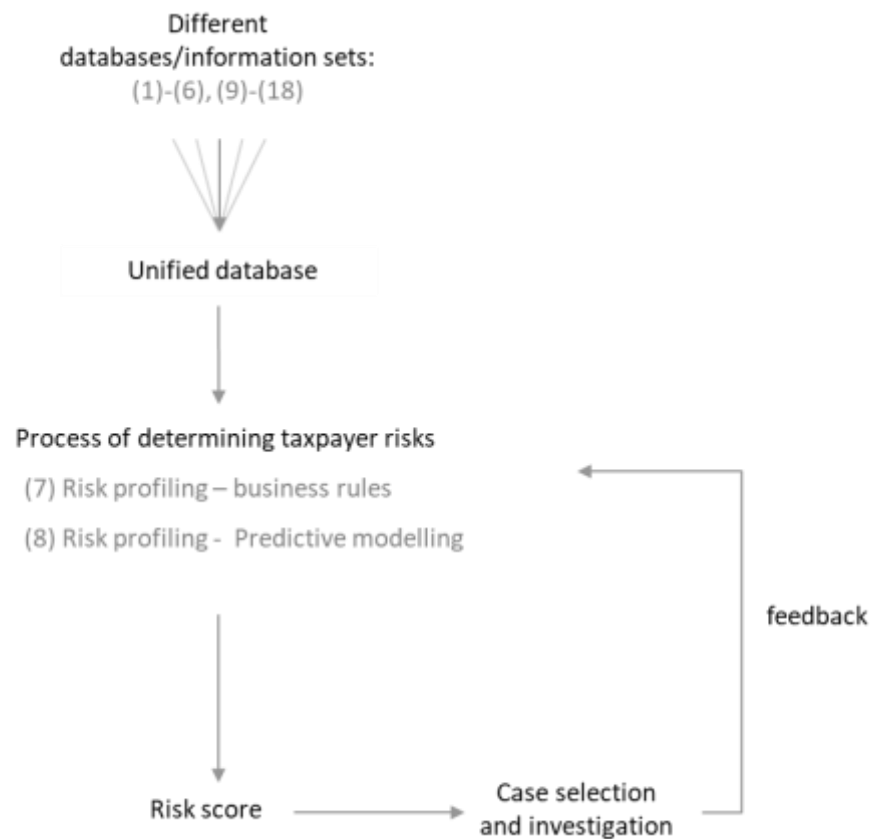
**Table 1.** Audit case selection criteria reported to the ISORA

Item	Rating
(1) Economic sector	1 – Yes   0 – No
(2) Location	1 – Yes   0 – No
(3) Taxpayer category	1 – Yes   0 – No
(4) Ownership in a corporate entity	1 – Yes   0 – No
(5) Taxpayer behavior	1 – Yes   0 – No
(6) Frequency (time between audits)	1 – Yes   0 – No
<b>(7) Risk profiling - business rules</b>	1 – Yes   0 – No
<b>(8) Risk profiling - predictive modeling</b>	1 – Yes   0 – No
(9) Internal intelligence function	1 – Yes   0 – No
(10) Third-party information	1 – Yes   0 – No
(11) Commercial register	1 – Yes   0 – No
(12) Collected tax	1 – Yes   0 – No
(13) Significant changes to taxpayer	1 – Yes   0 – No
(14) Audits as a result of BEPS or ATP issues	1 – Yes   0 – No
(15) Audits as a result of international EOI	1 – Yes   0 – No
(16) Tax control framework based “audits”	1 – Yes   0 – No
(17) Compliance checks	1 – Yes   0 – No
(18) Information cross-checking	1 – Yes   0 – No
(19) Random Audit	1 – Yes   0 – No

Notes: This table describes the audit case selection criteria as reported by the countries' tax administrations to the ISORA. Our measure of risk profiling includes: (7) business rules, (8) predictive modelling.

<sup>47</sup> We changed the data for risk profiling from the ISORA database for Germany, China, Kenya, Thailand, Greece, and Portugal. Risk-profiling indicators are missing for Kenya and Thailand for 2014 and 2015 in the ISORA database, and we change it to 0 according to our hand-collected information. We correct the risk profiling variable for Germany to 0 (Germany indicated as 1 for all four years in the ISORA database), and China, which should be 0 for all years (China indicated 1 for 2014 and 0 for 2015, 2016, 2017 in the ISORA database). In the case of Germany, audit cases are selected based on size and industry (although Germany will adopt it out of our sample period). In the case of China, early actions to categorize taxpayers are based on size and industry. In July 2015, the State Tax Authority launched the "1,000 Enterprises Initiative", focusing on identifying (tax) risks, assisting enterprises to improve their tax control systems of the largest business groups in terms of size, turnover and tax contribution in China (including private enterprises, multinationals, and all state-owned enterprises), and providing better service to reduce disputes. The collected data serves as input for risk profiling and modelling for different industries, supporting the tax credit rating for other taxpayers and helping to generate industry benchmarks. This '1,000 Enterprises Initiative' represents the start of the risk-based audit approach and is only available for the biggest enterprises. Greece implemented risk-profiling in 2016, which was 0 in the ISORA dataset; therefore, we changed it to 1. We changed Portugal from 0 to 1 for all the years, as Portugal has started using risk profiling for large taxpayers before 2014 (IOTA, 2012).

**Figure 1.** Risk profiling and other items in ISORA on tax audit case selection



Notes: This figure exemplifies how both data from different databases (e.g., data from tax returns and third-party information) available in tax administrations and advanced analytical techniques are used for risk profiling. Numbers represent ISORA audit case selection items (1) to (18) as available in the ISORA questionnaire. Overall, the ISORA data covers 19 items on audit case selection strategies: (1) Economic sector, (2) Location, (3) Taxpayer category, (4) Ownership in a corporate entity, (5) Taxpayer behavior, (6) Frequency (time between audits), (7) Risk profiling - business rules, (8) Risk profiling - predictive modeling, (9) Internal intelligence function, (10) Third party information, (11) Commercial register, (12) Collected tax, (13) Significant changes to taxpayer, (14) Audits as a result of BEPS or ATP issues, (15) Audits as a result of international EOI, (16) Tax control framework based “audits”, (17) Compliance checks, (18) Information cross-checking, and (19) Random audit. The items (1) to (6), (9) to (18) from the ISORA case selection data describe taxpayers' characteristics or information sources. Rule based or advanced analytical techniques (such as clustering and association analysis, risk profiling, decision trees, regressions, and predictive models) are employed to analyze the data from different databases to trace and identify risky cases and to evaluate probability of non-compliance. Our measure of risk profiling includes (7) Risk profiling - business rules, (8) Risk profiling - predictive modelling.

The country of Ireland provides an ideal example of what ‘risk profiling – business rules’ entails. Ireland uses an intelligent system applying rules of analysis against customer data held in the Tax Administration Data Warehouse and scoring taxpayers according to the rules they break (IOTA, 2012). As an example of ‘risk profiling – predictive modeling’, the Canadian Revenue Agency (CRA) connects data from several CRA systems with a comprehensive dataset of

taxpayers' information (filing and assessment information, risk profiles, historical audits, collections, and appeal information) to determine high-risk taxpayers in SMEs. Then, the data mining and machine learning algorithms, including cluster analysis, decision trees, neural networks, and deep learning, are employed to develop predictive models and score and identify the highest-risk taxpayers (OECD, 2019). Appendix 1 provides general information about risk-profiling in selected OECD countries.<sup>48</sup>

### 3.2. Research Design

In order to explore the relation between the use of risk profiling and tax avoidance, we estimate the following model using least squares pooling, where  $i$  denotes firm,  $j$  denotes country, and  $t$  denotes the year:

$$Tax\ Avoid_{i,j,t} = \beta_0 + \beta_1 RiskProfiling_{j,t} + \beta_2 Enforcement_{j,t} + X_{i,j,t} + \varepsilon_{i,t} \quad (1)$$

The dependent variable is tax avoidance.<sup>49</sup> We use the tax avoidance measure developed by Atwood et al. (2012), which is the difference between taxes calculated at the statutory tax rate and taxes actually paid. We follow De Simone et al. (2020) and calculate tax avoidance as  $\frac{(\text{pre-tax income} \cdot \text{statutory tax rate}) - \text{current taxes paid}}{\text{pre-tax income}}$ , where pre-tax income (PTI) equals pre-tax earnings (PI) less special items (SPI), and current taxes paid (CTP) equals total tax expense (TXT) less deferred taxes (TXDI). Hence, *Tax Avoid* increases in firms' tax avoidance. This measure accounts for different statutory tax rates across countries over time and thus is suitable for cross-country samples.<sup>50</sup>

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<sup>48</sup> For more detail about the ISORA survey questions on audit case selection and description of results, see Appendix 2 and 3.

<sup>49</sup> From a conceptual point of view, we follow prior literature (Lisowsky et al., 2013), which defines tax avoidance behavior as 'any activity that reduces the firm's explicit taxes in any manner, including tax positions that may or may not be challenged'.

<sup>50</sup> When using ETR and cash ETR as dependent variables, results for the variable of interest, *Risk Profiling*, are not significant. However, the Atwood et al. measure for tax avoidance is particularly adequate for cross-country comparisons, and for our research question. The results using the Atwood et al. measure are robust across several specifications.

The variable of interest in our analysis is *Risk Profiling* at the country-year level, a binary indicator variable, which equals one if risk profiling is employed and zero otherwise. We expect a negative relation between risk profiling and tax avoidance and predict the coefficient of *Risk Profiling*,  $\beta_1$ , is negative for *Tax Avoid*. We control for the natural logarithm of enforcement. We follow Alexander et al. (2020)<sup>51</sup> and measure *Enforcement* as the total number of employees in tax administrations divided by the number of active firms (corporate income taxpayers) per country per year.<sup>52</sup> To facilitate interpretation, the enforcement measure is multiplied by 100 so that it can be interpreted as the total number of employees in tax administrations per 100 firms. We replace missing data for enforcement with the nearest observation for the respective country. Thus, we capture differences in human resources employed in tax administrations to perform tax audits at the country level, with our scores of *Enforcement*. Thereby, we are able to explore whether the employment of risk profiling has an incremental effect on firms' tax behavior. Similar to our main variable, and in line with previous studies, we expect a negative relation between this enforcement proxy and *Tax Avoid*.

We include a set of time-varying control variables ( $X_{i,j,t}$ ), both at the country level and at the firm level, to alleviate the concern that the result is driven by other factors. The country's GDP per capita and GDP growth as indices for market size and overall economic activity are used in the model. Furthermore, we include a set of control variables for firm characteristics. We control for firm profitability (measured by pre-tax ROA, prior year loss, sales growth), leverage (measured by the sum of long-term and short-term debt), R&D (measured by R&D expense), cash holding (measured by cash and equivalents), all scaled over total assets. *Pre-tax ROA* equals pre-tax income divided by lagged total assets. We use firms' size ( $\ln assets$ ) to control for differences in tax planning related to scale. All these variables, following empirical

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<sup>51</sup> They measured enforcement as the ratio of citizens to tax staff at the central government tax agency and converted this ratio into tax staff per 1,000 inhabitants.

<sup>52</sup> If the number of active taxpayers is missing, we replace it with the number of total taxpayers.

evidence, are related to tax avoidance (Edwards et al., 2016; Law & Mills, 2017). In addition, we control for *PP&E*, which also indicates tax avoidance opportunities (Chen et al., 2010; De Simone et al., 2020). Furthermore, we add the Worldwide Governance Indicators (WGI) to our regression to control for country characteristics (Isidro et al., 2020; Kaufmann et al., 2011; Osswald & Sureth-Sloane, 2020). The indicators consist of six dimensions: voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, the rule of law, and control of corruption. Lastly, we account for industry and year-fixed effects in all regressions to control for unobservable tax-related differences across time and industry affecting our results. To account for the potential correlation of standard errors at the country level, we cluster standard errors at the country level.<sup>53</sup> All variables are defined in Appendix 4.

### ***3.3. Sample and Data***

We obtain the audit case selection and enforcement data from the ISORA database from 2014 to 2017 to construct our variable of interest, *Risk profiling*, and key control variable Enforcement. Furthermore, the statutory tax rate data is taken from the KPMG Corporate Tax Rates Table<sup>54</sup>, which provides information on all corporate income taxes and related taxes on corporate profits across countries. We use other country-level control variables such as the annual level of GDP per capita and GDP growth from the World Bank.

Our primary analysis from equation (1) is at the firm level. We start from all the firm-year observations in Compustat North America and Compustat Global from 2014 to 2017 for those countries with sufficient audit selection and enforcement data in the ISORA database. We translate financial reporting data from Compustat Global into US dollars using yearly exchange rates from the World Bank. We exclude firms with negative pre-tax income from our sample, following prior literature (Atwood et al., 2012). We drop all observations that do not have

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<sup>53</sup> We note that our results are robust to variation of clustering (firm, industry, and country\_industry).

<sup>54</sup> See KPMG Corporate Tax Rates Table, <https://home.kpmg/xx/en/home/services/tax/tax-tools-and-resources/tax-rates-online/corporate-tax-rates-table.html>.

sufficient data to construct variables in equation (1). After our screening procedure, the final sample includes 46,908 firm-year observations across 54 countries between 2014 and 2017. Appendix 5 presents the sample selection. Furthermore, we use tax administration and tax performance data from USAID's CTD, which provides comparable information relating to tax administration systems in an internationally comparative context.<sup>55</sup>

### **3.4. Descriptive Statistics**

Our sample comprises both developed and developing countries. Table 2 reports descriptive statistics for *Tax Avoid* and the statutory tax rate (STR) by country. Countries with the most observations in our sample are China (12,770 observations), followed by the United States (10,326 observations), Canada (2,135 observations), and the United Kingdom (2,055 observations). Firms from the United States and Malta show the highest tax avoidance, 0.176 and 0.121, respectively. In comparison, Hungary and Portugal report the lowest level of tax avoidance. Table 2 reports considerable variation in the corporate tax rate in our sample, with the highest rate for the USA (40 percent) and the lowest rate for Bulgaria (10 percent). The variation regarding the implementation of risk profiling across countries is provided in Table 2. China, the Czech Republic, Germany, Japan, and Korea do not use risk profiling between 2014 to 2017. Greece, Kenya, Thailand, and Turkey started to employ risk profiling in 2016. The US and Morocco employed risk profiling in 2015.

Table 3 reports summary statistics for firm-level variables. We winsorize all firm-level variables at the 1 percent and 99 percent levels. The mean (median) of tax avoidance is 0.033 (0.064), indicating some level of tax avoidance in our sample consistent with prior research (e.g., Atwood et al., 2012). The sample firms report a mean (median) Pre-tax ROA of 9.2 (6.6) percent

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<sup>55</sup> USAID CTD was launched to promote tax system assessment and measurement as a means to promote improvements in tax policy and tax administration. See USAID Collecting Taxes Full Database 2019, <https://www.usaid.gov/documents/1865/collecting-taxes-full-database>. The data is publicly available from the USAID DRM website.

and Sales growth of 14.9 (7.1) percent. Around 10.5 percent of the firm-year observations show an accounting loss in the previous year.

**Table 2.** Mean of selected variables by country

Country	<i>Tax Avoid</i>	STR	Risk profiling 2014	Risk profiling 2017	Number of firm-year observations
Argentina	0.019	0.35	1	1	166
Australia	0.053	0.30	1	1	1,173
Austria	0.010	0.25	1	1	185
Belgium	0.050	0.34	1	1	247
Brazil	0.063	0.34	1	1	536
Bulgaria	-0.061	0.10	1	1	115
Canada	0.068	0.27	1	1	2,135
Chile	-0.054	0.23	1	1	319
China	0.006	0.25	0	0	12,770
Colombia	-0.077	0.27	1	1	107
Croatia	0.049	0.20	1	1	146
Cyprus	-0.074	0.13	1	1	91
Czech Republic	0.001	0.19	0	0	37
Denmark	-0.065	0.23	1	1	225
Estonia	-0.001	0.20	1	1	49
Finland	-0.071	0.20	1	1	336
France	0.042	0.33	1	1	1,417
Germany	-0.021	0.30	0	0	1,205
Greece	-0.053	0.28	0	1	249
Hong Kong	-0.068	0.17	1	1	475
Hungary	-0.143	0.16	1	1	53
Iceland	0.015	0.20	1	1	25
Indonesia	-0.081	0.25	1	1	784
Ireland	-0.091	0.13	1	1	181
Israel	-0.019	0.25	1	1	691
Italy	-0.114	0.30	1	1	689
Japan	-0.001	0.33	0	0	859
Kenya	-0.070	0.30	0	1	72
Korea	-0.097	0.24	0	0	18
Latvia	0.042	0.15	1	1	52
Lithuania	0.006	0.15	1	1	94
Luxembourg	-0.015	0.29	1	1	134
Malaysia	-0.066	0.24	1	1	1,152
Malta	0.121	0.35	1	1	30
Mexico	-0.116	0.30	1	1	221
Morocco	-0.009	0.31	0	1	165
Netherlands	-0.011	0.25	1	1	337
New Zealand	0.011	0.28	1	1	252
Norway	-0.040	0.26	1	1	249
Peru	-0.068	0.29	1	1	194
Poland	-0.009	0.19	1	1	1,467
Portugal	-0.129	0.21	1	1	113
Romania	-0.081	0.16	1	1	144
Russia	-0.058	0.20	1	1	521
Singapore	-0.082	0.17	1	1	1,144
Slovak Republic	0.017	0.22	1	1	13
Slovenia	-0.003	0.18	1	1	67
South Africa	-0.020	0.28	1	1	469
Spain	-0.042	0.27	1	1	337
Sweden	0.002	0.22	1	1	683
Thailand	0.017	0.20	0	1	781
Turkey	0.009	0.20	0	1	553
United Kingdom	-0.012	0.20	1	1	2,055
United States	0.176	0.40	0	1	10,326

**Table 3.** Descriptive statistics

<b>Variable</b>	<b>Obs.</b>	<b>Mean</b>	<b>Std. Dev.</b>	<b>P25</b>	<b>P50</b>	<b>P75</b>
<i>Tax Avoid</i>	46908	0.033	0.313	-0.022	0.064	0.164
<i>Pre-tax ROA</i>	46908	0.092	0.098	0.032	0.066	0.121
<i>Prior loss</i>	46908	0.105	0.307	0.000	0.000	0.000
<i>Sales growth</i>	46908	0.149	0.399	-0.009	0.071	0.195
<i>PP&amp;E</i>	46908	0.303	0.266	0.085	0.237	0.454
<i>Leverage</i>	46908	0.251	0.238	0.055	0.208	0.373
<i>R&amp;D</i>	46908	0.016	0.034	0.000	0.000	0.019
<i>Cash</i>	46908	0.194	0.214	0.050	0.123	0.257
<i>Ln (Assets)</i>	46908	6.218	2.186	4.833	6.143	7.602
<i>Risk Profiling</i>	46908	0.605	0.489	0.000	1.000	1.000
<i>Ln (Enforcement)</i>	46908	0.510	0.823	-0.298	0.730	0.956
<i>STR</i>	46908	0.282	0.074	0.250	0.250	0.333
<i>Ln (GDP per capita)</i>	46908	9.962	0.953	8.902	10.498	10.843
<i>GDP Growth</i>	46908	3.063	2.512	1.229	2.077	6.272
<i>Corruption</i>	46908	0.770	0.946	-0.271	1.280	1.514
<i>Voice and Accountability</i>	46908	0.208	1.223	-1.504	1.000	1.110
<i>Political Stability</i>	46908	0.202	0.667	-0.499	0.292	0.678
<i>Government Effectiveness</i>	46908	1.028	0.654	0.408	1.387	1.557
<i>Regulatory Quality</i>	46908	0.849	0.857	-0.147	1.159	1.631
<i>Rule of Law</i>	46908	0.820	0.955	-0.267	1.387	1.649
<i>Transfer Pricing Rules</i>	46908	0.004	0.065	0.000	0.000	0.000
<i>CFC Rules</i>	46908	0.134	0.341	0.000	0.000	0.000
<i>Thin Capitalization Rules</i>	46908	0.092	0.263	0.000	0.000	0.000
<i>R&amp;D Tax Incentives</i>	46908	0.510	0.256	0.500	0.500	0.500
<i>Anti Avoidance Rules</i>	46908	0.062	0.193	0.000	0.000	0.000

Notes: This table describes the sample and summary statistics for the cross-country sample of our main variables for 16,492 firms and 46,908 firm-year observations from 2014 to 2017 used in the empirical tests. All continuous variables are winsorized at the 1st and 99th percentiles.

Table 4 displays the Pearson correlations for the variables used to test our hypothesis H1. We observe a negative correlation between Tax Avoid and Enforcement. We note a positive correlation between Tax Avoid and Pre-tax ROA. We also observe a small but significant positive correlation between Tax Avoid and Sales growth, PP&E, R&D.

## Is Risk Profiling in Tax Audit Case Selection Rewarded?

**Table 4.** Correlations

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13
1) <i>Tax Avoid</i>	1.000												
2) <i>Risk profiling</i>	0.016*	1.000											
3) <i>Ln (Enforcement)</i>	-0.132*	-0.285*	1.000										
4) <i>Pre-tax ROA</i>	0.114*	-0.053*	0.010*	1.000									
5) <i>Prior loss</i>	-0.029*	0.110*	-0.053*	-0.123*	1.000								
6) <i>Sales growth</i>	0.040*	-0.068*	0.026*	0.285*	0.091*	1.000							
7) <i>PP&amp;E</i>	0.022*	-0.000	0.029*	0.001	0.009	0.102*	1.000						
8) <i>Leverage</i>	0.027*	0.119*	-0.112*	-0.110*	0.073*	0.193*	0.248*	1.000					
9) <i>R&amp;D</i>	0.038*	-0.174*	0.052*	0.195*	0.002	0.127*	-0.174*	-0.155*	1.000				
10) <i>Cash</i>	0.008	-0.225*	0.052*	0.419*	-0.026*	0.254*	-0.173*	-0.200*	0.334*	1.000			
11) <i>Ln (Assets)</i>	0.042*	-0.012*	-0.207*	-0.184*	-0.097*	-0.043*	0.097*	0.275*	-0.099*	-0.197*	1.000		
12) <i>Ln (GDP per capita)</i>	0.127*	0.521*	-0.377*	-0.084*	0.109*	-0.083*	-0.113*	0.135*	-0.038*	-0.186*	0.197*	1.000	
13) <i>GDP Growth</i>	-0.069*	-0.622*	0.403*	0.067*	-0.116*	0.093*	0.034*	-0.138*	0.133*	0.238*	-0.103*	-0.685*	1.000

Notes: This table provides Pearson correlations for the sample. \* denotes significance at the .05 level.

## 4. Results

### 4.1. Main Result: Tax Avoidance

We investigate whether and how the employment of risk profiling is associated with tax avoidance at the firm level. Table 5 displays the results of our estimate of equation (1). Column (1) reports the results of our baseline model. We observe a negative and significant coefficient estimate for *Tax Avoid*, suggesting that the employment of risk profiling is associated with a lower level of tax avoidance. The coefficient -0.046 indicates that the employment of risk profiling is associated with a 4.6 percentage point reduction in tax avoidance. The effect is therefore substantial in magnitude, given that our measure of tax avoidance (i.e., Atwood et al., 2012); the difference between the cash effective tax rate and the statutory tax rate per country), is, on average, 3.3 percentage points across all countries and firms (cf. Table 3). On average therefore, firms' cash effective tax rate increases above the statutory tax rate. A possible explanation for the large effect size would be that those firms with high tax avoidance in prior years (for P75, for instance, tax avoidance amounts to 16.4 percentage points, cf. Table 3), have a particular reduction in their tax avoidance.

Relatedly, we also observe a negative and significant coefficient estimate on *Ln (Enforcement)* in all columns, which suggests that firms engage in less tax avoidance when tax enforcement is stronger. This is consistent with prior literature (Atwood et al., 2012; Hoopes et al., 2012), which provides evidence of the effectiveness of enforcement to curb tax avoidance. With regard to other control variables, R&D is positively related to tax avoidance, consistent with Dyreng et al. (2017) and De Simone et al. (2020), which indicate that firms use R&D accounts for tax avoidance.

In column (2), we add additional control variables at the country level to control for the effect of a country's governance structures: *Voice and Accountability*, *Government Effectiveness*, *Political Stability*, *Rule of Law*, and *Regulatory Quality*. These variables reflect the citizens'

perception of participating in selecting the government, the quality of public services, the risk of political instability, the extent to which agents have confidence in and abide by the rules of society respectively, and the ability of the government to formulate and implement policies and regulations. A higher score indicates better governance of the country. We continue to observe a significant relation between *Risk Profiling* and *Tax Avoid* after adding these controls, which suggests that our results are consistent.<sup>56</sup>

To address potential concerns about the impact of the denominator (pre-tax income) in measuring tax avoidance for the dependent variable, column (3) additionally employs the variable *One over Pre-tax Profit* (Edwards et al., 2021) to control for trends in tax avoidance. We find consistent results. Column (4) includes additional control variables (*Transfer Pricing Rules*, *CFC Rules*, *Thin Capitalization Rules*, *R&D Tax Incentives*, *Anti Avoidance Rules*) from the Tax Attractiveness Index<sup>57</sup> to capture possible changes in the tax base as a result of the implementation of anti-avoidance measures. We continue to find consistent results.

To mitigate concerns on whether differences in the number of observations across countries bias our results, we repeat our main regression using weighted least squares (WLS, based on Guenther, 2018) in column (5), with weights being the number of firms in each country. Consistent with our baseline regression, we continue to find a negative association between the implementation of risk profiling and tax avoidance. Imbalances in the distribution of firms across countries do not affect our results.

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<sup>56</sup> Since these additional control variables are correlated, we repeated the regression with only Regulatory Quality as an additional control variable (untabulated) and find that our results hold.

<sup>57</sup> The Tax Attractiveness Index includes 20 different equally weighted tax components and provides a comprehensive picture of countries' tax environment. We selected the parameters related to firms' tax avoidance strategies. Data of the Tax Attractiveness Index including its components is available on <https://www.tax-index.org/>.

**Table 5.** Risk profiling and tax avoidance

<b>VARIABLES</b>	<b>(1)</b> <i>Tax Avoid</i>	<b>(2)</b> <i>Tax Avoid</i>	<b>(3)</b> <i>Tax Avoid</i>	<b>(4)</b> <i>Tax Avoid</i>	<b>(5)</b> <i>Tax Avoid</i>
<i>Risk Profiling</i>	-0.046*** (0.017)	-0.037*** (0.011)	-0.037*** (0.011)	-0.036** (0.017)	-0.017** (0.007)
<i>Ln (Enforcement)</i>	-0.034** (0.016)	-0.029*** (0.010)	-0.029*** (0.010)	-0.035*** (0.012)	-0.043*** (0.003)
<i>Pre-tax ROA</i>	0.410*** (0.072)	0.395*** (0.079)	0.386*** (0.079)	0.404*** (0.076)	0.332*** (0.024)
<i>Prior loss</i>	-0.026** (0.012)	-0.029** (0.011)	-0.027** (0.012)	-0.028** (0.011)	-0.037*** (0.010)
<i>Sales growth</i>	0.010** (0.005)	0.014** (0.006)	0.014** (0.006)	0.011** (0.005)	0.014*** (0.005)
<i>PP&amp;E</i>	0.065*** (0.020)	0.075*** (0.017)	0.075*** (0.017)	0.068*** (0.019)	0.079*** (0.009)
<i>Leverage</i>	-0.028 (0.033)	-0.039 (0.032)	-0.037 (0.032)	-0.034 (0.032)	-0.039*** (0.009)
<i>R&amp;D</i>	0.325*** (0.087)	0.200*** (0.064)	0.203*** (0.062)	0.279*** (0.075)	0.203*** (0.063)
<i>Cash</i>	-0.061** (0.027)	-0.050** (0.023)	-0.048** (0.023)	-0.055** (0.024)	-0.014* (0.008)
<i>Ln (Assets)</i>	-0.002 (0.002)	-0.004** (0.002)	-0.005*** (0.002)	-0.003 (0.002)	-0.007*** (0.001)
<i>Ln (GDP per capita)</i>	0.045** (0.017)	0.042* (0.021)	0.043** (0.021)	0.085** (0.039)	0.059*** (0.008)
<i>GDP Growth</i>	0.003 (0.005)	0.008 (0.005)	0.008 (0.005)	0.007 (0.005)	0.020*** (0.002)
<i>Corruption</i>		-0.063 (0.039)	-0.064 (0.040)	-0.035 (0.033)	-0.111*** (0.014)
<i>Voice and Accountability</i>		-0.014 (0.014)	-0.014 (0.014)		0.016** (0.008)
<i>Government Effectiveness</i>		-0.099* (0.050)	-0.101* (0.050)		-0.072*** (0.021)
<i>Political Stability</i>		-0.048** (0.021)	-0.048** (0.021)		-0.066*** (0.007)
<i>Rule of Law</i>		0.286*** (0.060)	0.286*** (0.060)		0.255*** (0.021)
<i>Regulatory Quality</i>		-0.118*** (0.029)	-0.117*** (0.029)		-0.070*** (0.014)
<i>One over Pre-tax Profit</i>			-0.002** (0.001)		
<i>Transfer Pricing Rules</i>				-0.012 (0.053)	
<i>CFC Rules</i>				-0.037* (0.021)	
<i>Thin Capitalization Rules</i>				-0.038 (0.037)	
<i>R&amp;D Tax Incentives</i>				-0.000 (0.011)	
<i>Anti-Avoidance Rules</i>				0.066 (0.041)	
<i>Constant</i>	-0.488** (0.187)	-0.426** (0.204)	-0.431** (0.206)	-0.869** (0.380)	
Observations	46,908	46,908	46,908	46,908	46,908
R-squared	0.077	0.093	0.097	0.083	0.131
Industry FE	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes

Notes: This table presents the results of equation (1). The dependent variable is *Tax Avoid*, measured as the difference between taxes calculated at the statutory tax rate and taxes that are actually paid, based on De Simone et al.

(2020) and Atwood et al. (2012). Our main variable of interest, *Risk Profiling*, is an indicator variable equal to one if risk profiling - business rules or risk profiling - predictive modeling equal to one according to ISORA audit case selection data. Additional control variables are included in Columns (2), (3), and (4). In Column (5), baseline regression is estimated using weighted least squares. All continuous variables are winsorized at the 1% and 99% levels. Variables are defined in Appendix 4. Industry and year fixed effects are included in all regressions. We report robust standard errors clustered at the country level in parentheses. \*, \*\*, and \*\*\* denote significance at the 10%, 5%, and 1% levels, respectively.

We further investigate when the association between implementing risk profiling and reduced tax avoidance starts and how long this association last. We do not expect tax avoidance in  $t$  to respond to risk profiling in future years (e.g.,  $t+1$  and  $t+2$ ), meaning that we do not expect anticipatory tax avoidance effects. Instead, we expect the tax avoidance effect to appear in the year when firms face the implementation of risk profiling (year  $t$ ). In addition, we expect to find delayed tax avoidance effects, which implies that tax avoidance in  $t$  responds to the implementation of risk profiling in past years (e.g.,  $t-1$  and  $t-2$ ). The results in Table 6 support our assumption and reveal that there are no significant effects of the future implementation of risk profiling on current tax avoidance (anticipatory effect). Instead, firms will reduce their tax avoidance more significantly in years after the implementation of risk profiling, which suggests that changing the tax avoidance plan may take some time.

**Table 6.** Timing of tax avoidance around the implementation of risk profiling

	<b>Implementation of Risk Profiling</b>	<b>Tax Avoid in <math>t</math></b>
Anticipatory Response	<i>Risk Profiling in <math>t + 2</math></i>	-0.005 (0.021)
	<i>Risk Profiling in <math>t + 1</math></i>	-0.015 (0.018)
	<i>Risk Profiling in <math>t</math></i>	-0.046*** (0.017)
Delayed Response	<i>Risk Profiling in <math>t - 1</math></i>	-0.061*** (0.017)
	<i>Risk Profiling in <math>t - 2</math></i>	-0.076*** (0.015)
	Controls & FE	yes

Notes: This table presents the results of the main regression, including lead and lagged values for our variable of interest *Risk Profiling*.  $t$  denotes the year in which we observe *TaxAvoid*. *Risk Profiling in  $t - 2$* , for instance, denotes the implementation of risk profiling two years before we observe *TaxAvoid*. Controls and fixed effects from the main regression are included in all regressions. We report robust standard errors clustered at the country level in parentheses. \*, \*\*, and \*\*\* denote significance at the 10%, 5%, and 1% levels, respectively.

## 4.2. Cross-sectional Tests

### *Firm Size and Industry*

While the negative association estimated in Table 5 addresses the average effect of risk profiling, the effect might vary across heterogeneous firms. In this section, we analyze the potential heterogeneous effect of risk profiling depending on the firm size, which usually is one of the audit selection criteria.<sup>58</sup> To test the potential heterogeneous effects of firm size, and especially whether the association of risk profiling and tax avoidance is stronger for larger firms (H2), we split the sample into three size groups (*Ln Assets*) within country-year.

Table 7 Panel A presents the regression results of equation (1) for the dependent variable *Tax Avoid* based on different firm sizes, measured as total assets, split in thirds: small, medium, and large. Interestingly, the results suggest that risk profiling has a deterrence effect on all firms, irrespective of size. However, the effect is more pronounced for large firms, suggesting that risk profiling increases control over the large taxpayers, in spite of possibly frequent audits, and improve the compliance of these groups. Note that Compustat only covers public firms, and thus small firms in our sample may already have a relatively larger size than private firms. As such, our result should be interpreted with caution.

Untabulated results of our main regression per industry show that the negative association between risk profiling and tax avoidance persists across most industries.<sup>59</sup> We believe that industry, similar to size, is not a new indicator for tax avoidance for the tax administrations because already before implementing risk profiling, tax administrations assume that specific industries

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<sup>58</sup> For instance, the German tax administration divides firms into four size classes (very small, small, medium and large) based on revenue and taxable profit, while other tax administrations might differentiate between two size-classes.

<sup>59</sup> Results display significance at the  $p < .1$  level for Construction, Food/Agriculture, Pharmaceuticals, Textiles/Printing/Publishing, Extractive/Mining, Manf: Chemicals/Glass/Metals, Manf: Electrical Equipment, Utilities/Cable/Broadcasting, and Services. Results are not significant, but negative as expected for Manf: Machinery, Manf: Transportation Equipment, Computers/Semiconductors, Transportation, Retailers, Financial/Insurance/Real Estate. Results are not significant and positive for Manf: Instruments and Wholesalers.

have higher tax risk and already conducted the focused audits (e.g., in the intangible-intensive pharmaceutical industry<sup>60</sup>). Our results on industry, therefore, aligns well with our result on size, which similarly does not seem to be a novel criterion for tax case selection. We accordingly find an effect for small, medium, and large firms.

Thus, risk profiling promises to detect those firms with yet undetected tax risk. Our results across size and industry emphasize that the association with tax avoidance is firm-specific rather than industry-specific.

#### *Tax Administration Effectiveness*

Firms' adaptation in their levels of tax avoidance associated with risk profiling for tax audit case selection may depend on firms' perception of tax administrations' effectiveness in designing and executing risk profiling and subsequent audits. We use two specific characteristics as proxies for tax administrations' effectiveness, both from ISORA data. First, we use the employment of risk profiling experts, namely data scientists, behavioral researchers, and computer systems analysts. Continuous in-house availability of risk profiling expertise likely improves the design, and execution of risk profiling. Second, we use the number of tax auditors, measured as the number of full-time equivalents (FTE) employed in audit, investigation, and other verification. In the presence of risk profiling, tax auditors are needed to effectively target high-risk taxpayers. Otherwise, the identification of high-risk taxpayers is of little consequence.

Table 7 Panel B presents the regression results of equation (1) for the dependent variable *Tax Avoid*, again including all control variables, notably *Enforcement* level among others. We distinguish in columns (1) and (2) between firms in countries without and with risk profiling experts. Columns (3) and (4) display firms in countries with a low number of tax auditors (first quartile) and firms in countries with a high number of tax auditors (fourth quartile). Results

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<sup>60</sup> See TRAC, [https://trac.syr.edu/tracirs/trends/v10/industry\\_4\\_retail.html](https://trac.syr.edu/tracirs/trends/v10/industry_4_retail.html); (Neuman et al., 2020).

show that indeed, risk profiling is associated with less tax avoidance only when firms have reasons to assume that risk profiling is based on high expertise and well-staffed tax audits. In other words, risk profiling must be equipped with both expertise and workforce. Only then do firms perceive risk profiling as effective and adapt their tax behavior. Therefore, in line with our theory, we find evidence that the effectiveness of risk profiling in reducing tax avoidance heavily relies on its execution in tax administrations.

**Table 7.** Cross-sectional tests

<b>Panel A: Risk Profiling and Firm Size</b>				
<b>VARIABLES</b>	<b>(1) Small firms</b>	<b>(2) Medium firms</b>	<b>(3) Large firms</b>	
<i>Risk Profiling</i>	-0.049*** (0.017)	-0.040** (0.016)	-0.062*** (0.019)	
<i>Ln (Enforcement)</i>	-0.014 (0.014)	-0.033** (0.015)	-0.056*** (0.016)	
Observations	15,636	15,636	15,636	
R-squared	0.055	0.071	0.146	
Industry FE	yes	yes	yes	
Year FE	yes	yes	yes	

<b>Panel B: Implementation of Risk Profiling in Tax Administrations</b>				
<b>VARIABLES</b>	<b>(1) No Risk Profiling Experts</b>	<b>(2) Risk Profiling Experts</b>	<b>(3) Low FTE Tax Audit</b>	<b>(4) High FTE Tax Audit</b>
<i>Risk Profiling</i>	-0.036 (0.031)	-0.069*** (0.019)	-0.023 (0.023)	-0.023*** (0.003)
<i>Ln (Enforcement)</i>	0.014 (0.015)	-0.047** (0.017)	0.000 (0.012)	-0.072*** (0.004)
Observations	3,914	17,846	8,249	7,571
R-squared	0.046	0.098	0.042	0.145
industry FE	yes	yes	yes	yes
year FE	yes	yes	yes	yes

Notes: This table presents the cross-sectional results of estimating the baseline regression (Table 5). The dependent variable is *Tax Avoid*, measured as the difference between taxes calculated at the statutory tax rate and taxes that are actually paid, based on De Simone et al. (2020) and Atwood et al. (2012). Our main variable of interest, *Risk profiling*, is an indicator variable equal to one if risk profiling - business rules or risk profiling - predictive modeling equal to one according to ISORA audit case selection data. In Panel A, the results of equation (1) are split by size (total asset) thirds per country and year. In Panel B, Columns (1) and (2) present the result of equation (1) split by risk profiling expertise in tax administrations. (*No*) *Risk Profiling Experts* represents tax administrations that (do not) employ data scientists, behavioral researcher scientists, and computer systems analysts according to ISORA data. Columns (3) and (4) present the results using a subsample of corporations located in countries with a low and high number of full-time employees in audit, investigation, and other verification. Low (high) full-time employees denote corporations in countries with 25<sup>th</sup> (75<sup>th</sup>) percentiles in full-time employees in audit, investigation, and other verification. All continuous variables are winsorized at the 1% and 99% levels. Variables are defined in Appendix 4. Industry and year-fixed effects are included in all regressions. We report robust standard errors clustered at the country level in parentheses. \*, \*\*, and \*\*\* denote significance at the 10%, 5%, and 1% levels, respectively.

### 4.3. Supplementary Analysis

#### *Tax Administration Performance*

We use country-level analysis to examine the association of risk profiling and the performance of tax administrations in different countries. We employ the data from USAID CTD, which compares the administrative frameworks, functions, and performance of different tax administrations.<sup>61</sup> To test for the association between the use of risk profiling and tax administration performance, we estimate the following regression at the country level, where  $j$  is the country identifier, and  $t$  is the year identifier:

$$\begin{aligned} \text{Tax Admin Performance}_{j,t} &= \beta_0 + \beta_1 \text{RiskProfiling}_{j,t} + \beta_2 \text{Enforcement}_{j,t} + \delta X_{j,t} \\ &+ \varepsilon_{j,t} \end{aligned} \quad (2)$$

Tax Admin Performance is one of two variables: Cost of Collection, or Tax Effort. Both indicators are collected and calculated by USAID's CTD. Similar to our main tests, we control for enforcement level and country characteristics, and we include year fixed effects.

First, we use the cost of tax collection as the dependent variable to capture the efficiency of tax administrations, as given by CTD. The measure for the *Cost of Collection* is calculated as the ratio of the total annual tax administration expenditures (budget) to the net tax revenue collected by the tax administration (in percent). The lower the *Cost of Collection*, the more efficient the tax system is in collecting all taxes.<sup>62</sup> The data is available for two points in time over the sample period (2015 and 2017). We replace the missing data for 2014 with 2015 values and for 2016 with 2017 values.

While the employment of risk profiling may increase efficiency by devoting the resources to high-risk taxpayers it may also trigger substantial costs in terms of data and IT systems, which

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<sup>61</sup> For an overview of CTD comparable data on taxation, see USAID COLLECTING TAXES 2017/ 2018, [https://www.usaid.gov/sites/default/files/documents/1865/CTD\\_Program\\_Document\\_-\\_2017-18\\_-\\_FINAL.pdf](https://www.usaid.gov/sites/default/files/documents/1865/CTD_Program_Document_-_2017-18_-_FINAL.pdf).

<sup>62</sup> Note that this indicator does not take into account that some tax administrations rent the building or use government buildings and nationwide Information Technology (IT) hardware, or similar costs.

may outweigh the reduction in enforcement costs. Hence, the association between risk profiling and the cost of tax collection is ambiguous. The results in column (1) of Table 8 suggest that the use of risk profiling is associated with lower *Cost of Collection*. The positive coefficient estimate for *Enforcement* suggests that the cost of collection also increases in higher enforcement levels, i.e., more tax administration employees per 100 firms.

Our second dependent variable for tax administrations' performance, *Tax Effort*, estimates the taxes a country could potentially collect based on its macroeconomic, demographic, and institutional features. Tax Effort equals the actual amount of tax revenue as a percent of GDP related to the potential tax to the GDP ratio (tax capacity). In other words, Tax Effort indicates how much tax revenue a country collects relative to how much it could collect, predicted on the basis of several factors such as macroeconomic, demographic, and institutional characteristics of a country. For example, a tax effort of 1.0 shows that a country is collecting exactly its predicted capacity. A low tax effort (tax effort below one) indicates the country collects less. In years, where data for Tax Effort are missing, we use the nearest observation instead.<sup>63</sup> We expect and find that the employment of risk profiling is associated with higher tax revenues and brings country closer to its full capacity, i.e., closer to a tax effort of 1.0. Results reported in column (2) of Table 8 show that the use of risk profiling could facilitate the tax collection of a country to reach its full potential.

Overall, we provide evidence that the employment of risk profiling for tax audit case selection reduces the cost of enforcement and improves the performance of tax administrations, specifically the cost of tax collection, and tax effort.

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<sup>63</sup> Results hold and are even more pronounced ( $p < .05$ ) when not imputing missing data and reducing the sample to observations where Tax Effort is available in all years (untabulated).

**Table 8.** Risk profiling and tax administration performance

<b>Variables</b>	<b>(1) <i>Cost of Collection</i></b>	<b>(2) <i>Tax Effort</i></b>
<i>Risk Profiling</i>	-0.255** (0.105)	0.058* (0.031)
<i>Ln (Enforcement)</i>	0.113*** (0.036)	0.031 (0.020)
<i>Voice and Accountability</i>	0.328*** (0.111)	0.033 (0.038)
<i>Political Stability</i>	0.170* (0.087)	-0.033 (0.028)
<i>Government Effectiveness</i>	0.893*** (0.284)	-0.183** (0.084)
<i>Regulatory Quality</i>	-0.106 (0.204)	-0.151*** (0.052)
<i>Rule of Law</i>	-0.618* (0.317)	0.059 (0.074)
<i>Corruption</i>	0.002 (0.188)	0.148** (0.064)
<i>Ln (GDP per capita)</i>	-0.416*** (0.124)	0.090** (0.035)
<i>GDP Growth</i>	-0.013 (0.016)	-0.009** (0.004)
<i>Constant</i>	4.689*** (1.146)	-0.214 (0.317)
Observations	196	200
R-squared	0.424	0.496
Year FE	yes	yes

Notes: This table presents the results of equation (2). In column (1), the dependent variable is *Cost of Collection*, which equals the ratio of the cost of administering the tax system to the total revenues collected by the tax administration. In column (2), the dependent variable is *Tax Effort*, which compares the actual value of tax as a percent of GDP to tax capacity. Our main variable of interest, *Risk Profiling*, is an indicator variable equal to one if risk profiling - business rules or risk profiling - predictive modeling equal to one from ISORA audit case selection data. Variables are defined in Appendix 4. Year fixed effects are included in all regressions. We report robust standard errors clustered at the country level in parentheses. \*, \*\*, and \*\*\* denote significance at the 10%, 5%, and 1% levels, respectively.

## 5. Conclusion

We conduct a cross-country study to explore whether and to what extent risk profiling is associated with firms' tax avoidance after controlling for the level of enforcement and other country characteristics. We use annual country-level data on audit case selection (ISORA) across 54 countries from 2014 to 2017 to measure risk profiling.

Our results indicate that the employment of risk profiling is on average negatively associated

with corporate tax avoidance, irrespective of firm size. That is, risk profiling could potentially deter the strategic responses to audits and enhance the effectivity of audits by attenuating bunching below a certain threshold of revenue to avoid an audit. We find no anticipatory effect of tax avoidance, and firms will significantly reduce their tax avoidance in the year of implementation of risk profiling, with an even larger effect in subsequent years. The results hint at reaction time for firms to adapt their perception of tax administrations' effectiveness after the implementation of risk profiling, and to adapt their tax behavior. However, we find the negative association only for countries that employ risk profiling experts, and for countries with a high number of tax auditors. In other words, the implementation of risk profiling affects firms' tax behavior only when design and execution assure a high quality, and when sufficient workforce can focus on high-risk taxpayers.

In additional tests, we analyze whether risk profiling is associated with tax administrations' performance and focus on two measures, cost of tax collection, and tax effort. We find that risk profiling significantly reduces the cost of tax collection, i.e., the ratio between tax administration's budget and its tax revenue. Also, risk profiling increases the tax effort, i.e., the difference between the amount of tax actually collected and potentially collected is reduced. Broadly speaking, our results confirm the connection between the high performance of tax administration and their use of risk profiling.

To the best of our knowledge, this is the first cross-country study to examine the association between risk profiling in tax audit case selection and corporate tax avoidance. We do not infer causality between the employment of risk profiling and corporate tax avoidance behavior. Instead, we paint a consistent picture of the association between the use of risk profiling and tax avoidance, which tax administrations actively seek to combat.

We acknowledge that our analysis is subject to some limitations. We can only refer to data on risk profiling included in the ISORA questionnaire and as self-reported by tax administrations.

We mitigate this limitation by validating our measure with other available resources such as tax administrations' websites, PwC summaries, World Bank reports, and contacting tax experts in different countries. In addition, we acknowledge that during our observation period from 2014 to 2017 only a few countries implement risk profiling, which reduces variation in our data. Further, countries' decision to implement risk profiling may be a function of the overall level of tax avoidance. Our country-specific control variables may capture some of these concerns. Finally, unobserved events concurrent with implementing risk profiling may bias our results. Despite these limitations, we believe that our findings provide insights to researchers, policy-makers, and tax administrations globally.

Our findings enrich the debate on tax enforcement design. They underline the importance of investing the analytical techniques of tax administrations to support advanced risk-based audit selection mechanisms. While several countries are well advanced in implementing such strategies, others seem to be rather reluctant to either dedicate resources or overcome legal or political obstacles. Our results indicate that the use of risk profiling is related to lower tax avoidance, whereas this relation strongly relies on the execution of risk profiling by tax administrations. More broadly, our results indicate that risk profiling not only relates to less tax-avoiding firm behavior but also a better performance of tax administrations.

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## Appendix 1. Risk profiling in selected countries

Australia	The Australian Tax Office uses a risk-based approach to increase the detection capability of the revenue authority. It employs a range of activities aimed at preventing, deterring, detecting, and dealing with the risks of non-compliance. This risk-based approach includes techniques such as qualitative, quantitative assessment and probability forecasts using predictive techniques.
Austria	Austria uses risk analysis systems using tax returns and case history information and evaluates/compares this information to assign risk levels to each taxpayer.
Bulgaria	Risk analysis and risk criteria at the national level. In Bulgaria, past taxpayer data, supplemented with external data, are gathered to create risk scores and categories. The risk assessment employs the point systems, which generate points based on different criteria and determines the taxpayers' total risk score.
Canada	Audit selection based on data-mining techniques (neural networks, decision trees). In Canada, data is extracted from several systems to identify the high-risk taxpayers in the Small and Medium Enterprises (SME) population. Data mining/machine learning algorithms, including cluster analysis, decision trees, neural networks, and deep learning, are used in developing SME predictive models for income.
France	Audit selection is based on data mining and other statistical tools.
Ireland	An intelligent system applying rules of analysis against customer data held in the Tax Administration data warehouse and scoring taxpayers according to the rules they break.
Italy	Big data and data mining analysis is another area where the Italian Revenue Agency has started adopting and exploring new approaches: hiring skilled data scientists and developing Advanced Analytics tools is part of this strategy that aims at fostering tax compliance while creating better risk profiles of clusters of taxpayers. The use of data analytics and the related activities aim at mining data to help increase tax collection, target compliance initiatives and improve efficiency. The application of data mining techniques is part of a risk-analysis strategy, focusing on: estimates of individual income (74.6% positivity rate versus 33.9% using traditional techniques); identification of VAT fraud profiles (80% positivity rate); definition of taxpayer profiles based on the financial reports archive.
Malaysia	Data-driven audit case selection (automated audit selection). The risk-based audit techniques also include advanced analytics using statistical models.
Netherlands	Dutch Tax and Customs Administration gathers and analyzes many types of information at the central level, including the industry sector-related information, information from tax returns, compliance surveys, risk database, third-party information, and information from other authorities. It employs risk-based approaches, such as data-matching and advanced analytics.
Sweden	In Sweden, risk-based tax audits are employed using data at both central and regional levels. The risk-based tax audit techniques include data-matching and predictive techniques such as predictive models to identify unreported income.
Turkey	Risk-based audits are centralized at the national level. Risk-based audit techniques are based on data mining.
United Kingdom	HM Revenue and Customs employ extensive data-matching and data-mining techniques (including decision trees and neural networks), score-based risk assessment using statistical tools.

Source: Khwaja et al. (2011), IOTA (2012, 2018), OECD (2004, 2017, 2019), Tax administrations' websites

Further details and anecdotes about country experiences and how tax administrations developed and use risk profiling are provided in Khwaja et al. (2011).

We collect additional anecdotal evidence and provide a selection of excerpts to illustrate tax administrations' motivation to implement risk profiling.

**Finland, Pekka Ruuhonen, Director General, Finnish Tax Administration, IOTA (2017)**

*We strongly believe that investing in analytics is valuable and benefits the administration immensely. We will, in the near future, invest in Big Data know-how, Big Data environment, robotics and utilizing the data available on the internet. Seize the moment, as it might be too late tomorrow - Digital economy offers challenges and opportunities to all tax administrations.*

**Hungary, Csilla Tamásné Czinege, Director General for Taxation Issues, Hungarian Tax and Customs Administration, IOTA (2016)**

*As a summary, it can be stated that the tools applied and introduced by the National Tax and Customs Administration of Hungary in order to whiten further the economy as well as to repel tax frauds have reached their impacts: amounts of tax revenues have increased, more targeted tax audits have become more effective and, because of preventive effects of measures and their effects deterring from further infringements, level of taxpayers' voluntary compliance has risen. On the basis of all these, we are entitled to say that the measures described above have enhanced the professional reputation of Hungary's state tax and customs authority not only in our closer region but also in a wider area: throughout the European Union.*

**Spain, José Borja Tomé, Deputy Director, IT Department, Spanish Tax Agency, IOTA (2016)**

*Data analytics offers uncountable opportunities for tax administrations, and poses new challenges in order to leverage efforts and investments. A winning strategy will be to combine simple technologies which can be used by anyone keeping governance of information under control, with deploying advanced analytic projects which will need careful selection and a tailored organization. Integrating the results of the analysis into the operational systems can ease user adoption.*

**European Commission, Caroline Edery, Head of Unit, European Commission, Directorate-General for Taxation and Customs Union, IOTA (2016)**

*With the increased use of data analytics tax administrations are moving towards a more risk based tax compliance strategy. Data analytics allow for developing sophisticated risk profiles, analysing trends, flagging potential audit issues and identifying higher-risk cases for deeper investigation and cutting off avenues for fraud before they even occur.*

## Appendix 2. Survey questions

### International Survey on Revenue Administration (ISORA) 2018<sup>64</sup>

<b>Case Selection</b>	
5 Does the administration make use of any of the selection processes /criteria listed below to formally initiate a verification / audit intervention?	<input type="radio"/> Yes <input type="radio"/> No
If “YES“, check all appropriate boxes	D) Economic sector (e.g. Financial, Banking, Industrial etc.) E) Location F) Taxpayer category (e.g. self-employed, professionals etc.) G) Ownership in a corporate entity H) Taxpayer behavior I) Frequency (time between audits) J) Risk profiling – business rules K) Risk profiling – predictive modelling L) Third party information M) Internal intelligence function N) Commercial register O) Collected tax P) Significant changes to taxpayer Q) Audits as a result of Base Erosion and Profiting Shifting (BEPS) or aggressive tax planning issues R) Audits as a result of international exchange of information S) Tax control framework based “audits“ T) Compliance checks (e.g. payroll checks) U) Information cross checking V) Selected by auditors based on their judgement and experience W) Other, briefly describe in the space provided...

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<sup>64</sup> See <https://data.rafit.org/?sk=3dba84d7-1dd8-4533-b682-c0dfcb1d7f13&sId=1637514078838>.

International Survey on Revenue Administration (ISORA) 2016<sup>65</sup>

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**Case Selection**

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6 Does the administration make use of any of the selection processes / Criteria listed below to formally initiate a verification / audit intervention

- ☐ Yes
- ☐ No

If “Yes“, check all appropriate boxes below

- ☐ Economic sector (e.g. Financial, Banking, Industrial etc.)
  - ☐ Location
  - ☐ Taxpayer category (e.g. self-employed, professionals etc.)
  - ☐ Ownership in a corporate entity
  - ☐ Taxpayer behavior
  - ☐ Frequency (time between audits)
  - ☐ Random
  - ☐ Risk profiling – business rules
  - ☐ Risk profiling – predictive modelling
  - ☐ Third party information
  - ☐ Internal intelligence function
  - ☐ Commercial register
  - ☐ Collected tax
  - ☐ Significant changes to taxpayer
  - ☐ Audits as a result of Base Erosion and Profiting Shifting (BEPS) or aggressive tax planning issues
  - ☐ Audits as a result of international exchange of information
  - ☐ Tax control framework based “audits“
  - ☐ Compliance checks (E.g. payroll checks)
  - ☐ Information cross checking
  - ☐ Selected by auditors based on their judgement and experience
  - ☐ Other, briefly describe in the space provided...
- 

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<sup>65</sup> See <https://data.rafit.org/?sk=3dba84d7-1dd8-4533-b682-c0dfcb1d7f13&sId=1637514126154>.

### Appendix 3. Descriptions of the ISORA results

The IMF ISORA 2016 Understanding Revenue Administration Report<sup>66</sup> provides explanations on and descriptives about their survey on audit case selection. The subsequent table from their report, provides the percentage of administrations indicating the use of a specific process or criterion in different groups of countries.

**Table 40. Administrations Using Specified Case Selection Criteria, 2015  
(Percent)**

Group	Small States (31)	Lower Income (44)	Higher Income (60)	All (135)
Economic Sector	81	95	88	89
Third-Party Information	77	91	92	88
Taxpayer Behavior	77	84	88	84
Taxpayer Category (for example, self-employed)	71	77	88	81
Information Cross-Checking	61	84	87	80
Significant Changes to Taxpayer	65	77	87	79
Selected Based on Judgment	77	70	73	73
Internal Intelligence Function	61	80	73	73
<b>Risk Profiling—Business Rules</b>	<b>42</b>	<b>70</b>	<b>82</b>	<b>69</b>
Compliance Checks (for example, payroll checks)	71	64	70	68
Collected Tax	55	66	68	64
Frequency (time between audits)	42	75	62	61
BEPS or Aggressive Tax Planning Issues	23	57	67	53
Random	58	50	52	53
Location	39	48	62	52
International Exchange of Information	26	39	75	52
Tax Control Framework-based "Audits"	23	61	52	48
Ownership in a Corporate Entity	39	41	52	45
<b>Risk Profiling—Predictive Modeling</b>	<b>19</b>	<b>45</b>	<b>50</b>	<b>41</b>
Commercial Register	19	25	42	31
Other	6	7	10	8

Note: Numbers in parentheses equal the sample size for data supplied in each column. BEPS = base erosion and profit shifting.

<sup>66</sup> See <https://www.imf.org/en/Publications/Departmental-Papers-Policy-Papers/Issues/2019/03/07/ISORA-2016-Understanding-Revenue-Administration-46337>, p. 80.

#### Appendix 4. Variable definition

<b>Panel A: Firm-level variables</b>		
Variable	Definitions	Source
<i>Tax Avoid</i>	$[(PTI * \text{Statutory Tax Rate}) - CTP] / PTI$ , where PTI = pre-tax earnings (PI) less special items (SPI), STR is the combined average statutory corporate income tax rate at all layers of government in the country during the year $t$ , obtained from KPMG, and CTP = current taxes paid, measured as total tax expense (TXT) less deferred taxes (TXDI). Based on De Simone et al. (2020) and Atwood et al. (2012).	Compustat
<i>Pre-Tax ROA</i>	Pre-tax Income (PI) scaled by lagged total assets (AT).	Compustat
<i>Prior Loss</i>	A dummy variable, equal to 1 if the firm had negative <i>Pre-Tax ROA</i> in the previous year and 0 otherwise.	
<i>Sales Growth</i>	Percentage change in Sales (SALE) from year $t-1$ to year $t$ .	Compustat
<i>PP&amp;E</i>	Net property, plant, and equipment (PP&ENT) scaled by lagged total assets (AT).	Compustat
<i>Leverage</i>	Sum of long-term and short-term debt, scaled by lagged total assets, set to 0 if missing.	Compustat
<i>R&amp;D</i>	R&D Expense in year $t$ scaled by lagged total assets, set to zero if missing.	Compustat
<i>Cash</i>	Cash and equivalents scaled by lagged total assets, set to zero if missing.	Compustat
<i>Ln Assets</i>	Natural log of total assets.	Compustat
<b>Panel B: Country-level variables</b>		
<i>Risk Profiling</i>	An indicator variable equal to one if risk profiling - business rules or risk profiling - predictive modeling equal to one from ISORA audit case selection data.	ISORA
<i>Enforcement</i>	The number of full-time employees in tax administration/total number of active firms (corporate income taxpayers) multiplied by 100. If the number of active taxpayers is missing, we replace it with the number of total taxpayers.	ISORA
<i>STR</i>	Statutory tax rate, the average statutory corporate income tax rate in the country at year $t$ .	KPMG
<i>Ln (GDP per capita)</i>	Natural logarithm of per-capita GDP.	World Bank
<i>GDP Growth</i>	The percentage change in GDP in a country from year $t-1$ to $t$ .	World Bank
<i>Corruption</i>	A yearly estimate of perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption.	World Bank World-wide Governance Indicators (WGI)
<i>Voice and Accountability</i>	A yearly estimate of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media.	World Bank World-wide Governance Indicators (WGI)
<i>Political Stability</i>	A yearly estimate of citizens perception of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including politically motivated violence and terrorism.	World Bank World-wide Governance Indicators (WGI)
<i>Government Effectiveness</i>	A yearly estimate 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,	World Bank World-wide Governance Indicators (WGI)

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	and the credibility of the government's commitment to such policies.	
<i>Regulatory Quality</i>	Yearly estimate which captures the perception of the ability of the government to formulate and implement policies and regulations.	World Bank World-wide Governance Indicators (WGI)
<i>Rule of Law</i>	Yearly estimate which captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence.	World Bank World-wide Governance Indicators (WGI)
<i>Transfer Pricing Rules</i>	An indicator variable equal to one if there are no specific rules concerning transfer pricing in law and 0 otherwise.	The Tax Attractiveness Index
<i>CFC Rules</i>	An indicator variable equal to one if a country has not implemented controlled-foreign corporation rules and 0 otherwise.	The Tax Attractiveness Index
<i>Thin Capitalization Rules</i>	A categorical variable equals one if the deductibility of interests is not limited in the country, equals 0.5 if the deduction of interests is limited in the country, and equals 0 if thin capitalization rules are clearly defined in the country.	The Tax Attractiveness Index
<i>R&amp;D Tax Incentives</i>	A categorical variable equals one if a country's R&D tax credits or deductions in relation to R&D costs are among the top 25% most attractive incentives worldwide in the year, equals 0.5 if a country offers tax incentives that are not among the 25% most attractive, R&D Tax Incentives receives, and equals 0 if no R&D Tax Incentives are offered in a country.	The Tax Attractiveness Index
<i>Anti-Avoidance Rules</i>	A categorical variable equals one if a country has no anti-avoidance rules, equals 0.5 if a country has a general anti-avoidance rule in the national tax law, and equals 0 if a general rule plus special anti-abuse clauses are applied in a country.	The Tax Attractiveness Index
<i>FTE Tax Audit</i>	Number of full-time employees in audit, investigation, and other verification.	ISORA
<i>Risk Profiling Experts</i>	An indicator variable equals one if tax administrations employ data scientists, behavioral researcher scientists, and computer systems analysts, and equals 0 if the tax administrations do not employ any of these three experts.	ISORA
<i>Cost of Collection</i>	The ratio of the cost of administering the tax system to the total revenues collected by the tax administration. It is expressed as a percentage or as the cost of collecting 100 currency units of tax revenue.	USAID's Collecting Taxes Database (CTD)
<i>Tax Effort</i>	Yearly estimate compares the actual value of tax as a percent of GDP to tax capacity (predicted value of tax as a percent of GDP considering macroeconomic, demographic, and institutional characteristics of a country).	USAID's Collecting Taxes Database (CTD)

**Appendix 5. Sample selection**

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**Panel A: Country level**

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<b>Step</b>	<b>Description</b>	<b>No. of Observation</b>
1	Countries with OECD data	58
2	Less country observations without sufficient data for variables	54

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**Panel B: Firm level**

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<b>Step</b>	<b>Description</b>	<b>No. of Observation</b>
1	Compustat 2014-2017	174,293
2	Merge with country level data	147,792
3	Less duplicate observations	140,982
3	Less firm observations without positive pre-tax income	106,329
4	Less firm observations without sufficient data for variables	46,908

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Notes: This table describes the sample selection. Panel A presents the sample selection at the country level over the period from 2014 to 2017. Panel B presents the sample selection at the firm level.

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