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ABOUT THE JOURNAL

The Journal of Tax Administration (JOTA) is a peer-reviewed, open access journal concerned with all aspects of tax administration. Initiated in 2014, it is a joint venture between the University of Exeter and the Chartered Institute of Taxation (CIOT).

JOTA provides an interdisciplinary forum for research on all aspects of tax administration. Research in this area is currently widely dispersed across a range of outlets, making it difficult to keep abreast of. Tax administration can also be approached from a variety of perspectives including, but not limited to, accounting, economics, psychology, sociology, and law. JOTA seeks to bring together these disparate perspectives within a single source to engender more nuanced debate about this significant aspect of socio-economic relations. Submissions are welcome from both researchers and practitioners on tax compliance, tax authority organisation and functioning, comparative tax administration and global developments.

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MESSAGE FROM THE CHARTERED INSITUTE OF TAXATION

The Chartered Institute of Taxation is an education charity with a remit to advance public education in, and the promotion of, the study of the administration and practice of taxation. Although we are best known for the professional examinations for our members, we have also supported the academic study of taxation for many years and are pleased to widen that support with our involvement with this journal.

WEBSITE

The Journal of Tax Administration website can be found here: www.jota.website

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EDITORIAL NOTE

This issue of JOTA presents a collection of research articles and practitioners' commentaries. There is also a new section featuring the research at the Chartered Institute of Taxation (CIOT).

The first two articles focus on the effect of **new methodologies** on the tax profession. The article by Patrick Buckley, Elaine Doyle, Brendan McCarthy, and Ruth Gilligan investigates how technological advances in applications of artificial intelligence (AI) can change the work of tax practitioners. The authors argue that the analysis should be based on the tasks and the career stage, rather than on the occupation, because of the uneven effect of AI automation on various roles. This important point applies to many other occupations; using the approach proposed in the paper can lead to unexpected insights in the current debate around the effect of AI on the labour market. The article by Agung Darono and Aldi Pratama looks at the implications of using Big Data analytics in tax audits in Indonesia. This case study illustrates how tax authorities can utilise the benefits of the novel tools alongside the traditional use of data to improve the efficiency of risk-based audits and the transparency of the work of tax auditors.

Cyril Chimilila and Vincent Leyaro analyse the capabilities and revenue extraction efficiency of tax administrations in 42 countries in Sub-Saharan Africa. They identify relative contributions of various factors (such as the level and allocation of resourcing, the utilisation of advanced technologies, internal organisation and the macroeconomic environment) to tax administration efficiency using the panel stochastic frontier estimation technique.

Stephanie Walton explores how the use of subsidiary tax havens by U.S. firms affects tax accrual quality. The positive effect established in this study suggests that the managers of the U.S. domiciled firms with foreign subsidiaries are compelled to provide more precise tax accrual information when the subsidiary jurisdiction has less tax transparency. Thus, tax accrual quality serves as a signal to the firm's external stakeholders about the level of its discretion over the operations of its foreign subsidiary.

The article by Marlon Manya Orellana and Miryam González-Rabanal investigates the handling of the double taxation of dividends by the convention between Ecuador and Spain, with the focus on economic double taxation, rather than the conceptually different legal double taxation. The authors analyse how the incidence of international economic double taxation influences firms' decisions about location, level of debt, and the management of dividends, and how it affects the dynamics of foreign investment.

The paper by Robert Warren, Timothy Fogarty, and Philip Cola analyses the implications of using special agents from the U.S. Internal Revenue Service (IRS) Criminal Investigation Division to uncover tax evasion. There is evidence that the majority of suspected tax evasion cases investigated by special agents belong to other categories of crime, such as money laundering or identity theft. Using a unique survey of former and current special agents, the authors offer an explanation of the deviation of the results of their work from their mission.

The article by Wei Zhang presents an analysis of the legal framework for determining the value-added tax to be applied to a barter transaction in the absence of its market price, as could be the case with a one-off, unusual service. The author proposes a new article for inclusion in European Union legislation that would resolve this issue.

In the **Commentaries** section, we present contributions by practitioners based on their experience with tax administration in specific jurisdictions, as well as general observations and practical recommendations for tax administrators.

Mohammed Abdullahi Umar from the United Arab Emirates University joins Rabiu Olowo from the Lagos State Ministry of Finance in Nigeria to provide a commentary that outlines the categories of risks facing tax administrations in less developed countries. This contribution lists practical suggestions as to how these different categories of risks can be assessed and managed in a systematic way in order to improve tax compliance.

Hank Williams, Deputy Commissioner-General at the Strategic Services of Tax Administration Jamaica (TAJ), contributed a commentary on the successful completion of the Revenue Administration Information System (RAiS) project. Under this project, TAJ invested in the development of a sophisticated risk model of compliance that was implemented via a customised Internet-based platform. This improved service for taxpayers, which has led to an increase in the number of electronic tax filings and an associated improvement in correct reporting and payments.

The **CIOT** section includes an article describing the research presented at one of the recent ADIT seminars, a summary of the CIOT's collective response to the U.K. government's call for evidence on the umbrella company market, and a review of a book by a CIOT Fellow.

The article by Ann Barnshaw Kengaaju and Lakshmi (Celina) Solayen discussed the automatic exchange of information, a mechanism prescribing the exchange of taxpayer information between tax authorities around the world at regular intervals. While greater transparency helps to curb tax evasion, there are concerns about taxpayers' right to privacy. The authors offer some recommendations for balancing the two objectives.

In the United Kingdom, H.M. Treasury published its call for evidence on the umbrella company market on 30 November, 2021. Its aim was to obtain informed views on the role of umbrella companies in the labour market and their interaction with the tax system and employment rights. Gareth Myles has adapted the full text of the CIOT's response to the call for evidence for our readers.

A book by Chris Thorpe, *Implied trusts and beneficial ownership in modern UK tax law*, published by Spiramus Press, was reviewed by Paul Gilmour, a renowned expert in the subject. The review includes an extensive bibliography with useful links to the related academic literature and case studies.

Nigar Hashimzade and Stephen Daly
Managing Editors

ARTIFICIAL INTELLIGENCE AND THE TAX PRACTITIONER

Patrick Buckley[1]; Elaine Doyle[2]; Brendan McCarthy[3] and Ruth Gilligan[4]

Abstract

The advent of artificial intelligence (AI) and machine learning (ML) has sparked concern that many jobs are at risk of automation. This paper contributes to this debate in the context of the tax practitioner. We describe a methodological approach that redefines the appropriate loci of analysis as a combination of the level of task and the career stage rather than focussing on the tax role at a macro level. We use these revised loci to perform a meta-analysis of existing studies in order to examine the role of the tax practitioner. The change in focus of analysis reveals a number of insights which have been heretofore obscured.

Keywords: Artificial Intelligence, The Future of Tax, Tax Professionals and Emerging Technology.

1. INTRODUCTION

A significant trend in the evolution of Information Technology (IT) over the last two decades has been the increasing importance of technologies that enable the collection and analysis of large volumes of data. In parallel with the digitization of existing data sources, the introduction of new platforms, such as mobile phones and the Internet of Things (IoT), have led to an exponential increase in the volume of, and velocity at which, data that can be collected by information systems. A range of supporting techniques, usually referred to as "big data" enables the storage and analysis of these vast data streams. The development of a host of mathematical and algorithmic tools, some novel and some recently enabled by technical progress, has led some commentators to believe that Artificial Intelligence (AI) is beginning to reach the capabilities conceived of by its early proponents.

Against this background, a recent stream of academic research has emerged which seeks to predict the impact that information systems powered by these interrelated and rapidly developing technologies will have on the labor market (Brynjolfsson & McAfee, 2011). As evidenced by the historical origins of the word "Luddite", concerns about automation and "jobless futures" are not new. Current concerns about "computerization" and the potential threat to occupations from current and near future technological advances were raised by Frey and Osborne (2017), who suggested that 47% of all jobs in the United States were at risk of automation by 2030. This research sparked a debate about the likely impact of technological development on the future of the job market.

Many of the studies in this area forecast that tax work is highly susceptible to being automated. For example, the two categories in Frey and Osborne's (2017) study which specifically mention

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tax—"tax examiners and collectors, and revenue agents" and "tax preparers"—are assigned 93% and 99% probabilities of being computerized respectively. Many other occupations that would have similarities to tax practitioners—for example, "bookkeeping, accounting and auditing clerks"—are assigned equally high probabilities. This pattern can be observed across numerous studies with similar objectives. While we acknowledge that the role of the tax practitioner goes far beyond that carried out by tax preparers, these are nevertheless worrying statistics for the tax profession and merit academic attention.

This paper aims to contribute to this debate in a number of ways. First, answering calls in the literature for more nuanced analysis, we provide a methodology that can be used to analyze roles using a combination of the level of task and professional career stage rather than by occupation as a whole. We use a meta-analysis of existing studies to consider this in the context of the tax practitioner. This analysis reveals a number of insights that are obscured by an analysis which only operates at the occupational level. AI automation is forecast to automate many of the tasks traditionally associated with the tax practitioner. However, this automation is likely to be felt unevenly across tax roles. In particular, tasks traditionally associated with entry and low-level positions are most at risk from automation, while tasks traditionally assigned to more experienced employees are less vulnerable. From this perspective, AI automation is best conceived of as something that disrupts traditional career pathways rather than something that eliminates the tax practitioner role. Nonetheless, the likelihood of significant dislocation requires stakeholder engagement from across the tax profession in order to develop new models that can adapt to the changing environment.

The remainder of this paper is structured as follows. The study begins by reviewing the extant literature on the impact of technology on employment and the evolution of AI before reviewing current forecasts as to the impact of AI on the job market. We then examine the work carried out by tax practitioners and how this may be impacted by technological advances. This inquiry generates a number of open research questions which inform the analysis. In the methodology section, we describe a research design that aims to address some of the weaknesses inherent in existing studies. Moving on, the results section provides a case study that demonstrates our approach in operation in the context of the role of the tax practitioner. The paper concludes by presenting a number of findings and providing some suggestions for further research.

2. LITERATURE REVIEW

The General Impact of Artificial Intelligence

The evolution and future development of AI

The development of machines that can mimic or surpass human intelligence has been anticipated since before the invention of digital computers. For example, Isaac Asimov's formulation of the "Three Laws of Robotics" first appeared in print in 1942 (Asimov, 1950). The academic origin of AI is usually traced back to the Dartmouth Summer Research Project on Artificial Intelligence conference organized in 1956 by John McCarthy (Nilsson, 2009). Anticipation of progress in the field has continually seesawed. Periods of euphoric overexpectations—e.g., predictions in 1965 that computers would be able to undertake any work that a man was capable of (Crevier, 1993) —have been followed by periods of pessimistic retrenchment (Nilsson, 2009).

There is currently sustained interest in, and optimism about, AI research. One notable feature of today's AI is that programmers have developed algorithms that can self-enhance, becoming smarter as well as more efficient and effective (Alm et al., 2020). New techniques, such as genetic algorithms, have been developed while techniques with a longer pedigree, such as neural networks, have been reinvigorated by the use of innovative approaches such as deep learning. These advances have been allied with increasingly powerful hardware and data sets of a scale unimaginable even a few years ago. Taken together, these have allowed for advances in the development of AI-powered systems, such as voice assistants and self-driving cars (Badue et al., 2020; Hoy, 2018). While less eye-catching, AI has arguably had an even more significant impact in areas such as finance, medical decision support systems, recommender systems, face recognition, and machine translation (Marr & Ward, 2019). *The Economist*, a pillar of the establishment, proclaimed data to be the new oil and AI to be the dominant technology of the future (Parkins, 2017).

Despite this interest and general optimism, there is still a vast degree of uncertainty about the future development and impact of AI and its developmental trajectory (Autor et al., 2020). Many experts believe that there are no fundamental barriers to the development of artificial general intelligence (AGI) (Bostrom, 2016). Some of these analysts predict a "Cambrian explosion" of intelligence, where AI systems are leveraged to build more advanced AI systems which will, in turn, be tasked with developing even more advanced AI (Muehlhauser & Salamon, 2012). Forecasts of this nature often see an AI system with a level of intelligence comparable to that possessed by humans as being a temporary milestone along the road to systems that leverage the efficiencies associated with IT to quickly and dramatically exceed an individual human's intellectual capacity (Bostrom, 2016). Other experts are more cautious (Autor et al., 2020). While acknowledging the progress to date and the empirical evidence that evolution has already produced at least one species with human-level intelligence, they believe that the path to AI may be far more difficult than its cheerleaders suppose (Penrose, 2002). Some believe that intelligence is fundamentally non-algorithmic in nature. From this perspective, deterministic Turing machines will never be able to replicate intelligence (Penrose, 2002). Another, more philosophical, issue is whether the notion of conceiving intelligence as an attribute associated with a singular entity is fundamentally flawed (Clark, 2005). Instead, both consciousness and intelligence may be properties embedded in a larger cultural feedback loop. From this perspective, intelligence in any meaningful sense cannot be engineered in the absence of a social context (Dennett, 2017).

Despite the universally acknowledged difficulty of making predictions in such a space, some have attempted to make forecasts as to the likely date of specific achievements being reached in the development of AI. A commonly selected milestone for such forecasts is that of an AI system that demonstrates human-level general intelligence (Baum et al., 2011). Presenting an aggregated summary of several surveys of AI expert communities, Bostrom (2016) provides the following median estimates: a 10% probability of AGI by 2022, a 50% probability by 2040, and a 90% probability by 2075.

Uncertainty also dominates prognostications about the impact of AI on society. Broadly speaking, two futures are envisaged. The first forecasts the impact of AI to be positive (Kurzweil, 2005). Cognitively superior AI will supercharge the development of technologies such as genetic engineering and nano-technology that will extend and enhance human life. These technologies will help to develop solutions to challenges such as resource depletion and climate change. Economically, AI systems and robots will perform the physical and cognitive tasks required to produce goods and services. This will free humans from the necessity of

offering labor in order to acquire the necessities of life. In a nutshell, the development of AI labor may mean that individuals need not work at all. Instead, they will have far more choice in how they spend their time, be that in consuming entertainment, or participating in creative endeavors or more traditional, economically focussed activities.

Pessimists proffer a far wider range of potential futures where the development of AI has negative impacts. Many of these dystopias arise from what Bostrom (2016) calls the principal-agent problem. Briefly, the suggestion is that an inferior intelligence will be unable to control either the capabilities or motivations of a superior one (Bostrom, 2016). In the same way that, for example, a dog or cat is unable to even conceive of human motivations, humans will be utterly unable to understand or control AIs that advance beyond a certain level of complexity. In this situation, some fear a future where humans become an endangered or extinct species (Joy, 2000). Others fear a more subtle but, ultimately, just as corrosive future, where human agency is diminished and eventually destroyed by the practical and philosophical superiority of AI systems (Harari, 2016).

Even in a scenario where technical limitations prevent AI from disappearing from human understanding beyond a cognitive horizon, pessimists raise serious concerns about the spread of AI (Arntz et al., 2016). On the face of it, predictions that AI systems and robots will perform the majority or all of the labor required to meet human needs seem benign. However, even such an eventuality raises numerous questions. The decline in the use of skills such as navigation and map reading due to satellite navigation is taken as evidence that systems that start as question-answering "oracles" have a tendency to evolve into authoritative "sovereigns", which can lead to learned helplessness in their would-be masters (Bostrom, 2016). In an economy where production is managed by AI systems, social and economic power will reside with those who control the AI systems (Autor et al., 2020). If current trends continue, that would suggest that societal power will become vested in a small group of elite actors, while the majority of humanity has little or no real agency (Harari, 2016).

The impact of technology on employment

Concern about technology replacing human labor and the consequent impact on the economy and society has a long history. Nearly two centuries ago, Ricardo (1821) theorized that technology causes unemployment when equilibrium wages fall below the level needed for subsistence and results in workers not taking the relevant jobs. In the 1930s, Keynes (1936/2010) forecast that new technologies would lead to decreasing demand for human labor. Leontief (1983) wrote that the role of humans as the most important factor of production is bound to diminish in the same way that the role of horses in agricultural production was initially diminished and then eliminated by the introduction of tractors. Such prognostications often carry the weight of their proponent's emotional propensity. Some predict a world where individuals can engage their artistic and creative faculties unfettered by the need to work to meet their physical needs (Kurzweil, 2005). Others forecast a dystopia where the majority of humanity submit to dependent bondage to the state or to corporate entities (Bostrom, 2016; Harari, 2016).

It is clear from history that the evolution of technology has had a significant impact on the situation (e.g., the move from rural to urban living), organization (e.g., focus on the individual/family moving to the guilds and further to the corporations), and type (e.g., agriculture to manufacturing to services) of labor market (Leontief, 1983). Furthermore, the observation that technological advancement can make occupations obsolete fails to take

account of the larger context in which such advances occur. As economists have long understood, an invention that replaces workers with machines will have repercussions beyond the immediate market (Autor et al., 2020). Put briefly, technological progress has two effects on the job market (Aghion & Howitt, 1994). As technology substitutes for labor, there is a destructive effect. Workers are displaced by new machines and technologies. However, the process of introducing these new technologies leads to increased opportunities and higher productivity in other sectors of the economy. This leads to the capitalization effect, where companies enter industries where productivity is relatively high, leading to an expansion of employment in those industries (Aghion & Howitt, 1994). The overall effect leads to a change in the structure of the jobs market rather than a simple reduction in work available (Autor et al., 2020). As long as human labor retains the ability to adapt to changing conditions by acquiring new skills by means of education, the overall impact of technological change on the job market should be positive (Autor et al., 2020; Goldin & Katz, 1998).

AI and the future of employment

The uncertainty and variance that characterizes long-term, macro-level predictions about AI is mirrored in temporally local forecasts. One area that has been the subject of significant interest in recent times is the impact of AI systems on employment patterns and the structure of the labor market. Technological change has always impacted on the labor market. As described previously, the general consensus is that technological change tends to alter the structure and allocation of work within the labor market without necessarily changing the overall amount of work available (Autor et al., 2020).

This general consensus has been disturbed by the increasing ubiquity of IT and the rise of AI. In brief, the suggestion is that the human monopoly on tasks requiring significant cognitive processing is being broken (Loebbecke & Picot, 2015). Rifkin (1995) suggests that a new epoch in global economic activity, where fewer and fewer workers are needed to produce goods and services for the global population, is emerging. In a similar vein, Ford (2009) suggests that, as companies continue to automate their manufacturing processes, labor will comprise an ever smaller component of companies' cost structures. Other researchers analyze empirical data and point to significant losses of middle class jobs, and the digitization and automation of routine cognitive tasks, as harbingers of more significant dislocations (Autor & Dorn, 2013; Autor et al., 2020; Levy & Murnane, 2013). Some see no end to this trend. For example, Kurzeil (2005) suggests that AI systems will match and then quickly surpass human cognitive abilities in a relatively short period of time, rendering human workers obsolete in all economic activities. Others predict that computers will perform all tasks "for which logical rules or a statistical model lay out a path to a solution, including complicated tasks that have been simplified by imposing structure" (Levy & Murnane, 2013, p. 30).

A small but growing number of academic studies are attempting to quantify these risks. Current research aimed at evaluating the impact of AI automation on occupations was initiated by Frey and Osborne (2017). Their research suggested that 47% of all jobs in the United States may be at risk of automation by 2030. Since then, a number of other studies of the same phenomenon have arrived at different, although not necessarily contradictory, conclusions.

Any forecasts about the future are necessarily imprecise and uncertain. However, both theoretical and empirical evidence suggests that a significant dislocation of the labor market is occurring. Given that this dislocation is happening simultaneously with other trends, such as aging populations, rising protectionism, and climate change, there is an urgent need for

research into this phenomenon to both inform and guide policymakers when they are making decisions. The COVID-19 pandemic has significantly exacerbated this situation, with all sectors of society turning to technology to facilitate working from home, communicating remotely with work colleagues, team members and clients, moving from physical to online delivery of goods and services, and so on.

Broadly speaking, the emerging consensus from the latest research is that AI will have a significant destructive effect on at least some occupations (Arntz et al., 2016; Frey & Osborne, 2017; Rifkin, 1995). However, there are still extremely significant lacunas in our knowledge, which stymie any proper planning aimed at managing these changes. In particular, while the general trend of predictions is clear, there is significant variance across the forecasts generated by different approaches. A second gap is that, while it is clear that occupations will change, it is less clear what form the change will take and whether particular occupations will be eliminated or merely altered. Several authors suggest that the shortcomings are caused by using occupations (at the macro level) as the loci of study (Frey & Osborne, 2017; Goos et al., 2009). A potentially more revealing analytical lens would be the tasks that occupations are composed of.

The Tax Profession

Deconstructing professions

There are a wide variety of perspectives on how to best to study, analyze, and categorize the diversity of professions extant in the modern world. Anteby et al. (2016) offer a three-part framework for conceptualizing professions, which suggests that professions can be understood through three lenses of "becoming", "doing" and "relating". These lenses are analytical tools that home in on different aspects of the professional experience. The "becoming" lens is concerned with professions as journeys of socialization, whereby communities induct members and maintain shared cultural values, norms, and worldviews (Van Maanen & Schein, 1979). The "relating" lens focusses attention on a profession's relationships, and how professions collaborate with other groups to perform interdependent work or compete to expand their social and economic influence.

For this study, the most appropriate perspective is provided by the third lens, which is referred to as the "doing" lens. A profession is often understood, at least partially, in terms of the work activities that its members undertake, or, as Abbott (2005) calls it, the "task area" of the profession (p. 322). In addition to providing a definitional structure, Abbott (2005) highlights competition for control and oversight of tasks as factors that can help us to understand professions and identify jurisdictional claims and boundaries between professions. The division of tasks within and between professions has significant consequences for a profession's relative standing and the growth or decline of its social and economic influence.

If a profession is defined, at least in part, in terms of the tasks that its members perform, this raises several important questions. First, how does the set of tasks perceived as being within the scope of competency of a profession change over time? Second, how does jurisdiction over tasks change over time between professions and how does that change the relationship between professions? The evolution of task competency is also important in that it can prompt the development of new occupations through mechanisms such as the hiving off of perceived menial tasks, the formation of proto-professions due to technological change, or the

mobilization of non-professional actors to legitimize existing "non-work" activities (Hodson & Sullivan, 2012).

As the set of tasks that a profession claims jurisdiction over changes, the profession itself will evolve. For example, as IT replaces the in-person performance of many of the tasks traditionally associated with librarians, Nelson and Irwin (2014) describe how librarians redefined their profession from being "masters of search" to "masters of interpretation" to "connectors of people and information". This evolution in response to change in the wider ecological context is neither unexpected nor necessarily negative. It is, nonetheless, a phenomenon that individual professions must attend to in a constantly changing world.

The role of the tax practitioner

At a basic level, the role of the tax practitioner is to assist taxpayers to comply with tax legislation while also providing them with advice about how to structure transactions in order to optimize (usually to minimize) their tax liabilities (Hahn & Ormeño Pérez, 2020; Sorola et al., 2020). Tax advice is routinely dispensed by a broad range of business professionals, including accountants, auditors, lawyers, barristers, payroll agents, former and current members of the relevant government revenue authority, tax experts working within industry, and those officially designated as tax consultants as result of their membership of tax-dedicated professional bodies (Doyle et al., 2009; Hahn & Ormeño Pérez, 2020). The term "tax practitioner" attempts to cover this diverse range of individuals. Some work as sole practitioners or in accounting, legal, or tax specialist partnerships, and will undertake various kinds of tax work. Tax experts working in industry are more typically employees of a company or a group of companies and will identify with, and serve only, that company's interests as heads or members of an in-house/internal tax department. While there is a lack of consensus in the literature as to the precise definition of a tax practitioner, a study conducted by the Organisation for Economic Co-operation and Development (OECD) in 2008 describes the tax practitioner as the actor that sits between taxpayers and tax authorities in the tripartite relationship that exists within the tax field (OECD, 2008). This conceptualization distinguishes tax practitioners from tax authority employees (or revenue practitioners). For the purposes of this paper, we include the entire spectrum of actors acting as intermediaries between revenue authorities and taxpayers but exclude revenue practitioners (those working in tax administration) from our definition of tax practitioner.

On a basic level, tax practitioners working in practice typically provide two distinct services to their clients or employing organization (see, for example, Doyle et al., 2014; Frecknall-Hughes & Kirchler, 2015; Hahn & Ormeño Pérez, 2020). The first type of service comprises the provision of assistance to complete tax returns and to comply with the other administrative requirements of relevant revenue authorities, and assistance with the calculation of tax liabilities and meeting payment deadlines. These are generally called tax compliance services. The second category is the provision of what are habitually referred to as tax planning services, which are often intended to mitigate the client or employing organization's tax liabilities. Accounting practices of all sizes generally have dedicated tax departments that handle tax compliance and tax planning services for their clients. Tax experts working in industry also engage in tax compliance and tax planning work, but they will identify with, and serve only, their employing company's interests, as their employer is their only client (Frecknall-Hughes & Kirchler, 2015; Frecknall-Hughes et al., 2017). In order to work effectively as a tax practitioner, strong technical skills—including a thorough understanding of technical tax

issues, tax legislation and case law—and the ability to both research source material and perform complex tax computations, are required (PricewaterhouseCoopers [PwC], 2017c).

Tax administration and technology

The increasing use of digital technologies in the tax field is being driven not only by the technological advances outlined above but by the pace of regulatory change and the digitalization of tax authorities. Often driven by budget deficits, cuts in staff numbers, and the inefficiencies of existing tax collection methodologies, many tax administrations have invested heavily in data integration and analytics in order to gain a more accurate view of business and personal transactions (Barton, 2020). Tax authorities worldwide are relying more and more on digital methods to collect and analyze taxpayer data, transforming how they collect tax (Alm et al., 2020; Barton, 2020; Dobell, 2017; Nibbe, 2020). In turn, they are requiring taxpayers to provide huge amounts of information and to perform real-time digital filing, which they are using to facilitate real-time or near real-time tax collection and audit selection (EY Global, 2020a; Nibbe, 2020). Using various statistical and data mining technologies to identify outliers, and unusual relationships and patterns, tax authorities can identify a wide range of non-compliant behaviors in a proactive, targeted, and cost-effective manner (Alm et al., 2020; Dobell, 2017). Tax authorities are also sharing information about specific taxpayers and tax structures with their counterparts worldwide more frequently. This sharing has been made feasible now that data is increasingly digitalized.

Some examples of specific technological innovations being considered by, or being used by, revenue authorities include: the use of blockchain in the area of e-voting in order to encourage the public to participate in the process of agenda setting (Myeong & Jung, 2019); prepopulating tax returns with third-party data (Alm et al., 2020); the use of chatbots to develop new digital channels of communication between the public and the government in Greece (Androutsopoulou et al., 2019); the adoption of advanced IT which works as a substitute for human resources by the tax bureau in China (Li et al., 2020); and the use of digital technologies to facilitate co-production between the government and the public in China (Huang & Yu, 2019). This evolution in how tax authorities are operating has meant that tax practitioners must keep pace with these technological developments in order to continue to meet their clients' needs in this changing environment. As a result of the increasing digitalization of revenue authorities and more general advances in technology, the nature of day-to-day tax work is beginning to change. Some examples of how tax practitioners are leveraging technology are outlined below.

Technology and tax practice

IT is enabling the use of accurate, detailed data from a wider range of sources to drive more in-depth analysis that would previously have been difficult, time-consuming, or even impossible to accomplish (PwC, 2019). The automation of source data pulls—using Extract, Transform and Load (ETL) solutions—can help to streamline the requirements of new complex calculations and the need to supply more granular data in order to respond to tax authorities' increasing demands for transparency (PwC, 2017b, 2019). Visualization tools are being used to enhance the quality and dynamic display of data for dashboard and presentation purposes (PwC, 2019). AI can also automate structured or unstructured tasks, mimicking the actions of humans but with greater speed and accuracy, thereby improving efficiency and effectiveness (EY Global, 2020b; PwC, 2019). AI can work 24 hours a day, seven days a week. The EY 2020 Global Tax Technology and Transformation Survey found that a typical tax team spends 40%

to 70% of its time gathering and manipulating data, when this can be done in a fraction of the time by AI (EY Global, 2020b).

Data analytics and modeling solutions are also being used to assist with tax planning work. This involves feeding a range of data inputs, including legislation, case law, company data, and corporate strategy, into an AI model so that it can quickly assess the impact of legislative changes on an organization and proactively make tax recommendations (Dobell, 2017; EY Global, 2020b; PwC, 2017b). These transformative capabilities apply throughout the tax lifecycle, from planning to compliance reporting and controversy (PwC, 2019).

Research contribution

This study aims to make a number of contributions. First, we provide a methodological approach that can be used to refocus existing empirical data in order to explore the issue of automation at the level of the task combined with career progression. Drawing on theory from the literature exploring the sociology of work, we use Hodson and Sullivan's (2012) concept of a "doing" lens in order to analyze a profession as the specific tasks that are performed by practitioners—a potentially more revealing analytical frame. To demonstrate the utility of this approach, we provide an analytical case study which applies our methodology to a specific case study, namely the role of the tax practitioner. The case study serves to validate our methodology. It also provides several suggestive insights about the effect of AI on the tax practitioner labor market which will be of interest to practitioners, policymakers, and researchers if they are established as being generalizable by broader studies.

3. METHODOLOGY

We examine the impact of AI on the role of the tax practitioner using a two-stage process. The stages can be broadly described as the task analysis phase and the digitization susceptibility phase. The purpose of the first phase was to provide a more nuanced understanding of a particular role by dividing it up into specific tasks. The idea is that, at this more granulated level of resolution, it will be possible to make more accurate estimates as to the likelihood of a particular activity being automated. To give a simple example, call routing is a traditional task associated with a receptionist. This specific task is clearly an activity that can be, and is, routinely automated. However, a receptionist may have numerous other tasks, such as meeting and greeting guests. The susceptibility of a particular occupation to digitization is best considered in terms of the tasks that make up the broader role.

Traditionally, the role of tax practitioner is seen as being a steady, secure, white collar job. However, Frey and Osborne (2017) estimate the role of tax preparer (typically carrying out tax compliance work, which is one of two categories of work done by a tax practitioner) to be one of the most susceptible to automation, assigning it a probability of 99%. One of the leading firms in the industry, PwC, issued a report that assessed the likelihood of people using AI systems rather than humans for tax preparation to be 54% (PwC, 2017a). The combination of the traditional security, prestige, and salary associated with the role, allied to its perceived susceptibility to automation, means that it is an ideal context for consideration in this study.

Task Analysis Phase

The purpose of the task analysis phase of the research is to identify specific tasks associated with a role. In order to achieve coverage, an approach using triangulation between three qualitative research methods was used. The first research method employed was a traditional review of the academic literature in order to identify task-based descriptions of the role of tax practitioner. The second method used was an analysis of websites identifying job vacancies for tax practitioners. These advertisements usually contain detailed descriptions of the roles involved, broken down into specific tasks, and so were valuable sources of data for this study. The third data source used was a number of semi-structured interviews with tax practitioners at different stages of their careers who were asked to identify the tasks they perform on a daily basis. An aggregated master list of tasks, in which some tasks were combined where appropriate, was created using the information obtained from these sources. While the approach was applied to the role of tax practitioner in this study, these data sources are freely available for most occupations, making it generalizable.

Automation Susceptibility Phase

After identifying the component tasks of the role, the next stage was to develop a probability estimate of the likelihood of that particular task being automated in the near future. As mentioned previously, there is considerable debate in the literature about the validity of the estimation approach used by virtually every study. In order to sidestep this debate, the approach taken in this case study was to average estimates from a range of studies. In order to maintain comparability, a number of criteria were used to select studies. First, the studies had to originate from a reputable source, defined as a peer-reviewed journal, a recognized national or international body, or a recognized corporate actor. Only macro-level analyses which set out to provide estimates across the entire labor market were included. Studies which focused on specific industries or professions were excluded. For comparability of analysis, only studies which generated probability estimates were included. A web and database search was conducted in order to identify a corpus of relevant studies, which were then pruned using the criteria identified above. A brief description of the five studies retained for use in the automation susceptibility analysis is outlined in Table 1.

Using the data contained in the reports below, a probability estimate was calculated for each task that was identified as being a component of the role of tax practitioner. For each individual task, each report was interrogated in order to find the occupation or job that best matched the task being analyzed. If no suitable match could be found, no data from the relevant report was included for that task. If a number of occupations or jobs were identified, all of them were included in the analysis.

Table 1: List of Studies Used to Generate an Estimate of the Automation Susceptibility of Individual Tasks.

Frey and Osborne (2017)	This study used a Gaussian process classifier to estimate the probability of automation for 702 occupations. The Gaussian process classifier estimated the probability of automation using O*NET data, which is collected from labor market analysis in the United States and is regularly updated using surveys of each occupation as they evolve over time.
White et al. (2019)	This report, published by the Office of National Statistics in the United Kingdom, analyzes the jobs of 20 million people in England. Data from the Program for International Assessment of Adult Competencies (PIAAC) was used to determine the tasks carried out by individuals when performing their role in the workplace. The PIAAC data was then used to assign a probability to specific occupations.
Arntz et al. (2016)	The OECD conducted a study in response to Frey and Osborne's (2017) report. It focuses on the susceptibility of individual tasks being automated. The study uses the National Statistics Office's PIAAC survey of adult skills to map the task composition of specific occupations and then generates a probability estimate based on that.
Fuei (2017)	This study examines the risk of automation among jobs in Singapore. While limited to a national context, the study does analyze the entire labor market, using the International Standard Classification of Occupations (ISCO) standard. Where multiple ISCO codes are mapped to an SSOC code, they use the average of the probabilities matched to a job.
Manyika et al. (2017)	McKinsey Global Institute published this report, which analyzed where AI can replace humans. The authors use a similar methodology to that employed by Frey and Osborne (2017). However, they disaggregate jobs into tasks and integrate expert opinion with the probability estimates.

4. FINDINGS

The Task Analysis Phase

As described earlier, triangulation between three data collection methods was used to create an aggregated list of specific tasks associated with the role of tax practitioner. First, a search of the academic literature found a number of papers that identified subtasks associated with the role. Frecknall-Hughes and Kirchler (2015) and others (Doyle et al., 2014; Hahn & Ormeño Pérez, 2020; Sorola et al., 2020) suggest that a macro-level examination of the role divides it into two distinct categories: tax compliance and tax planning. Within these specific roles, a number of subtasks can be identified, such as the preparation of tax returns, the provision of advice to clients in respect of how to manage their tax affairs, and policy advocacy. Thuronyi and Vanistendael (1996) discuss the six key tasks carried out by tax practitioners: tax planning, the provision of advice ancillary to financial services, the preparation of tax returns, the preparation and audit of commercial accounts, the representation of taxpayers before tax administration, and the representation of taxpayers before the courts.

Second, online resources which identified the subtasks associated with the tax practitioner role were consulted. O*NET (www.onetonline.org) is an online database of occupational information which was created by the United States Department of Labor. The Irish Tax Institute is a professional body representing tax practitioners in the Republic of Ireland. Their website (https://taxinstitute.ie/) provides a detailed analysis of the tasks that members are expected to perform as part of their professional duties. Another class of online resources consulted was recruitment websites, such as Myplan (https://myplan.ie) and Monster (https://www.monster.com). These sites regularly advertise tax roles and often contain detailed job descriptions for them.

The third data source used was a series of semi-structured interviews with tax practitioners, during which they were probed about the tasks they perform in their current role. Three individuals were interviewed in the context of this study, all of whom worked for a multinational accountancy practice. One individual was a newly graduated trainee while the other two were more experienced individuals at director level. The list of tasks associated with the role of the tax practitioner that emerged from this phase of the research is set out in Table 2 below.

In addition to identifying the tasks associated with tax practice, we gathered data about the level of employee (in terms of hierarchy) who usually performs a particular task. In the vernacular of the profession, these are referred to as tax trainees, tax managers, and tax directors. The tasks traditionally performed by practitioners operating at each level were mapped using the data sources above.

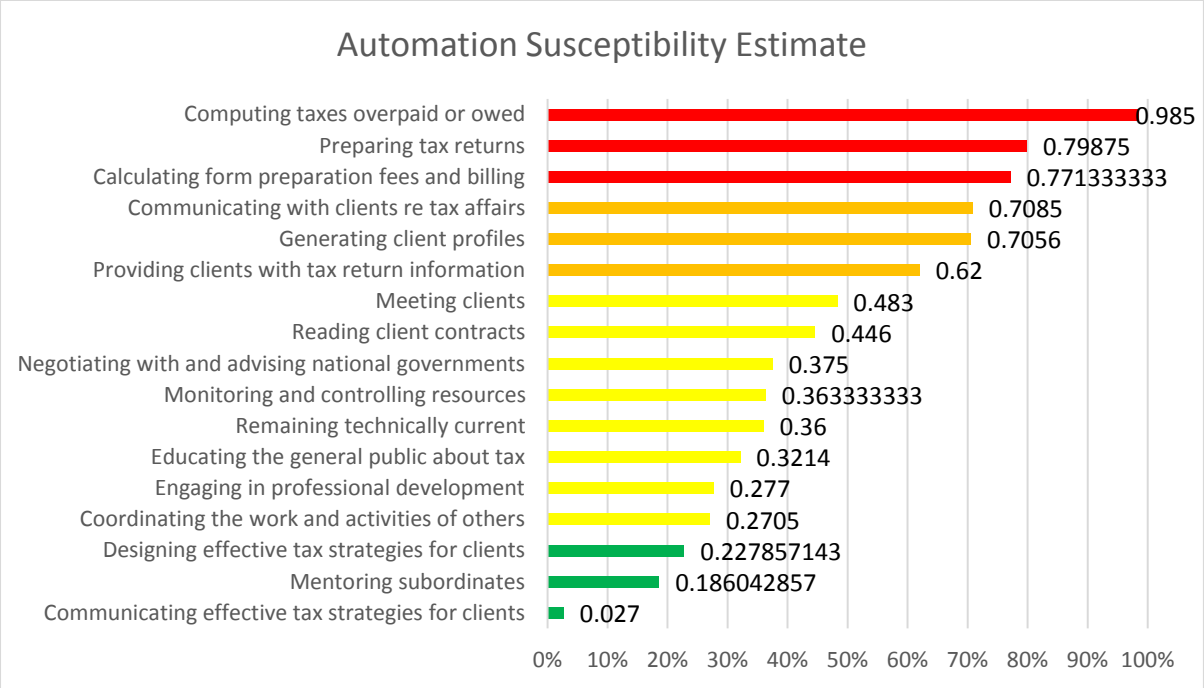
Table 2: Taxes Associated with the Role of Tax Practitioner.

Computing taxes overpaid or owed
Preparing tax returns
Calculating form preparation fees and billing
Communicating with clients re tax affairs
Generating client profiles
Providing clients with tax return information
Meeting clients
Reading client contracts
Negotiating with and advising national governments
Monitoring and controlling resources
Remaining technically current
Educating the general public about tax
Engaging in professional development
Coordinating the work and activities of others
Designing effective tax strategies for clients
Mentoring subordinates
Communicating effective tax strategies for clients

Automation Susceptibility Phase

Figure 1 displays a bar chart that summarizes the results of this analysis.

Figure 1: Task Automation Susceptibility Estimates for Tax Practitioners



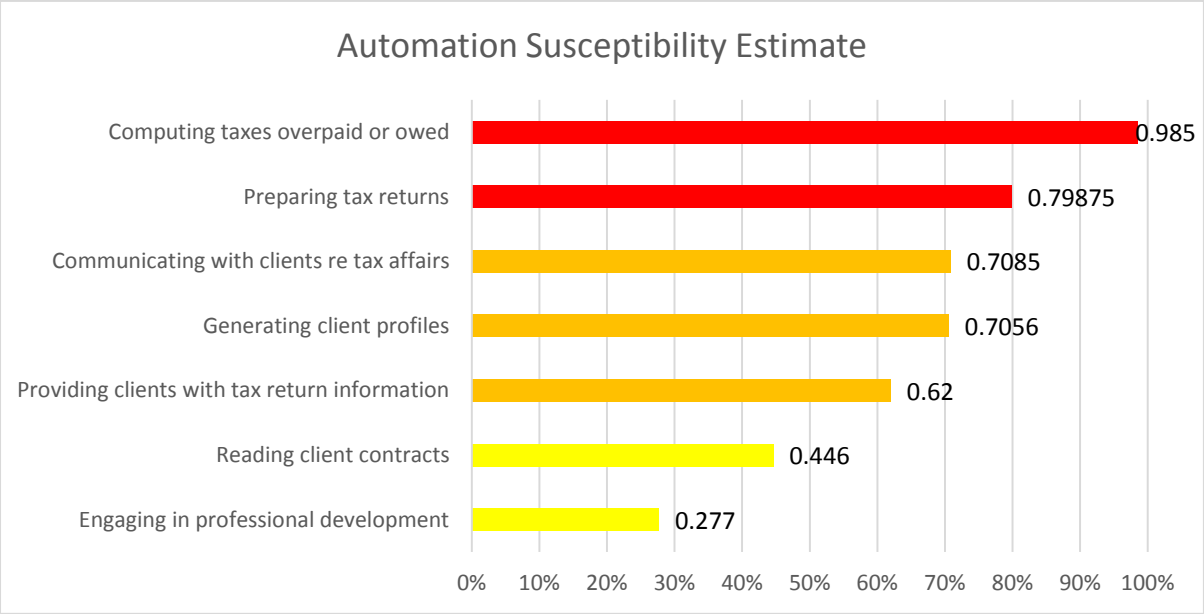
As might be expected, computing tax liabilities, preparing tax returns, and preparing fee notes for clients were the top three tasks most likely to the automated, with probabilities of 99%, 80%, and 77% respectively. The tasks that appear at the bottom end of Table 1 are designing

effective tax strategies, communicating these effectively to clients, and managing staff, all of which involve less quantitative skill. Interestingly, of the 17 tax practitioner tasks examined, only six are estimated to have a susceptibility to automation of more than 50% and these mainly fall into the tax compliance category of tax practitioner work. Once the work involves reading contracts, educating clients and others, managing teams, and tax planning, there is a much lower likelihood of automation.

In the task analysis phase, as well as gathering data about the tasks considered part of the role of tax practitioner, we gathered data about the level of employee who usually performs a particular task. Figures 2, 3, and 4 illustrate tasks associated with tax trainees, tax managers, and tax directors respectively.

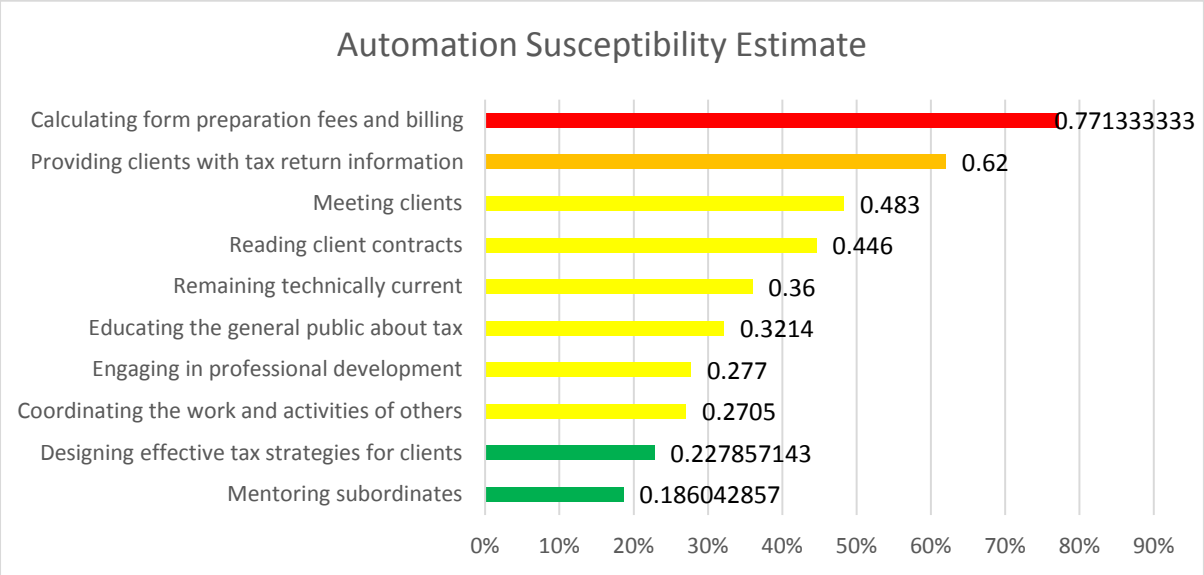
Once we begin to break down the tasks according to the level of seniority of the tax practitioner, we really begin to get a better picture of what the future tax practice role might look like. The tax compliance type tasks most likely to be automated are typically the ones carried out by tax trainees during their initial training years. Indeed, of the seven tasks usually carried out by tax trainees, five have a greater than 62% likelihood of automation, with the others being reading contracts (45% chance of automation) and engaging in professional development (just 28% likelihood of automation).

Figure 2: Task Automation Susceptibility Estimates for Tax Trainees



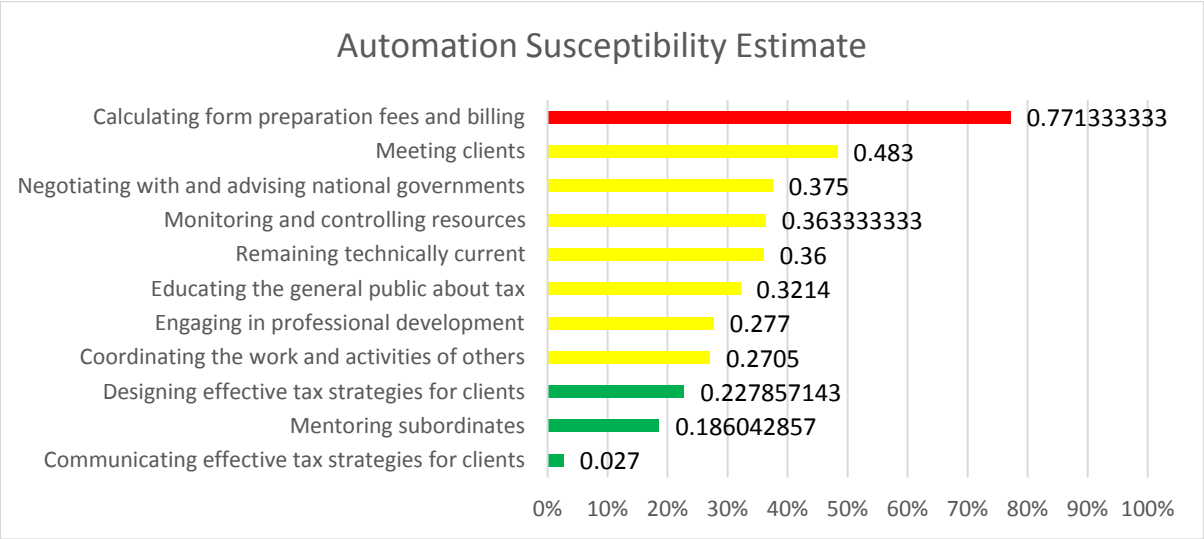
Turning to tax managers, we begin to see the aspects of the role that are less likely to be automated becoming more important. While tax managers are still involved in tax compliance work, the tasks of keeping up to date with tax developments, coordinating the work of others, and designing effective tax strategies are more important at this career stage, all of which are much less susceptible to automation. Only two of the ten tasks associated with this level of tax practitioner have a greater than 50% likelihood of becoming automated.

Figure 3: Task Automation Susceptibility Estimates for Tax Managers



At tax director level, almost all tasks are categorized as having a less than 50% susceptibility to being automated, with most having a less than 38% susceptibility. At that career stage, tax practitioners spend most of their time carrying out tax planning work for clients, managing people and resources, and engaging in tax education and policy advising work. All of these tasks are much less likely to be carried out by a machine in the future.

Figure 4: Task Automation Susceptibility Estimates for Tax Directors



5. DISCUSSION AND CONCLUSIONS

Rapid, disruptive technological change is arguably the dominant feature of modern life. Societies, countries, and economies are in a continual state of flux driven by the creative-destructive energies that are released by rapid technological innovation. In the past, technologies such as electricity, the internal combustion engine, and telecommunications have been the sources of this change. Today, many commentators suggest that AI and ML are the nascent technologies that will drive social and economic change for the next generation.

This prospect is viewed with uncertainty by all and with trepidation by many. While some suggest that AI will lead to a golden age of prosperity, many others forecast that it will have a wide range of negative impacts, ranging from the dystopian to the apocalyptic. What unites commentators is a general acceptance that our current forecasts are too uncertain to serve as reliable guides for planning and policy formulation.

One particular area of significant concern is the likely impact of AI-enabled automation on the labor market, particularly traditionally secure, high status professions associated with middle-class employment. The same uncertainty that bedevils forecasts in other AI-related spheres affects forecasts within this domain. Some suggest that there is nothing new in heaven or earth and that labor market dislocation due to technological innovation is neither particularly new nor particularly concerning. Others posit that AI systems will supplant human employees in much the same manner as the internal combustion engine did the horse (Leontief, 1983).

Our purpose in this paper is to attempt to move this debate forward in the context of tax practice work. By applying a methodological approach that uses a combination of tasks and career stage as a lens rather than macro-level occupation, we develop a much more nuanced understanding of how automation is likely to affect the role of tax practitioner as a whole. The revised level of resolution at the task and career progression level rather than at the occupational level brings several issues to the fore.

There is general acceptance in the literature that AI automation will have a significant impact on tax practice. Our case study supports this, with several of the tasks traditionally associated with tax practice seen as being highly susceptible to automation (mainly the tasks associated with tax compliance). However, our case study clearly demonstrates that blunt analysis at the level of a particular occupation hides important granularities. Our analysis forecasts that some tasks are very likely to be automated while others remain unlikely to be automated, at least for the foreseeable future. Our analysis suggests that rather than the tax practitioner role disappearing, it can be better characterized as needing to evolve.

Our analysis suggests that the effects of automation will be felt differently at different stages of a traditional pathway through the tax practice career. It is the tasks that are mostly performed and associated with early career practitioners that are seen as being most vulnerable to AI automation. This feature raises several important questions that all stakeholders associated with the profession must address.

First, how will tax practice be repopulated if traditional pathways to career advancement are dislocated? Our results do not suggest that tax practitioners will become extinct. However, it is certainly plausible that far fewer individuals will be needed at the level associated with tax trainee. If so, a key question moving forward is how tax practitioners will replenish their more senior ranks if the bottom rungs of the career progression ladder are populated by significantly fewer trainees.

Related to this is the issue of skill and knowledge development. It is generally the case in organizations that more cognitively demanding tasks are performed by more experienced individuals. The tasks most vulnerable to AI automation are often seen as being repetitive and undemanding. At first glance, the automation of such tasks may seem to be a positive development for employers and employees alike. However, this perspective takes no account of the development of knowledge and skill that is engendered by performing these tasks. For example, being able to design effective tax strategies for clients may require the kind of

practical knowledge that is only developed through years of experience of computing tax liabilities. In an extreme case, firms may face severe skills shortages a few years after engaging in significant automation. Higher order skills may atrophy and disappear because a lack of entry-level positions is rupturing the supply pipeline of employees capable of performing such tasks.

Several remedies for this potential challenge can be prescribed. Educational institutions will be expected to adopt their offerings to close the skills gap. However, this will be a challenge, particularly in respect of the development of soft, applied skills that are difficult for non-practitioners to acquire outside of a realistic professional context. A more radical possibility is that employers will allocate tasks to employees despite their relative inefficiency in order to foster the knowledge required for the development of higher order skills.

It is possible to discern other potential impacts of AI automation beyond the employee-employer relationship and the supply of labor to the economy. Entry-level positions have traditionally been gateways to well remunerated, high status roles. The relatively large number of such entry-level positions has generally served to encourage social mobility. Organizations need large numbers of employees at these levels and are content to hire numerous trainees because they do not earn high salaries. In other words, there are lots of opportunities available for those who wish to embark on a career. However, in a situation where AI automates these tasks, organizations will need far fewer entry-level employees. It is easy to imagine a situation arising where "who you know" becomes important in obtaining one of the far fewer, albeit higher status positions. Such a development would have a detrimental effect on meritocratic social mobility.

A final consideration is that this altered career path may also impact upon the desirability of pursuing a career in the tax profession. A reduction in the number of entry-level positions would mean that the career pyramid would become far narrower. Individuals would need to achieve promotion within their organization at a speed that dwarfs even today's fast pace or risk being left behind permanently. The profession may evolve towards a state where a small number of individuals (say 5%) perform high-value tasks and are remunerated accordingly, while the other 95% are relegated to performing low-value tasks that cannot be automated but are, nonetheless, poorly paid. In other words, a rational, risk-weighing decision maker (the very type of intellect the tax profession seeks to attract) may deliberately avoid a career where the chances of obtaining "good" money are very low because they require a combination of difficult skills that take time to acquire, coupled with relatively few opportunities. In the long run, the reduction of opportunities may have a significant deleterious effect on tax practice as a whole.

The use of technological innovations, such as robotics and AI, will not diminish the need for tax practitioners to have technical tax expertise. However, tax professionals will need to upskill in order to adapt to an environment where humans and machines work increasingly together, and enhance their technology and data analysis skills. Tax practitioners also need to adapt to the way in which tax authorities are digitally administering the tax system. Those who can leverage technology and data analytics in order to manipulate large volumes of data efficiently will free up valuable time for tax planning and the evaluation of key tax and finance performance indicators for their clients or employing organization. Tax practitioners will need to ensure that they are involved in cross-functional technology implementation and process management controls so that tax practitioners can optimally leverage data collected from financial reporting systems. Tax practitioners will also need to add value in other ways—for

example, by understanding the nuances of the business and interacting more closely with other organizational functions, or leveraging new insights into data that the technologies provide—in order to address their clients' (or employing organization's) wider objectives. Building relationships, influencing decisions across business functions, and communication skills will become essential competencies.

Forecasting the future is a notoriously uncertain endeavor. Prognostications regarding the impact of AI on tax practice must be treated with skepticism. This study provides a more nuanced analysis of where particular stress points may emerge in the profession. When this analysis is added to the weight of numerous other studies which forecast significant disruption within tax practice, the sum effect is to sound a clear call for significant reflection amongst all stakeholders associated with the profession as to how to future is to be met.

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TAX AUDIT IN THE ERA OF BIG DATA: THE CASE OF INDONESIA

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Abstract

This research uses an interpretive case study strategy to investigate how big data affects tax audits in Indonesia, both with regard to tax audit management and policy, and to tax auditors' individual audit assignments. The study reveals that the impact of big data on tax audit exists in two aspects. First, at audit policy level, big data is used as part of risk analysis in order to determine which taxpayers should be audited. Second, at the individual tax audit assignment level, tax auditors must utilise big data in order to acquire and analyse data from taxpayers and other related parties. Big data has the following characteristics: it involves huge volumes of information, it is generated at a high velocity, it includes a wide array of data types, and it contains high uncertainty. Big data can be analysed in order to reinforce the results gained from risk engines as a part of a compliance risk management system at the audit policy level. Meanwhile, at the individual tax audit assignment level, empirical evidence shows that tax auditors may deal with: (1) large volumes of data (hundreds of millions of records) that originated from previous fiscal years (historical records); (2) variations in the format and sources of data acquired from taxpayers which, to some extent, may be giving an auditor the authority to request data in a format that suits their analytical tools—with an inherent risk that the data can only be acquired in its native format; (3) data veracity that requires the tax auditors to review data sources because the adopted data analysis techniques are determined by the validity of data under audit. The main benefit expected to be gained from the implementation of big data analytics in respect of tax audits is the provision of valid and reliable information that evidences that taxpayers are compliant with tax laws.

Keywords: Audit Policy, Audit Test, Big Data, Data Compatibility, Data Veracity.

1. BACKGROUND AND RELATED WORKS

Tax audit is one of the main features of tax administration. It is conducted in order to determine whether taxpayers have paid their taxes in accordance with the tax laws. As with any other type of audit, such as financial, compliance, or operational audits (see, for example, Arens et al., 2017), one of the crucial stages of a tax audit is that of evidence collection. In recent times, electronic data has become the dominant type of evidence of business transactions due to the extensive implementation of information technology (IT) in the business environment. Electronic data, in this context, has also evolved into big data. The term "big data" is used to describe a huge volume of data that has a rapid growth rate and is presented in various formats that cannot be processed using traditional data processing tools (Edery, 2016; Luisi, 2014; McAfee et al., 2012; Microsoft & PricewaterhouseCoopers [PwC], 2018; Organisation for

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Economic Co-operation and Development [OECD], 2016b; Schroeck et al., 2012; Vasarhelyi et al., 2015).

In global tax administration practice, big data is one of the most critical issues being discussed, particularly as it relates to the development of the digital economy (OECD, 2015). Several studies explain how tax authorities have begun to harness its powers within their tax administration business processes. Big data plays a significant role in a number of tax administration functions, including risk analysis, tax compliance monitoring, law enforcement, dispute resolution, and upstream compliance (Chen et al., 2015; Cockfield, 2016; OECD, 2016a; Veit, 2019). Moreover, Dimitropoulou et al. (2018) propose a framework in which big data would be utilised as part of the tax dispute settlement procedure using the mutual agreement procedure scheme. On the other hand, Brink and Hansen (2018), and Volvach and Solovyev (2018), emphasise how taxpayers could use big data to identify their tax risks or develop their tax planning activities.

Consequently, the existence of big data requires tax authorities to process and analyse electronic data, and to communicate the information acquired as competent and adequate audit evidence. Indonesia's tax authority, the Direktorat Jenderal Pajak (DJP), or Directorate General of Tax, is in the same situation (DJP, 2017; Djuniardi, 2016). The most critical issue is how tax auditors in Indonesia handle big data when conducting tax audits (in term of collecting and analysing audit evidence). Under the provisions of Law 6/1983 and its amendments, which concern general provisions and tax procedures (hereinafter "KUP law"), the DJP is authorised to collect evidence (including electronic data) in order to assess taxpayers' compliance. The assessment is conducted through a tax audit, in which the tax authority tests the evidence that it has collected. The result is a tax provision that states whether the tax payments that have been made are appropriate, underpayments, or overpayments, so that adjustments can be made. In its Information Technology Blueprint, the DJP states that big data analytics is one of the pillars of information and communication technology development that support the tax administration process (DJP, 2015). Accordingly, the DJP (in its internal training material) and Djuniardi (2016, 2018) explain that the DJP gradually selected several sample cases in which to utilise big data. These cases involve the identification of transactions for tax evasion purposes using transfer pricing schemes, value-added tax (VAT) invoice fraud, and asset tracing for tax arrears collection purposes (DJP, 2022; Sakti, 2021).

Based on the explanation above, it is necessary to explore how big data affects tax audits in more depth. This paper will use the Indonesian tax administration as a case study and examine how big data influences tax audits, both at audit policy level and at individual tax audit level. Indonesia was selected because of its significant economic size when compared to other G20 countries (see, for example, The Jakarta Post Editorial Board, 2019; G20 Sherpa Indonesia, 2019) and its successful tax reforms (see, for example, Lewis, 2019). Moreover, this study will help the Indonesian tax administration's stakeholders to understand how the Indonesian tax authority deals with big data issues when conducting tax audits. This study is an interpretive case study and is expected to explain the empirical situation by interpreting the authors' experiences, knowledge, and perspectives, while utilising verification procedures adopted by relevant disciplines.

Tax authorities must determine which taxpayers should be audited, based on limited resources. Consequently, they can only conduct audits in respect of a small number of registered taxpayers. The typical approach used to select taxpayers for audit is based on non-compliance risk analysis. Therefore, the tax authority requires adequate supporting data (OECD, 2004;

Pratomo, 2018). The next crucial issue faced by the tax authority is how to prepare an audit programme, particularly in respect of the acquisition and testing of audit evidence. Many factors determine an audit programme's design. One of the essential factors is the availability of data, both from taxpayers and other related parties.

The paragraphs above describe how tax authorities in many tax jurisdictions take the initiative to utilise big data in order to support their tax administration process, including tax audits. The following questions may then arise: what is big data and how can the use of it help tax authorities to perform their function?

According to Diebold (2012), the term "big data" began to be used by scholars and IT professionals, such as himself, John Mashey, Sholom M. Weiss, Nitin Indurkhya, and Douglas Laney between 1998 and 2001. The most referenced definition of big data is Gartner's[4], which is based on Laney's (2001) notion. According to Gartner, "big data is high-volume, high-velocity and/or high-variety information assets that demand cost-effective, innovative forms of information processing that enable enhanced insight, decision making, and process automation". Some scholars have tried to provide a comprehensive definition of big data. The definition proposed by Hu et al. (2014) attempts to cover several points of view:

(1) an "attributive" definition, as first noted by Laney (2001), which is popular as "the 3Vs" ("increasing volume, velocity, and variety") (Hu et al., 2014, p. 654). Gantz & Reinsel (2011) then added "veracity" (so the definition became "the 4Vs") to show that the content of big data has various degrees of validity that require data scientists to take a different approach when testing it;
(2) a "comparative" definition (see, for example, Manyika et al., 2011), i.e. big data deals with a huge volume of data that cannot be managed by common database software;
(3) an "architectural" definition (see, for example, Chang et al., 2018): big data is an efficient processing method when traditional database approaches and tools cannot be used due to data volume and velocity.

It is essential to note that big data is not a substitute for the relational databases or data warehouses that have been used to manage organisational data so far. Instead, it expands the data types, and the storage and search procedures available (Hu et al., 2014; Manyika et al., 2011; OECD, 2015). One big data characteristic that also applies to traditional databases is the considerable volume of data stored. In this context, several parties from both the industry and academic fields have proposed a solution known as the very large database (VLDB). This solution tends to take a "scale up" approach, in which the underlying relational database is continuously developed via additional hardware capacity, especially computer memory and storage systems. On the other hand, there is also a solution that tends to take a "scale out" approach. The development of data management capabilities also considers the diversity of data formats, which is not always in the form of interrelated tabular data but sometimes in the form of document networks.

Indeed, in the IT field, the terms "volume" and "speed" become relative. Diebold (2012) states that, in the field of econometrics, any more than 200 gigabytes (GB) of data is considered to be a large data set. However, in physics, experimental data sets usually contain much larger amounts of data. For example, according to Gaillard (2017), during Higgs boson particle

[4] https://www.gartner.com/en/information-technology/glossary/big-data

research, particle collisions produce about 1 petabyte (1 petabyte = 1,000,000 GB) of data within one second. Helskyaho (2017) even claims that data is considered to be big "when traditional processing with traditional tools is not possible due to the amount or the complexity of the data" (Slide 21). Moreover, the term "big" should not only be interpreted as "large in volume", which would be relative in this circumstance because it would depend upon the computing environment being used.

In the authors' view, the use of the term big data is more about the capability of data management tools to deal with more data types or formats in much larger sizes, while maintaining processing speed and ensuring data validity. Previously, organisations stored structured data within relational databases in tabular form and only included limited data types, such as numbers, text, and dates. Big data repository tools are able to manage advanced data formats, such as spatial data, global positioning systems (GPS), clickstreams, sensor devices, log files, images, audio files, videos, and other forms of unstructured data, as well as traditional data formats (Hu et al., 2014; Podesta et al., 2014; Vasarhelyi et al., 2015).

At the same time, the speed of data growth makes data volumes even larger. The increasing variety of inputs is not limited to traditional hardware, such as keyboards, mice, and barcode readers, but also includes sensory equipment connected to the network (known as the "Internet of Things" or the IoT). A couple of years ago, data input was performed only by the end user (i.e. human action). Various types of new hardware, such as sensors, generate data, thus data size increases exponentially. Consequently, IT specialists cannot rely on the traditional relational database management system software that has been standard for organisational data management since the 1980s. More non-relational database models are now available, such as the graph model, columnar data, document, and multi-model databases (Helskyaho, 2017; Lu & Holubová, 2019).

The following is a short illustration of how a typical transaction in our daily life, realised or not, involves the extensive use of big data. Someone uses a social media platform. In their timeline, there is an offer for a coffee maker from an online store that sells products via an e-marketplace. The user presses the "like" button and visits an online store using the link provided. A few moments later, after clicking a few times to see photos of, and videos about, the coffee maker, the person decides to buy it. They use a delivery service from a ride-hailing courier provided by the e-marketplace partner. The purchaser then pays for the coffee maker using a mobile banking application that is integrated with the e-commerce platform. About five hours later, the courier delivers the coffee maker to the buyer's front door. The buyer checks their new coffee maker to make sure that it works properly, then uses their smartphone to confirm that they have received the goods. That simple transaction involves the creation of hundreds (or even thousands) of data records by each party involved.

This type of transaction can happen thousands or even tens of thousands of times in one day on just one e-commerce platform. Each transaction may create dozens or hundreds of rows of data that are stored by the various parties associated with the transaction, including e-marketplaces, banks, ride-hailing couriers and mobile phone operators. In short, that is how big data works and grows. Data proliferates in various formats, including customer profile photos, product videos, clickstreams, the buyer's GPS location, and details of the delivery route taken. Data validation also happens in many ways: payment transaction data must be precise, for example, while ride-hailing couriers may receive delivery route suggestions via their smartphones. This illustration depicts how the digital economy works. Tax authorities must also find ways by which to capture the data generated from every single part of each

transaction. By collecting the data from the transaction above, for example, tax authorities can assess how every party involved complied with the tax rules for any combination of the size, type, and validity of the data.

Hence, from the authors' perspective, big data is a collection of data that grows very fast because it is generated from many sources. It comes from known input devices (e.g., mice, keyboards, scanners, QR-code/barcode readers, electronic data capture machines, and so on) and interconnected sensory devices within communication networks. The development of the data processing technology landscape has enabled the development of what we called big data when it was first introduced a decade ago. Big data is the data that we currently generate every day; data itself is now big data. Most people have used it whether they realised it at the time or not. Today, the main challenges arising from the use of big data involve how to facilitate the convergence and standardisation of devices and tools relating to it, so that the data can be analysed quickly (Helskyaho, 2017; Hu et al., 2014; Lu & Holubová, 2019).

As a result of big data's characteristics, tools and frameworks are required in order to prepare, process, and analyse it. Therefore, some studies discuss big data analytics as part of the wider business process (Alles & Gray, 2016; Davenport & Harris, 2007; Houser & Sanders, 2017; Pijnenburg et al., 2017; Santos et al., 2018; Tian et al., 2017). Big data analytics, in principle, also uses frameworks that are already available: (1) descriptive (in order to obtain data distribution); (2) diagnostic (in order to integrate data and identify relationships between data); (3) predictive (in order to make predictions based on existing data); and (4) prescriptive (in order to present suggested actions based on data collected (Richardson et al., 2019). The main difference in the way in which traditional databases (structured data) and big data are analysed stems from the capabilities of the tools used for the analysis. Big data analytics requires tools or devices that can deal with large volumes of data. For example, Microsoft Excel can only access up to one million rows of structured data. Therefore, we cannot use common spreadsheet tools like Microsoft Excel to process big data. Instead, we are required to utilise big data tools, such as R, Stata, Tableau, Power BI, or SAS (OECD, 2016b; Richardson et al., 2019).

Tax authorities can use big data analytics to conduct tax audits in order to assess taxpayers' compliance. Some experts also point out that data analytics, whether descriptive, diagnostic, predictive, or prescriptive, can be used at all stages of audits (selecting the auditees, preparing audit programmes, and performing both tests of controls and substantive audit tests) (Alles & Gray, 2016; Intra-European Organisation of Tax Administrations [IOTA], 2016; Kundu & Kundu, 2016; Mehta et al., 2019). In the same vein, the OECD (2016a) shows that using advanced analytics with large data sets will improve accuracy when selecting taxpayers for audit.

In the first part of this paper, the authors have discussed the background, related works, and purpose of the study. In the second part, they will explain the research methodology. The third section describes the audit function in the Indonesian tax administration system in order to give context to the discussed case. The fourth section includes the analysis and discussion of the research findings. In the last part of the paper, the authors present their conclusions and discuss the contribution made by the study to the literature.

2. METHODOLOGY

This study utilises a qualitative research method. It includes interpretive case studies, and the authors used documentation and interviews to collect the data. It explains the meaning of social-organisational phenomena in the context of their environment and complements the researchers' emic (insider) perspectives (Bakker, 2010; Creswell, 2013; Hartley, 2004; Johannesson & Perjons, 2014; McKerchar, 2008; Yazan, 2015; Yin, 2018). The use of interpretive case studies allows the researchers to explore the various meanings of the investigated cases in order to acquire a deep understanding of them. The researchers can then use their experience and knowledge to interpret these cases. Oates (2006) clarifies that interpretivism in IT-related research is concerned with the social setting of innovation, how IT is built by individuals and, moreover, how IT impacts individuals. This social focal point recognises that all conclusions are epistemological by nature. This type of research will enable us to acquire knowledge that is structured in such a way and can, to some extent, be applied to different cases by considering any surrounding contexts (Howcroft & Trauth, 2004; Klein & Myers, 1999; Walsham, 2006).

This study uses data acquired from interviews and documentation. Informants were selected using the interview approach taken by Salijeni et al. (2019). The authors used the snowballing method based on the recommendation of a key person (key informant) who participated in specific focussed group discussions organised by the DJP's Tax Audit Directorate. The group discussed how electronic data affects tax audits. The author was invited to the discussion and obtained permission to interview the informants for the study. Using the snowballing approach, the authors identified informants who had adequate credibility and capacity in respect of the study's topic. The authors approached potential informants and asked them whether they were willing to be interviewed. Once they agreed, the interviews were conducted. Due to some limitations (primarily related to the informants' time availability), the authors were required to contact some informants later for additional information via online communication channels, such as email and the WhatsApp instant messaging application. Table 1 consists of a list of research informants. The interviews were conducted in compliance with data confidentially provisions as regulated by Article 34 of KUP law. On the other hand, the documentation studies were conducted using tax administration documents in a broad sense, including legal rules, standard operating procedures, annual reports, training materials, and system application manuals (see Bowen, 2009; Coffey, 2014; Olson, 2010).

Table 1: List of Interviewees as Research Informants

Code	Role
TA1	Senior tax auditor; e-auditor, i.e. a tax auditor who is assigned by the DJP (Decree Number KEP 20/PJ/2019) to gain understanding of the taxpayers' information systems, and to acquire and convert electronic data in order to carry out tax audits.
TA2	Former tax auditor and e-auditor. Now a lecturer at the Indonesian Ministry of Finance's tax academy.
TA3	Tax officer assigned as a digital forensics specialist within a preliminary tax crime investigation (*pemeriksaan bukti permulaan*) task force.
TA4	Section head in the area of tax audit policy.
TA5	Head of a tax office.

3. TAX AUDIT POLICY AND TAX DATA MANAGEMENT: THE CONTEXT OF THE CASE

The Indonesian tax administration embraces a self-assessment system. The system is applied to taxes administered by the central government, such as income tax, VAT, stamp duty, and land and buildings taxes for the forestry, fishery, and mining sectors. KUP law mandates that taxpayers can calculate the amount of tax that they owe. Simultaneously, the law also authorises the DJP to conduct tax audits in order to verify the accuracy of taxpayers' calculations and ensure tax compliance.

In this section, the authors will highlight the interplay between tax audit and tax data management policies in order to gain a comprehensive understanding of the context. Tax audit is the responsibility of the Minister of Finance, who delegates it to the DJP. The DJP is responsible for establishing tax audit procedures, as stipulated in Article 31 of KUP law. The delegation is stated in Regulation of the Minister of Finance Number 17/PMK.03/2013 and its amendments (hereinafter PMK-17), which concern audit procedures. PMK-17 includes:

(1) policies for determining the criteria used when selecting taxpayers for audit;
(2) tax audit standards, including general standards (relating to tax auditor qualifications), audit implementation standards (relating to tax audit plans, audit programmes, and audit supervision), and reporting standards (relating to the preparation of audit reports);
(3) the obligations, rights, and authorities of both taxpayers and tax auditors when tax audits are being conducted;
(4) various procedures relating to tax audits, including document borrowing and electronic data acquisition procedures.

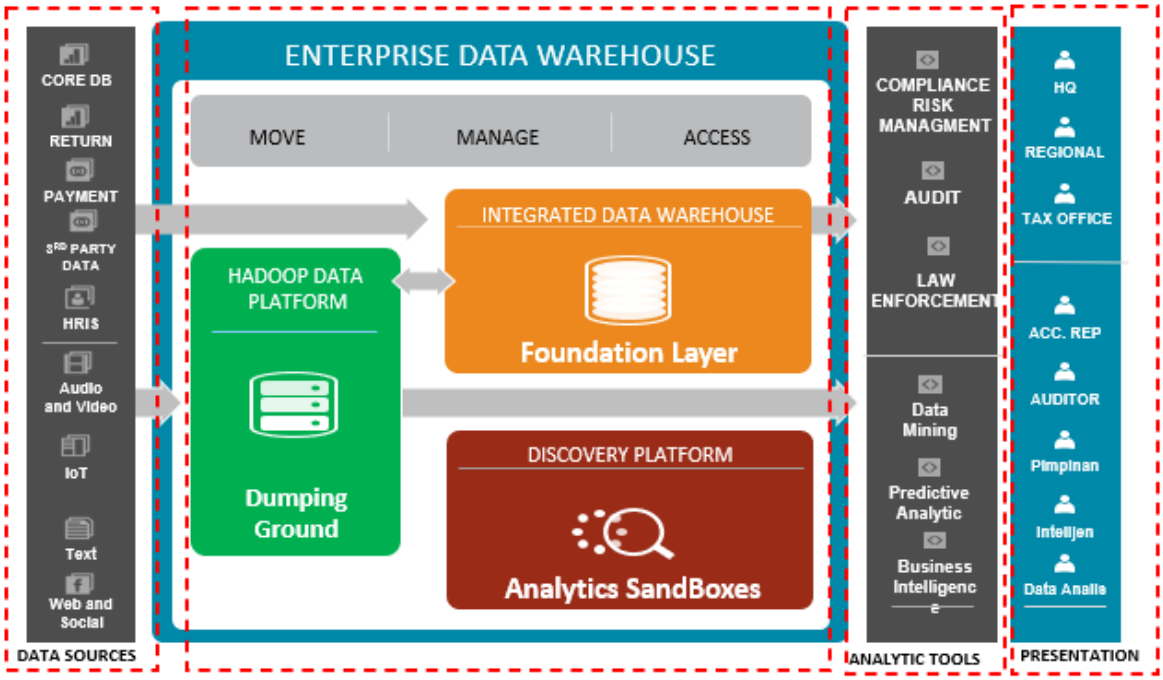
Subsequently, the DJP issued some circular letters (tax audit policies and technical guidelines) that act as implementation guides for PMK-17. For example, Circular Letter No. SE-15/PJ/2018 was issued in order to renew the existing tax audit policies. Generally, tax audit policy in respect of the selection of taxpayers for audit requires tax offices to establish a list of prioritised taxpayers. Each list is then reviewed and validated by the audit planning committees at regional tax office and DJP head office levels. The validation criteria are non-compliance indication and mode, tax potential, and tax debt collectability level. Meanwhile, the DJP published Circular Letter No. SE-24/PJ/2019, which concerned the implementation of compliance risk management (CRM) as part of the wider tax administration system. The output generated from CRM can be used for tax audit policy purposes.

Tax data management is a crucial part of the data collection process, helping to ensure that the selection of taxpayers for audit is implemented according to PMK-17 and Circular Letter No. SE-15/PJ/2018. Figure 1, as modified from a presentation by Djuniardi (2018), illustrates how tax data management supports the implementation of tax audit policy. The figure depicts the data flow and the functions that use the flow.

As illustrated in Figure 1, the tax data management system in Indonesia has several layers. The first is the data sources layer, which contains data from all sources. This layer is often called a data lake (see, for example, Devlin, 2018). Most of the data in the layer is acquired from taxpayers in the form of tax administration reports (such as taxpayer registration forms, tax returns, tax payment receipts), complaints (such as tax objection letters), and other tax administration service applications (such as tax clearance certificate requests). In addition, KUP law also requires other institutions, such as land administration offices, and banks and

other financial institutions, to send data to the DJP on a regular basis. Meanwhile, the DJP is also developing its own database by collecting data from other sources, such as social media platforms and tax intelligence practices.

Figure 1: Tax Data Management



Source: Adapted from Djuniardi, 2018. Used with permission.

The second layer is the enterprise data warehouse layer, where the results from the data ingestion and transformation processes are managed. This layer also applies data governance to ensure that access to the data is granted according to the information security policies. The third is the analytic tools layer, which consists of analytical tools used for tax administration functions. This layer uses some (big) data features in combination with data that has been processed through the enterprise data warehouse layer in order to conduct taxpayer compliance risk analysis. This analysis creates a list of taxpayers to be audited and provides details of the rationale for their selection. There can also be interplay between compliance risk analysis and tax audit policy. On one side, tax audit policy determines how compliance risk analysis algorithms work. On the other side, tax audit policy uses compliance risk analysis's output for policy formulation purposes.

The fourth presentation layer is the data visualisation layer. This consists of information dashboards, in aggregate and in detail, for each tax administration function, so that the information can be directly executed (for example, in order to issue tax audit assignments or form data marts (analytical cube or data models). Alternatively, the visualisation layer can be reprocessed to suit the needs of end users working in tax audit management.

The DJP has also published several circular letters containing technical guidance for tax audit fieldwork, as exhibited in Table 2. These circular letters show that electronic data has become part of the tax audit ecosystem, so tax auditors must also be prepared to handle big data. Consequently, tax auditors are required to have specific skills in order to prepare, process, and analyse big data as part of audit assignments.

Table 2: List of DJP Circular Letters Related to Tax Audit Policy Implementation

Number	Concerning
SE-10/PJ/2020	The use of the audit desktop application for detailed arrangements of the tax audit's implementation stages. The audit desktop application is the audit application used by the DJP's tax auditors for audit assignments, including preparation, implementation, and reporting activities. The implementation of the audit desktop application can, indirectly, be considered to be tax audit business process engineering because the application, in some ways, integrates tax audit workflows.
SE-10/PJ/2017	Tax compliance audit guidelines which regulate: (1) how to understand taxpayers' information systems; (2) how to get authorisation from taxpayers in order to access their electronic data processing equipment; and (3) how to obtain image files[5] and hash values[6] of audit evidence in the form of electronic data acquired from taxpayers.
SE-25/PJ/2013	e-audit guidelines which regulate: (1) the assignment of an e-auditor as part of a tax audit engagement; (2) the e-auditor's responsibility to process any electronic data acquired from taxpayers or provided by the other tax audit team members, and to provide such processed data in the format requested by the tax auditors.

4. CASE ANALYSIS AND DISCUSSION

This section will discuss the research findings obtained from the interviews. Five cases will be detailed using the presentation and analysis techniques described by Yin (2018). In this context, "case" refers to things scrutinised, such as organisations, departments, information systems, discussion forums, system developers, development projects, decisions, and so on (Oates, 2006). Cases will be studied thoroughly using various data collection methods (interviews, observation, document analysis, and/or questionnaires). The goal is to obtain rich and detailed insights into how each case became part of human activity.

Furthermore, the authors use an analysis technique that Diop and Liu (2020) describe as a "single setting case with multiple sub-cases" (p. 10). The single setting case is the implication for big data in the tax audit, while the multiple sub-cases are activities in the tax audit that are affected by the existence of big data. These sub-cases explore the use of big data, both at tax audit policy level and individual audit assignment level, by discussing:
(1) risk analysis and its relationship with taxpayer selection criteria for tax audit;
(2) how auditors extract audited taxpayers' data sets when these are large and in multiple formats;

[5] An image file is an exact duplicate, or bit-by-bit copy, of electronic data that contains all artefacts, i.e. information or data created as a result of the use of electronic devices that show past activity, such as time of access, deleted data, data fragments, hidden files, and unused or unallocated space (Goldstein, 2019; McKemmish, 2008; Montasari, 2017).

[6] A hash value is a value in the form of a combination of numbers, letters, or other characters with a fixed number of symbols generated by specific logical sequences and calculations (algorithms) for a set of electronic data. Hash values are used to maintain the integrity of the electronic data (Pethe & Pande, 2016). The DJP's Circular Letter No. SE-10/PJ/2017 states that, in order for it to be used for audit evidence, electronic data acquired from taxpayers needs to be in image file format and a hash value must be generated for it to maintain its integrity.

(3) audit tests and data analysis workflows;
(4) use of spatial data;
(5) web and social media data extraction.

The following subsections (4.1 to 4.5) describe the situations and the authors' interpretations of the problems. In subsection 4.6, the authors use an interpretive point of view and, based on the various facts that have been described above, attempt to construct guidelines that can be used to gain understanding of how the Indonesian tax authorities deal with big data for tax audit purposes.

4.1. Case 1: Risk Analysis in Audit Selection

Tax audit policy emphasises the importance of selecting taxpayers for audit using all data from the DJP's information system and facts obtained from observation and supervision activities. The utilisation of internal and external data when selecting taxpayers for audit generates a list of taxpayers. These can then be plotted on a two-dimensional graph with level of compliance and collectability on the axes. Therefore, data analysis should be performed to ensure that selected taxpayers meet the selection criteria.

In this context, the risk-based audit selection system can use an enterprise data warehouse that has been developed by the data and information management function at the DJP. As previously described, the enterprise data warehouse aggregates and transforms tax compliance data, such as information obtained from tax returns and VAT invoices, and comparative data acquired from third parties. The DJP already configures big data as part of its data management processes for its administrative functions. Next, as mandated by Circular Letter No. SE-24/PJ/2019 (which concerns compliance risk management), the system will generate a list of taxpayers to be audited based on a risk analysis conducted using various types of data stored within the enterprise data warehouse.

Djuniardi (2018) reported that the use of big data for compliance risk monitoring is still ongoing, with some use cases[7] being seen as "quick wins" for tax audit purposes and other law enforcement actions, including:

(1) data matching analysis (data equalisation) between third party data and data from tax returns and tax payment data, including data relating to income tax and VAT;
(2) network analytics to assess ownership and distribution relationships, so as to identify any related party or insider transactions;
(3) deep analytics for data matching and pattern identification in order to detect VAT fraud. One method that fraudulent taxpayers often use when attempting to reduce payable VAT is to credit VAT input using void VAT invoices.

The DJP's ability to use the three processes mentioned above results from its hard work over a long period to ensure that all taxation data is submitted in electronic format. Its efforts in this area have been recorded since 2000 (see, for example, Darono & Irawati, 2015). Tax return (Surat Pemberitahuan, or SPT) data has begun to include e-payment, e-tax return, e-filing, and e-invoice initiatives, which are being implemented gradually as the process takes a long time.

[7] A use case is series of intra-organisational or inter-organisational activities that are presented in a diagram (known as a use case diagram) in order to explain the relationships between business processes, procedures, application systems, and users that, if executed, will produce specific outputs (see, for example, Booch et al., 1998).

On the other hand, additional data from third parties (for example, banks, stock exchanges, and other financial institutions) became available as a result of the enactment of law number 9/2017, which concerns access to financial information for tax purposes. This law was introduced in order to fulfil Indonesia's obligation to carry out automatic exchange of financial information with fellow G20 members. This combination of factors provided the DJP with a large amount of data that covered various types of transactions, allowing it to carry out more in-depth tax audit risk analysis. The DJP immediately took steps to boost many of its organisational components, including its technology and human resource capabilities, in order to utilise big data for more in-depth risk analysis so as to determine tax audit targets more precisely.

4.2. Case 2: Extracting Large Data Sets Containing Multiple Data Formats

Interviews with TA-1 and TA-2 revealed that they had acquired all accounting data entries in the form of report files, spool files, or PRN files. These files are the electronic form of printed financial statements, so the structure, content, and file layouts are the same as the printed versions. The essential documents are general and supporting journals, general and subsidiary ledgers, and other relevant information that can be used to check taxpayers' tax returns. Data extraction and analysis techniques are used to check these returns (Cascarino, 2017; Hunton et al., 2004; ISACA, 2011; Zuca & Tinta, 2018).

TA-1, a senior tax auditor and e-auditor team member with more than twenty years of experience, stated that his most challenging audit assignment was when he received general ledger data consisting of more than ten million records. Meanwhile, TA-2, who worked as a tax auditor for more than ten years, related his experiences of dealing with several sources containing huge volumes of data. He was also required to handle various types of data source, including database management systems (known as DBMS), spreadsheets, and HyperText Markup Language (known as HTML) files. In order to deal with many types of data formats, auditors need to use a combination of data processing applications (for example, EmEditor, Power BI, and Python).

From another perspective, TA-3 noted that he faced a further challenge: the need to consolidate reports generated by many branches because the audited taxpayer did not report the details of the consolidation procedure used. There was only a summary of the transactions report available in the taxpayer's head office. Thus, TA-3 had to carry out a detailed data consolidation procedure. Approximately 110 million records from the company's branches needed to be analysed and tested. In another assignment, TA-3 stated that processing and analysing large report files also presented its own challenges if the data layouts were inconsistent. Moreover, when working with a report file that had a complicated layout pattern, the tax auditor is required to spend more time creating data extraction orders, so the execution of the data extraction query itself is slower. TA-3 mentioned that he obtained general ledger data with 16 million records in a report file format with a complicated layout that needed to be converted into a tabular or structured data format.

These audit assignments reveal several of the challenges faced by tax auditors:

(1) auditors need to use audit software that requires more powerful hardware support in order to perform various audit tests and data analysis tasks within acceptable timeframes;

(2) some data types and formats cannot be recognised and processed by specific audit tools, so tax auditors need to determine the audit tools that they can use while considering any other resources that they have.

In order to anticipate possible device constraints (hardware and software) and tax auditors' ability to acquire and process data, the DJP issued Circular Letter No. SE-25/PJ/2013, which stipulates that a tax auditor may request assistance from an e-auditor so that they can acquire and analyse electronic data as evidence for the tax audit that they are conducting.

TA-1 needed to use the Audit Command Language (ACL) audit software package instead of a standard spreadsheet application because the financial data acquired from taxpayers was relatively large. TA-2 was unsuccessful in performing data extraction using a Power BI Desktop software package with 8GB of memory. The auditor finally managed to perform data extraction procedures using a more powerful computer with 32GB of memory. Meanwhile, TA-3 had to use the pandas software library and Python on a computer with 8GB of RAM in order to extract the data. Previously, TA-3 had used the same computer with the Power BI Desktop application installed, yet had not managed to complete the extraction process.

The audit assignments described above illustrate how tax auditors face challenges relating to big data. Most of the time, data obtained from the taxpayer application system is in a ubiquitous format (such as report files). However, it is still important that the auditors understand the data layout. Moreover, if the data comes in various formats, the auditors should equip themselves with various tools suitable for use with the data.

The DJP issued Decree KEP-251/PJ/2020, concerning the establishment of the taxpayers' data integration team, in response to the evolution of taxpayer data management. It regulates cooperative compliance, which has been incorporated in the Indonesian tax system, in a broader scope. This provision also regulates tax audit functions relevant to cooperative tax compliance, such as general ledger tax mapping. However, it does not describe the technical procedures and data formats used to implement general ledger tax mapping in detail. In comparison, some authorities use the Standard Audit File for Taxation (SAF-T) approach, as proposed by the OECD (2004), or eXtensible Business Report Language (XBRL) (see, for example, Mousa, 2011). Understanding how the tax authorities set the standards and data formats used for audit purposes in this era of big data will make it easier for tax auditors to map the tools and techniques needed in order to acquire and process electronic data obtained from taxpayers.

Big data's presence in tax audits is a natural symptom of the entire data management constellation for business purposes. Computer hardware, mobile devices, various types of IoT sensors, data communication devices, and computer networks—especially those developed by emerging economies—are becoming increasingly affordable. The dominance of open source software (including operating systems, programming languages, and database management systems) within all communities makes data flow even faster. As a consequence, computing applications and data processing are ubiquitous and, ultimately, generate big data. The result of this situation for tax administration functions, including tax audit, is that it is necessary to acquire and process large amounts of data incorporating various data types. A further implication, especially for tax audits, is that while, in the 1990s, only big business entities had the capacity to implement end-to-end IT systems, today even a start-up company can choose to use the most sophisticated information management system—one that ultimately stores its data in a big data configuration. Every tax auditor must be alert to situations like this.

4.3. Case 3: Audit Test and Data Analysis Workflow

From the audit techniques perspective, data extraction and analysis (DEA) is the most suitable technique to use in order to test electronic data in the Indonesian tax administration system (Darono & Ardianto, 2016). DEA is a workflow that starts with data extraction and continues with data analysis. It is performed using various audit procedures designed in the audit plan and programme. Data extraction and analysis is a reliable tax audit technique that can, when used with the right audit tool to manage the size and variance of the data, be utilised to handle big data.

The DEA workflow can be summarised as follows:

(1) understanding the taxpayer system configuration and data processing applications;
(2) acquiring and extracting data using appropriate audit tools;
(3) performing data analysis using various audit tests, as stipulated in the audit plan.

Tax audit standards, which mainly relate to the audit test, suggest that tax auditors perform duplicate and gap detection, data relation, and data range validation tests. Furthermore, specific audit tests can be performed to test audited taxpayers' formal compliance, such as examining the timeliness and amounts of their withholding income tax payments, ascertaining whether they have met their VAT obligations (including crediting VAT input and under/overpayments), and confirming that their financial statements for commercial purposes and for tax purposes can be reconciled.

One of the objectives of a tax audit is to assess whether each transaction complies with the applicable tax regulations. The process by which tax auditors extract data from taxpayers' financial statements so that they can be analysed is as follows. The first step is to identify the data format. If it is structured data, it can be processed directly. Second, the data is summarised in a trial balance format according to the available chart of accounts. The auditor should be able to confirm all balances in the financial statement. Third, the auditor performs the validity test (such as a gap detection, a duplicate detection, or a validation of data range test). The purpose of this step is to ensure that the auditor is sufficiently confident that the data is valid.

Next, the auditor will run the tax compliance test for every transaction. One procedure used by auditors is the keyword search. This extracts every transaction record that includes specific keywords. Subsequently, those transactions are checked to ensure that they meet the applicable tax provisions. For instance, a tax auditor might search for all records that contain the words "rent" or "lease". Every record that matches the criteria will be examined, whether the applicable VAT and income taxes have been paid or not.

Other relevant keywords can be added in order to generate more results. The issue that arises in respect of big data is how to extract unstructured data and transform it into structured data in order to facilitate data matching. Tax auditors must also deal with data veracity issues. These require auditors to prepare audit tests in order to ensure data validity.

Several authors specifically address how big data analytics is related to audit programmes and tests. First, reconciliation between financial statements for commercial purposes and for taxation purposes can be carried out using diagnostics analytics techniques (see, for example, Richardson et al., 2019). This type of analysis will reduce the amount of time that it takes to complete a tax audit assignment. Our own observations show that it still takes a long time for

the tax auditor to produce a confirmed trial balance in order to reconcile the amounts recorded in each account detailed in the taxpayer's financial statements and confirm that these conform with the relevant tax provisions. Second, data veracity issues can be overcome by implementing machine learning. Of course, this is not a task for the individual tax auditor. It is the DJP's obligation to provide auditors with a tool that can ensure the veracity of the data obtained when producing audit evidence. Both practices will be easier to carry out following the implementation of big data analytics for tax audit purposes.

4.4. Case 4: Spatial Data

TA-5 discussed his experiences of the relationship between big data and the use of spatial data. Regardless of its size, spatial data can be generated by drones that conduct taxation data searches. The data can be used in tax administration functions, including tax audits. John Villasenor (2012, as cited in Fox, 2017, p. 82), states that a drone is "an unmanned aircraft that can fly autonomously". TA-5 added that it is legal to use drones to collect data for taxation purposes, as regulated in Article 35A of KUP law. According to a report by the Indonesian Ministry of Finance (2015), drones are seen as an innovation that can assist with the management of state finances. Spatial data can be collected using aerial photography techniques. The use of drones can be advantageous for spatial data collection because they can create maps effectively and efficiently, and at a relatively low cost. In addition, the data obtained can be used for comparison because it is relatively accurate and consists of detailed pictures of an object's current condition. It is also helpful when establishing benchmarks for data from the previous fiscal year. Moreover, the data obtained by drones can be enriched using Google Maps data in order to highlight specific issues or objects. Spatial data can be a significant factor when auditing certain taxpayers, such as oil palm plantation or chicken farm owners.

Spatial data, in principle, is commonly used to measure plantation or farm areas. It is combined with plant-level investment data released by official authorities in the relevant fields and compared with the information provided in taxpayers' tax returns. The critical reason for using spatial data is its veracity. Tax auditors need to prove that the data is valid in order to use it as an anchor or reference. Furthermore, tax auditors are required to have the capacity to convert and combine the spatial data with Google Maps data, so that it can be matched with data obtained from other sources.

In the authors' view, the use of spatial data for tax audit purposes will, in certain situations, be more complicated but it may also be more supportive for taxpayers whose businesses involve spatial areas, such as those in the agriculture, mining, forestry, or real estate sectors. Spatial data analysis still requires the use of some remote sensing analysis techniques because of its ambiguity (see, for example, Jain, 2008), making its utilisation as audit evidence a winding road. Spatial data analysis and interpretation techniques also require expertise that some tax auditors may not have. In this case, the proposed solution is to assign a tax appraiser who has knowledge of geomatics to the audit team.

4.5. Case 5: Web-Based and Social Media Data Extraction

The Internet has changed rapidly since it was first founded, with both private sector (e-commerce) websites and government (e-government) websites moving from being online brochures to becoming vehicles for interactive transactions (Drula, 2014; The World Bank, 2002). Recently, there have been initiatives to make the Internet a social interaction, social media, or new media platform (Edosomwan et al., 2011; Menke & Schwarzenegger, 2019). This suggests that the Internet itself is big data, as it shares the characteristics known as the 4Vs (described at the beginning of the paper). One thing that has exponentially driven changes in the way that the Internet is used is the convergence between two technologies that initially developed independently: the Internet and the mobile phone. This has allowed new businesses, such as e-commerce and social media platforms, to multiply. Transactions can be completed quickly using e-commerce (or e-marketplace) platforms. Some of these platforms are standalone businesses while others are integrated with other social media applications. The coffee maker purchase example detailed above illustrates the convergence of these technologies and the resulting data integration.

These changes in Internet use functions and patterns have resulted in online interactions taking place between tax authorities and taxpayers. Taxpayers can use the Internet in order to conduct business transactions and social interactions. The tax authorities can take advantage of various forms of information that appear on the Internet, including e-commerce and social media data, in order to monitor taxpayer compliance. The critical challenge for tax authorities is to level the playing field between online commerce (via e-marketplaces or social media platforms) and conventional commerce. If the tax treatments for these environments are uneven, it will cause inequality. If they are to take advantage of the boom in e-commerce, tax authorities should develop a data search and collection method that can be performed online. Technically, one method that can be used to search and collect data from online environments is web data extraction or web scraping (Chaudhari & Paikrao, 2012; Krotov & Silva, 2018). Web data extraction for taxation purposes in Indonesia is a legitimate technique that is regulated in Article 35A of KUP law.

TA-5, for example, was able to estimate a YouTube content creator's income utilising the web data extraction technique. The auditor used the extracted or scraped data for the risk analysis process before performing audit tests. Next, he familiarised himself with the monetisation process so that he was able to estimate the content creator's income by multiplying the number of content viewers and subscribers by the Google AdSense tariff. Finally, the auditor compared the estimated income with the income reported in the tax return to see if the amounts were reasonably close.

Web-based data and, in particular, social media data must have very high veracity levels in order to be of use to the tax authority. For example, one store in an online marketplace says that it sells fashion products, and shows the price of the items and the number that have been sold. Can the information immediately be stated as the sales value of the store for VAT or income tax purposes? It is, of course, not that easy to confirm the store's income solely based on that data. It still takes some work to establish the veracity of the data obtained from the Internet, including that acquired from social media platforms. Web and social media data is currently still used as supporting information (see, for example, OECD, 2017) for tax audit purposes such as profiling or gaining an understanding of a taxpayer's business network (i.e. ownership, consumers, and suppliers).

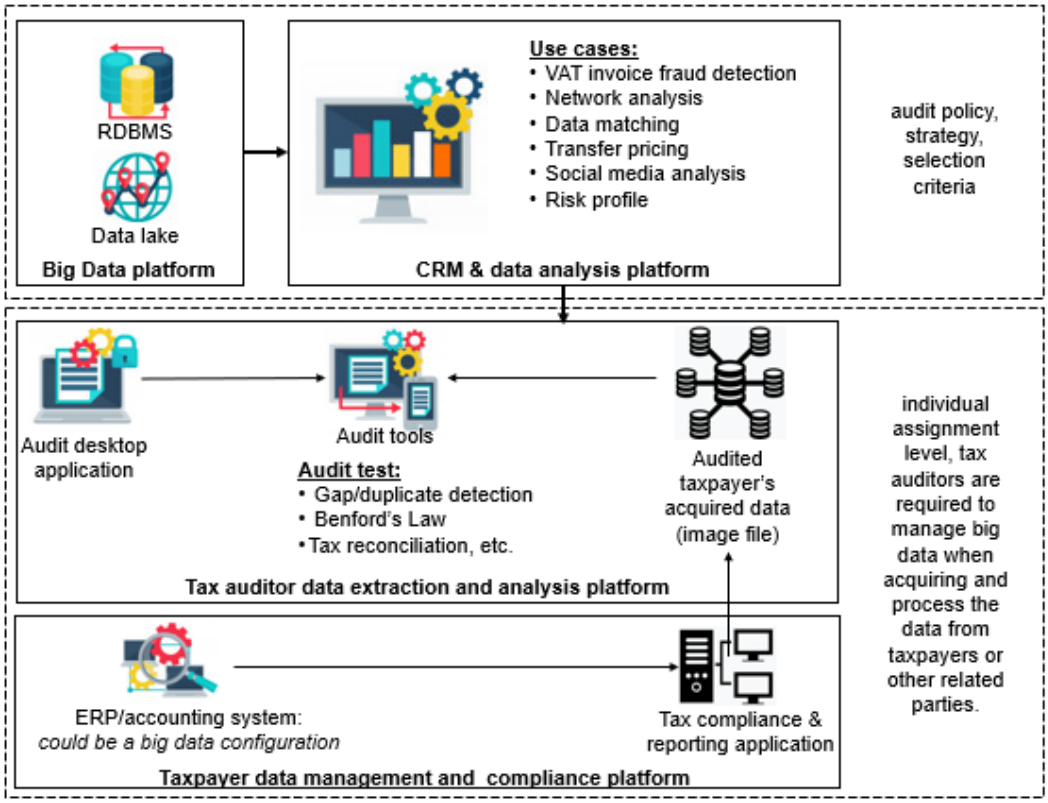
At present, when conducting tax audits, tax authorities tend to use big data analytics in order to pursue quick wins. In the authors' view, big data analytics for tax audits should be developed continuously in order to implement machine learning more comprehensively.

4.6. Multiple Sub-Case Analysis: Some Interpretive Insights

These cases have some similarities, which can be analysed further in order to formulate a framework that will help us to understand the impact of big data on tax audits. This section assembles some constructs from each sub-case so that a more systematic framework can be developed.

The authors observed that the influence of big data on tax audits—as one of the Indonesian taxation system's functions, as illustrated in Figure 2—exists in two aspects.

Figure 2: Influence of Big Data Deployment in Indonesian Tax Audits



Source: Designed by Freepik. This table was created by the authors using royalty-free images from www.Freepik.com

First, at the audit policy level, big data integrates structured and unstructured data in a data lake. The integrated data is obtained either from internal or external DJP data sources. Data is analysed using various analytical techniques, and fed to CRM and tax audit management systems for tax audit policy and audit selection purposes. Moreover, at this level, big data is considered to be a large volume of data that multiplies rapidly, consists of various data formats, and has a high level of uncertainty. It can be processed in a way that supports the DJP's CRM risk engine as part of the whole compliance risk management procedure. The goal is to find and manage taxpayers with high compliance risk profiles so that tax auditors can focus their

resources in order to supervise and audit these taxpayers. This should, ultimately, enable them to establish sustainable tax compliance. The use of big data for tax audit purposes will, of course, cause issues related to data security and privacy to arise. As a result, the DJP issued a series of provisions relating to procedures for maintaining data integrity, security, and availability, as detailed in DJP Regulation PER-41/PJ/2010, which concerns information security management policy, and DJP Circular Letter No. SE-30/PJ/2019, which concerns tax data access authority policy.

Second, at the individual tax audit engagement (or assignment) level, the assigned tax auditor can access various data relating to the audited taxpayer through the audit desktop application. The data includes taxpayers' full profiles, including tax returns, tax payments, VAT invoices, and other withholding tax slips. Tax auditors are not allowed to directly access the data lake that contains unstructured data relating to the taxpayer. They can only use data that has been processed and presented in the audit desktop application. Subsequently, the auditors design audit plans and programmes using the data provided. They extract the data using data extraction and analysis audit techniques, and perform audit tests. At audit test level, empirical evidence shows that:

(1) Tax auditors may need to handle large volumes of data (hundreds of million records) from previous fiscal years (historical records).
(2) They may also need to deal with taxpayer data format and source variations. This issue may, to some extent, be resolved by giving an auditor the authority to request data in a format that is compatible with their analytical tools. However, there is still a possibility that the data will only be available in its original format.
(3) The need to establish data veracity requires the auditors to review data sources. The validity of a data source will determine how the data obtained from it should be processed and analysed.

Based on the interviews with TA-2 and TA-3, it seems that tax auditors may be exposed to big data during the data extraction process. Alternatively, tax auditors can access the data lake directly. Therefore, tax auditors must have the competencies and skills needed to acquire data from taxpayers whose systems incorporate the use of big data. Meanwhile, from a data governance perspective, it is necessary to consider giving tax auditors access to data from established data lakes. In order to promote the idea of continuous improvement for tax auditors, the DJP, in collaboration with the Ministry of Finance's Tax Education and Training Centre, has organised a series of capacity-building activities in the form of certification training concerning business models related to the digital economy, tax data analytics, web data extraction and analysis, and digital forensics for tax law enforcement. However, in the authors' view, these measures are not sufficient to deal with current issues related to advanced big data analytics, such as cloud computing, containerisation, blockchain-based data, or deep learning for tax risk analysis. The DJP and the Tax Education and Training Centre should develop additional training programmes that address such issues.

This section ends with the authors' interpretation of how tax data should be understood, in the context of, and using data related to, tax audits as part of tax administration in Indonesia. With all its technical aspects, big data is a technological phenomenon and has become an organisational artefact. Therefore, it is critical that big data analytics becomes part of the tax administration's functions. Based on the description above, the authors argue that the main outcome expected from the implementation of big data analytics in tax audits is that it will provide tax auditors with information that can be used as evidence that taxpayers are either complying or failing to comply with tax laws.

5. CONCLUDING REMARKS

It can be concluded that the use of data, both in businesses and government institutions, is now always related to big data. Many vendors and technology developers are struggling to converge and standardise the available technological frameworks and applications. One day, big data platforms will be much easier to use for many purposes, including tax administration. This study has shown that big data is an integral part of the tax administration business process. It plays a critical role in all tax administration functions, including risk analysis, taxpayer supervision, and law enforcement. Publications produced by several tax consultancy firms have also noted that big data is now part of the tax planning and management procedures developed by taxpayers (Deloitte, 2016; EY Americas, 2019; PwC, 2015).

This study set out to determine how big data influences tax audits in the context of the current Indonesian tax administration practices. The findings suggest that there are two indicators of its influence:

(1) at the audit policy level, big data is used for risk analysis in order to identify taxpayers with high compliance risks who should be audited; thus, it can help tax administrations to achieve sustainable tax compliance;
(2) at the individual audit assignment level, tax auditors are required to design audit programmes that demonstrate how they acquire, process, and analyse audit evidence in big data formats.

This paper proposes two recommendations relating to the impact of big data on tax audit practices in Indonesia. First, it is crucial to improve tax auditors' capacity to acquire, process, and analyse big data. Second, it is necessary to have a data governance policy that allows tax auditors to use a data lake in order to obtain data that complements the structured data that is readily available through standard applications.

In terms of contributing to the broader tax administration literature, the results of this study show how tax authorities incorporate big data in tax administration tasks. Subsequent research could explore this further, investigating, for example, the characteristics of taxpayers' business processes that drive them to utilise big data as part of their data management procedures, how big data affects corporate tax planning and management processes (including data exchange between taxpayers and their tax advisers), or the need for tax authorities to adjust their provisions for data exchange in terms of cooperative tax compliance schemes, tax audit technical guidelines, and improved standard audit file structures and formats.

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TAX ADMINISTRATION CAPABILITIES AND REVENUE EXTRACTION EFFICIENCY IN SUB-SAHARAN AFRICA: EVIDENCE FROM A PANEL STOCHASTIC FRONTIER MODEL

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Abstract

Using panel data for 42 countries from 1991 to 2019, and applying a panel stochastic frontier model, this study examines the capabilities and efficiency of tax administrations in sub-Saharan Africa (SSA). The estimation results show that macroeconomic variables, aid dependence, and governance structures affect tax efforts. In addition, we find strong evidence that tax revenue extraction efficiency is influenced by the resourcing of tax administrations and the allocation of those resources to core tax administration functions, such as tax audits. Furthermore, technical efficiency is influenced by internal operational efficiency, which tends to reduce revenue collection costs. This implies that the resourcing of the tax administration, the quality of employment, the allocation of human and other resources, the application of technologies (such as mobile payment) in order to simplify tax administration and reduce costs, and staff motivation are equally important when attempting to maximise revenue administration capabilities and efficiency.

Keywords: Tax Effort, Tax Administration Capability, Technical Efficiency, Panel Stochastic Frontier Model.
JEL Classifications: H20, H24

1. INTRODUCTION

Generally, capable states are those able to garner enough tax revenues from the economy and ensure the effective implementation of policies through efficient public administration (Gaspar et al., 2016). An important question is, therefore, what influences the ability of the government to raise adequate revenue to fund public goods and services? This question has created renewed interest among scholars seeking to identify factors that influence states' tax revenue raising capacities. The question is particularly relevant for developing countries, like those found in sub-Saharan Africa (SSA), which are unable to raise adequate revenue to fund basic needs in both the public and social sectors (such as health care, basic education, and infrastructure). The observed high disparity between developed and developing countries in terms of their abilities to raise tax revenue, as measured as a percentage of tax revenue to gross domestic product (GDP), and the correlating observed differences in levels of development suggest that raising adequate revenue is a prerequisite for greater development. The capacity to collect taxes and to ensure the effective use of the taxes collected has given rise to "development clusters": groups of rich countries that have strong state capacities and groups of poor countries with weak state capacities (see, for example, Besley & Person, 2011).

The ability to raise tax revenue is influenced by, amongst other things, macroeconomic, structural, and institutional factors. According to Besley and Person (2011, 2014), the observed

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cross-country differences in ability to raise revenue exist as a result of the interaction between tax capacity, legal capacity, and public administration capacity. While ability to raise revenue (tax effort) is key, efficiency (the ability to collect more for the given amount of resources) is equally important. Many studies in this area have concentrated on the determinants of tax effort, and most have taken a similar approach, examining the production functions of tax revenue (tax to GDP) and factors which influence a state's ability to raise taxes. While there is a broad literature on the antecedents of tax efforts, there has been a dearth of studies of efficiency.

The lack of empirical evidence with regard to the drivers of capability and efficiency in government-specific functions is common and this is also the case for tax administration. This has been noted in studies by Fukuyama (2012), Cingolani (2013), and Giosi et al. (2014).

The few studies that have focussed on factors that affect effectiveness in raising tax revenue include Taliercio Jr. (2004) and Das-Gupta et al. (2016). These studies use various indicators of tax administration and examine how these indicators influence revenue collection across tax jurisdictions and between periods. Our study tries to bridge this knowledge gap about factors affecting effectiveness and efficiency in tax revenue collection. In particular, we endeavour to contribute to the literature by examining the influence of tax administration characteristics and practices on governments' tax revenue raising capabilities and efficiency in countries in SSA.

Unlike the aforementioned studies, this study approaches the problem of tax revenue extraction from a technical efficiency point of view. We estimate inefficiency using a stochastic frontier approach and assess the effects of various tax administration capability indicators on the observed cross-country inefficiencies. We adopt key indicators of tax administration capability, as used in Crandall (2010), Rasul and Roggery, (2013), the International Growth Centre (2014), Das-Gupta et al. (2016), Mills (2017), Ricciuti, Savoia and Sen (2016), and Dom (2017). The data on tax administration capability indicators for this study was obtained from African Tax Administration Forum (ATAF, 2017, 2019).[3] One limitation to this study arises from the fact that, while the ATAF took the initiative to collect and publish these indicators, it only publishes a few of them, and the most recent data available only covers some countries—its African Tax Outlook (ATO) member countries—for a period of just ten years (from 2010 to 2019).

This study advances the discussions in literature by extending its analysis to include an estimation of technical inefficiencies and an assessment of how these indicators influence cross-country differences in tax revenue raising efficiency. To that end, we estimated the marginal effects of the determinants of technical inefficiencies, which revealed an interesting insight: the allocation of resources to core tax administration functions significantly reduces inefficiency. Organisational factors, as observed through the cost of revenue, increase inefficiency while arrears recovery reduces inefficiency. Likewise, the capacity of the tax administration, as observed through the number of taxpayers per member of staff, has a significant effect on inefficiency.

Section two presents a review of the literature. It starts by providing a theoretical underpinning of tax administration capability in relation to compliance enforcement, the determinants of tax administration capability, and a review of the analytical approaches taken to estimate tax effort. Section three presents the methodology of the study. It covers the data used and its descriptive

[3] Full data is available from the author upon request.

statistics, as well as the empirical model and the analytical approach. Section four presents the findings, while section five summarises the study and discusses its implications.

2. A REVIEW OF LITERATURE

A Theoretical Framework of Tax Administration Capability

The capability of a tax administration is observed through its effectiveness in enforcing taxpayer compliance (see Das-Gupta et al., 1995; Das-Gupta et al., 2016). A tax administration's capacity and its efficiency are therefore inseparable. A capable tax administration ought to be effective at collecting the maximum possible level of revenue (or, at least, a set revenue target) while ensuring that it allocates its resources optimally so as to achieve this objective at the lowest possible cost.

Following Das-Gupta et al.'s (1995) example (with some adjustment), we argue that the efficient tax administrations raise more revenue, as they are capable of influencing the size of the tax base, its concentration, and taxpayer compliance, while simultaneously adopting technologies and approaches that simplify tax administration, and reduce tax collection and administration costs.

We start by specifying that: tax revenue (R) depends on tax rate (τ), tax base (B), and level of compliance (C).

$$R = \tau BC \tag{1}$$

The size of the tax base is related to level of income (Y) and concentration of the tax base refers to the number of taxpayers (N), such that:

$$B = b_0 Y^{b_1} N^{b_2} \tag{2}$$

Higher concentration improves the efficiency of the tax administration. When taxpayers are few and scattered, it is ineffective and costly to enforce compliance.

Furthermore, taxpayer compliance (C) depends on taxpayer compliance attitudes (E) and tax administration effectiveness (T). Tax administration effectiveness is, however, reduced by the size of underground economy (γ), such that:

$$C = c_0 E^{c_1} T^{c_2} \gamma^{-c_3} \tag{3}$$

It follows that by substituting (2) and (3) into (1), and collecting the terms, we obtain

$$R = b_0 c_0 \tau Y^{b_1} N^{b_2} E^{c_1} T^{c_2} \gamma^{-c_3} \tag{4}$$

where b_0, b_1, b_2, c_0, c_1 and c_2 and c_3 are constants.

Lastly, we assume that taxpayer compliance attitudes (E) hold constant in the short-term, such that:

$$R = a_2 \tau Y^{b_1} N^{b_2} T^{c_2} \gamma^{-c_3} \tag{5}$$

where $a_2 = b_0 c_0 E^{c_1}$ (6)

The meaning of equation (6) is that tax administration capability affects a government's ability to raise tax revenue. The channel for this effect is effectiveness in widening the tax base and enforcing compliance. A capable tax administration is able to reduce the size of the informal economy by registering as many as taxpayers as possible (see Savić et al., 2015), which increases taxpayer concentration, reduces tax administration costs, and improves tax revenue extraction efficiency.

Determinants of Tax Capacity and Tax Effort

The literature on tax capacity and tax effort reveals stylised facts about the differences between developed and developing countries' tax revenue mobilisation efforts. In addition, developing countries collect very little tax as a share of GDP when compared to developed countries (see, for example, Besley & Persson, 2014). Even when tax effort is considered in the analysis, developing countries are still shown to collect much less revenue than they have the potential to collect (see, for example, Mawejje & Sebudde, 2019). Therefore, the issues of low tax capacity and low tax effort in developing countries boil down to compliance issues and tax administration capability, rather than their tax-generating potential.

We may conceptualise the factors which affect tax capacity as intrinsic and extrinsic to the tax administration. Extrinsic factors include: the structure of the economic activities; political factors (see, for example, Ricciuti, Savioa & Sen, 2016; Yogo & Ngo Njib, 2016); social factors (see, for example, Azulai, et al., 2014; Roll, 2011); and the social contract between the state and its citizens (see, for example, Bird & Wallace, 2003). While extrinsic factors relate to the environment within which the tax administration operates and which determines the tax capacity and effort, intrinsic factors relate to the actions and characteristics of the tax administration organisation that affect tax administration capability and efficiency.

The level and structure of economic activities are the primary determinants of the ability to tax revenue collection. The level of economic activities represents the size of the tax base. In terms of a state's capacity to tax and, in particular, to tax incomes, the issue of the structure of the economy is far more important than income levels (see Tanzi, 1992). Tanzi and Zee (2000) note that the typical structure of developing countries' economies features a significant agricultural sector (mostly for subsistence), extensive informal sector activities and occupations, and many small business establishments. The existence of a large informal sector makes it difficult to identify economic transactions and complicates taxation (Joshi et al., 2014; Tanzi & Zee, 2000).

Likewise, the prevalence of a large subsistence agriculture sector with very short value chains limits a state's ability to expand the tax base for certain modern taxes, such as personal income taxes and value added tax, and thus limits its ability to collect high amounts of tax. Furthermore, personal income levels in developing countries are very low. A large proportion of the population in a developing country earns just enough for subsistence. Conversely, raising taxes from the incomes of the poor has both political and social implications (see Ricciuti et al., 2016). As a result, low-income countries impose very low marginal income tax rates (see Sicat & Virmani, 1988). Other considerations that limit the taxation of the incomes of the poor include equity and cost-effectiveness (Bird & Zolt, 2005; Junquera-Varela et al., 2017).
Natural resource endowment is another factor which affects the tax effort. Resource-rich countries extract very little tax from non-resource sources, such as personal incomes. Crivelli

and Gupta (2014) analyse the impact of expanding resource revenues in 35 resource-rich countries on different types of non-resource domestic tax revenues, and find a statistically significant negative relationship between resource revenues and total non-resource domestic tax revenues. Thomas and Treviño (2013) provide more insights into what causes this tendency. According to them, low contribution of non-resource taxes in resource-rich countries is a result of the prevalence of high levels of corruption, incentives for tax evasion, large tax exemptions, and/or weaker enforcement (Thomas & Treviño, 2013). Many resource-rich countries have, however, experienced governance problems and internal conflicts, which have undermined their efforts to collect non-resource domestic revenue. In economics, this is known as "the resource curse" (Auty, 1993).

Political systems also influence the development of a state's tax system. Weak and unaccountable states are unlikely to have strong motives to build fiscal capacity and their citizens are unlikely to develop strong compliance norms. The strengthening of institutions for taxation largely reflects a strong political will towards taxation (Bird et al., 2008). The level of development of the political system, therefore, is an important factor that helps with the establishment of strong institutions for taxation and the development of compliance norms. In the literature, it is widely acknowledged that democratic polities collect more taxes than non-democratic polities (see, for example, Ross, 2004, and Balamatsias, 2016). This is because of the support that they receive from their citizens through bestowed legitimacy. Democracy enables the development of strong institutions, and provides checks and balances in the system.

On the other hand, tax compliance is very low in states in which there is conflict and in fragile states. A lack of checks and balances, and weak accountability, has resulted in weak governance and rampant fiscal corruption existing in most developing countries (see CMI, 2016). Corruption lowers tax compliance and is negatively associated with overall tax revenue and most of its components. Corruption can also harm revenue potential through the introduction of tax exemptions or other tax loopholes in exchange for bribes (International Monetary Fund [IMF], 2019). In order to reduce corruption within a tax administration, it may be necessary to reduce the complexity of tax laws and procedures, reduce monopoly power, and reduce the degree of discretion that tax officials have (executive constraint).

Foreign aid also affects tax efforts, but in a more ambiguous way (see Clist & Morrissey, 2011). Most of the studies published in the past decade claim that aid discourages tax effort. Countries that receive more foreign assistance will collect less domestic tax revenue, as they have less incentive to pursue politically costly, local tax collection (see, for example, Gupta et al., 2004). However, other studies, such as Morrisey et al. (2014), highlight the positive effects that aid may have on taxation. When governments receive lower amounts of aid, it can have a significant effect, as this provides them with the resources to fund government initiatives that strengthen revenue collection. However, when they receive higher amounts of aid, governments may relax their domestic tax collection efforts.

Social and cultural norms also affect tax effort. Low-income countries have lower levels of taxation due to, among other reasons, the weaker taxpaying ethic that exists within them. As a result of a weaker compliance norm, any given statutory level of taxation will raise less revenue than would otherwise be expected. A norm is an intrinsic attribute that can be shaped by a number of factors, including culture. Taxpayer morale is diminished if they perceive that evasion is rampant, and that the state does not have the capacity to detect and punish noncompliance (Bénabou & Tirole, 2011). Tax morale can be linked to the fairness of the tax system. A high level of evasion makes that tax system unfair, as some taxpayers bear a higher

burden than others and, hence, become demotivated with regard to compliance. In a similar vein, studies have also found strong correlations between taxation and democratisation (Ross, 2004), public goods provision (Timmons, 2005), high quality services in exchange for taxes (Hanousek & Palda, 2004), and quality of governance (Moore, 2008).

Tax Administration Capability

Tax mobilisation also depends on institutional capacity, especially in situations where there are high levels of noncompliance. There is certainly no jurisdiction with full tax compliance. However, levels of tax noncompliance in developing countries, such as those in SSA, are relatively high when compared to those in developed countries. In a high noncompliance situation, the tax administration will have to play the role of policeman (see Savić et al., 2015). This would be typical for most of countries in SSA. However, due to resource limitations, tax administrations have to develop the capacities and capabilities to support voluntary compliance and enforce compliance where necessary. The capacity to enforce compliance involves the use of strategic interventions, such as risk-based audits, to detect noncompliance and penalise those who do not comply.

The review of literature discusses various aspects and features relating to tax administration capability. In summary, tax administration capability involves the ability to perform tax administration processes, utilising various inputs and interactions with various stakeholders in the most effective and efficient way, in order to mobilise high levels of tax revenue according to the potential of the economy. Thus, countries with low tax capabilities, as is the case in most developing countries, collect lower levels of tax revenue relative to economic activities (GDP) and their potential. A tax administration's capability is measured by various indicators of tax administration performance (see, for example, Crandall, 2010; Gallagher, 2004). These measures are indicative of how well, or how poorly, the tax administration is performing against its goals and objectives. The proper monitoring of these performance measures enables improvement in terms of management reforms, efficiency, cost awareness and overall effectiveness (OECD, 2011). The Tax Administration Diagnostic Assessment Tool (TADAT), which was developed under the auspices of the IMF and the World Bank, is an integrated monitoring framework that measures the performance of a country's tax administration in respect of essential tax administration aspects (ATAF, 2017, 2019; Crandall, 2010). The primary (and often considered to be the overall) indicator of a tax administration's capability and performance is its ability to raise taxes, which is measured as a ratio of tax revenue to GDP. More rigorous measures, such as the share of non-resources taxes to GDP or share of direct taxes to GDP, are also often used.

The overall performance of a tax administration depends on the implementation of tax administration functions. Tax administration capability and performance can be construed as an input-output framework, such that processes and inputs are the building blocks (indicators) for the achievement of the overall performance, i.e. tax collection capacity. Table 1, below, summarises the core functions of a tax administration and their corresponding capability indicators.

The recognition of the importance of the tax administration structure with regard to efficient tax revenue mobilisation has led to the transformation of tax administration functions including, notably, the creation of semi-autonomous tax administrations in most countries in SSA during the 1990s. When a tax administration is semi-autonomous, tax administration functions are freed, as the tax administration is no longer a department within the Ministry of

Finance. This results in improved revenue collection, reduced political interference, increased autonomy with regard to decision making (including recruitment) and resource allocation, enhanced utilisation of technologies (such as information and communications technology [ICT] for tax administration), and improved governance in tax administration (Crandall, 2010; Dom, 2017; Gallagher, 2004; Junquera-Varela et al., 2019).

Table 1: Selected Indicators of Tax Administration Capability

Tax administration functions	**Capability indicators**	**Measurement**
Overall performance (revenue extraction)	- Tax to GDP ratio - Non-resource tax to GDP ratio	- A ratio of tax revenue (or non-resources tax) collected as a share of GDP
Registration and filing compliance	- Percentage of taxpayers filing on time	- A ratio of the number of registered taxpayers to the number of tax administration staff
Taxpayer services and education	- Compliance rate	- Percentage of registered taxpayers who file returns and comply with their tax obligations
Returns processing and payment	- Revenue per unit of operational cost	- A ratio of total tax revenue collected to total operational costs
Collection of arrears	- Percentage of arrears to total revenue	- A ratio of total arrears recovered to total tax revenue collected during the period
Audit and investigations	- Percentage of staff in audit functions	- A ratio of tax administration staff in tax audit to the total number of tax administration staff
	- Audit recovery rate	- A ratio of tax revenue recovered through tax audits to total declared taxes
Appeals	- Average length of appeals case	- Average time taken to complete appeals (i.e. issue an appeal decision)
Administration	- Ratio of total staff to staff in core functions	- A ratio of tax administration staff in core functions (registration, returns processing, audit, investigation, debt management) to the total number of tax administration staff
Budget allocation	- Budget in core functions against total budget	- A ratio of budget allocated to core function to total budget of the tax administration

Source: Author's compilation from Crandall (2010) and ATAF (2017, 2019).

Since the 1990s, when these major reforms took place, many countries in SSA have continued to make efforts to improve and modernise tax administration in order to enhance their capabilities for revenue mobilisation. However, more effort is required in order to improve

their capacities for higher tax revenue extraction. The primary area in which most tax administrations in SSA need to improve is resource allocation. A report published by ATAF in 2019 indicates that the resources allocated for tax administration are inadequate in most countries in SSA. For instance, the number of tax auditors to total tax administration staff among ATO member countries stood at an average of 12 percent in 2018 and ten percent in 2019, which is far lower than the recommended ratio of 30 percent (ATAF, 2020, p.135).

In addition to increasing resources, such as the number of staff in the tax administration, it is important to ensure that employees have the necessary qualities and capabilities in terms of skills and competencies. The business environment within which tax administrations operate has become more complex, particularly with the emergence of the telecommunications sector, the mining sector, financial institutions, multinational corporations, international transactions, digital transactions, and e-commerce. As a result, staff require specialised skills in order to ensure effective tax administration and to curb tax evasion. Thus, a tax administration's failure to develop the skills of its employees in order to keep up with the pace of changes in the operating environment is likely to affect its capability.

While increasing resources is key, there is much scope to enhance tax administration capability by investing in technologies like ICT. ICT utilisation improves a tax administration's capability to enforce compliance, lowers tax compliance costs, and makes paying taxes more convenient for taxpayers. For instance, the recent developments that have enabled money transfers to take place via mobile phones have seen their way into tax administration. Mobile phone money transfer is now one of the most convenient and cost-effective ways of making tax payments and collecting taxes in countries like Tanzania and Kenya. This has boosted taxation efficiency and capabilities across many developing countries that have adopted these person-to-government (or P2G) payment methods. The inadequate utilisation of ICT, such as the lack of a full automation system for domestic taxes, limits a tax administration's scope to promote greater transparency and integrity[4], and its ability to strengthen its compliance risk management which, in turn, affects its capability and efficiency.

Technical Efficiency in Tax Revenue Extraction

Tax potential represents the level of taxes that can be collected given the size of the tax base, the structure of the tax administration, and the level of compliance. The level of taxes actually collected relative to the tax potential is known as the tax effort. Empirical analyses suggest that tax potential and tax effort differ across countries, and even between those with similar economic characteristics. Therefore, something beyond tax potential explains what is actually collected on the ground: the effects of tax policies, tax laws, tax administration efficiency, and tax administration capability, as well as governance structures (Bird & Martinez-Vazquez, 2008).

Tax potential and extraction efficiency are inherently unobservable. However, they can be estimated empirically. Analysis of technical efficiency in tax administration follows a similar approach to that used in production and cost modelling (see, for example, Langford & Ohlenburg, 2016: Mawejje & Sebudde, 2019). Thus, studies investigating tax effort and efficiency often take a production frontier approach in order to estimate tax efforts and tax potential, and to derive cross-country efficiencies in tax revenue extraction. The frontiers are

[4] Unlike customs, where most of the processes are automated, domestic revenue operations still involve a high level of human intervention.

estimated from sample data using either parametric (econometric) methods or nonparametric (mathematical programming) methods, such as Data Envelopment Analysis (DEA). The classic DEA model assumes that input and output variables are deterministic. However, tax effort and tax revenue are stochastic in nature.

These parametric and nonparametric methods have been used and emphasised as standard techniques by which to explore the relative efficiency of agencies and institutions (see Alm & Duncan, 2014). However, these techniques take different approaches when estimating the efficient frontier. Parametric methods make use of econometric methods to estimate production frontiers when estimating technical efficiency (or inefficiency). The difference between parametric and nonparametric methods of estimating production frontiers is that parametric methods distinguish between deviations due to inefficiency and deviations due to random shocks, while nonparametric methods do not (McKenzie, 2021). Since tax effort and efficiency in revenue administration are affected by random (stochastic) shocks, we implement a parametric model—specifically a stochastic frontier analysis (SFA)—to account for these shocks.

Tax mobilisation efficiency is affected by tax policies, tax laws, and tax administration. While the effects of tax policies and tax laws ought to be static, the effects of tax administration capabilities and practices change over time. Technical change over time is possible, as tax revenue collection is subject to stochastic shocks due to changes to, for example, operational arrangements, technology utilisation, management, resource allocation, and recruitment policies. Therefore, as far as the technical efficiency of the tax administration is concerned, it is imperative to use models that account for time-varying technical inefficiency. This necessitates the choice of parametric methods (such as SFA) over nonparametric methods (such as DEA).

The frontier model and the inefficiency can be implemented in a single-equation framework or a two-stage approach. In a two-stage approach, the frontier is estimated and estimates of technical inefficiency are derived. The technical inefficiencies are then regressed against the determinants of inefficiency in the second-stage analysis (see, for example, Mackenzie, 2021), using methods like a Tobit or ordinary least squares (OLS) model (Belmonte-Martin et al., 2021). However, this may lead to bias in the estimates of inefficiency, since the inefficiency variables can be correlated to other variables in the model (see Schmidt, 2011). As such, this study uses a single-equation framework, which involves simultaneous estimations of the frontier and inefficiency models in one equation. This approach has been used widely to study inefficiency in tax administration (Garg et al., 2014; Langford & Ohlenburg, 2016). Another strand of studies use a combination of parametric (SFA) and DEA models to estimate the frontier and inefficiencies (see, for example, Alm and Duncan, 2014). Alm and Duncan (2014) use a three-stage approach to estimate SFA and obtain coefficients that are used at a later stage to adjust the DEA. Mackenzie (2021) uses SFA and DEA to obtain inefficiencies, and later uses a Tobit regression to analyse the determinants of inefficiency.

3. METHODOLOGY

Analytical Strategy

The analytical strategy adopted in this study involves the estimation of a stochastic panel frontier model in a single-equation framework which includes the input variables for the frontier function and the variables that are postulated to account for technical inefficiency in tax administration. In order to distinguish countries' heterogeneity from inefficiency, we use both true fixed effect and true random effect specifications. A true effect stochastic frontier model captures the effects of time-invariant covariates that have nothing to do with inefficiency. At a later stage, we estimate the marginal effects of the determinants of inefficiency and plot these using scatter diagrams to provide a visualisation of their evolvement as the inefficiency variables change.

Data and Descriptive Statistics

The data used for this study covers 42 countries in SSA for a period of 29 years (1991 to 2019). It is mainly secondary data on tax revenue, macroeconomic variables, governance indicators, and tax administration. The panel data on tax revenue was compiled from UNU-WIDER's government revenue data set (UNU-WIDER, 2020).[5] Macroeconomic data, such as per capita GDP, openness (the sum of imports and exports as a share of GDP), capital formation, private credits, and official development assistance (ODA) was obtained from the World Development Indicators (WDI) dataset (The World Bank Group, 2022a). Regulatory quality data was extracted from World Governance Indicators (WGI) dataset (The World Bank Group, 2022b).[6] Executive constraint data represents the level of restraint on executive actions and was extracted from the World Bank database (The World Bank Group, 2022c). The size of the shadow economy data is adopted and compiled from the estimates produced by Schneider, Buehn and Montenegro (2010), and Medina and Schneider (2018). The data used for the determinants of inefficiency (i.e. administrative data relating to tax administration capability indicators) was obtained from the tax administration statistics compiled by the ATAF.[7] This administrative data provides meaningful and useful research into tax administration (see Mascagni, Monkam, & Nell, 2016; McCluskey & Isingoma, 2017). Summary statistics of the variables are provided in Table 2.

[5] This data set was previously compiled and published by the International Centre for Tax and Development.
[6] Regulatory quality reflects perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development.
[7] The summaries of tax administration data compiled by the ATAF are published annually in its African Tax Outlook reports.

Table 2: Summary Statistics of the Key Variables

Variable	Source	Obs	Mean	Std. Dev.	Min	Max
Tax to GDP ratio	ICTD	1,218	13.4	7.7	0.6	53.9
Log. GDP per capita	WDI	1,218	6.7	1.1	4.2	10.0
Shadow economy (% of GDP)	WDI	1,214	39.4	9.1	19.2	69.1
ODA (% of GDP)	WDI	1,216	9.9	10.2	-0.3	94.9
Capital formation (% GDP)	WDI	1,198	22.0	10.1	-2.4	79.4
Openness (% of GDP)	WDI	1,179	70.3	44.0	20.4	531.7
Private credits (% of GDP)	WDI	1,210	18.0	22.4	0.4	160.1
Regulatory quality	WGI	1,138	-0.6	0.6	-2.3	1.1
Executive constraint	WGI	1,215	4.1	1.9	1.0	7.0
Staff in core functions to staff	ATAF	356	0.7	0.3	0.2	5.4
Cost to revenue	ATAF	338	2.6	0.8	1.0	4.6
Arrears recovered to revenue	ATAF	248	32.1	30.3	0.3	146.9
Taxpayers to tax staff	ATAF	299	354.5	436.9	1.2	1966

Analytical Models and Data Analysis

The analytical models used in the study are second-generation stochastic frontier models. These are panel data models estimated using the maximum likelihood method. The models assume that there is a change in technical inefficiency over time (see for example, Battese & Coelli, 1992; Greene, 2005; Kumbhakar, 1990; Kumbhakar, Lien & Hardaker, 2014; Kumbhakar & Wang, 2005; Lee & Schmidt, 1993).

The stochastic frontier model is expressed as:

$$Y_{it} = \alpha + f(X_{it}; \beta) + \varepsilon_{it} \quad (7)$$

The model that is examined can be written as

$$y_{it} = \beta_0 + x_{it}'\beta + v_{it} - u_{it} \quad (8)$$

$$y_{it} = \alpha_{it} + x_{it}'\beta + v_{it} \quad (8)$$

$$\alpha_{it} \equiv \beta_0 - u_{it} \quad (9)$$

where the term $-u_{it}$ represents time-varying inefficiency.

These error components are estimated simultaneously in a single-equation framework which also combines input variables for the frontier function and the inefficiency function.

After combining the frontier and inefficiency models in a single equation framework, we extend the analysis to examine the marginal effects of the determinants of inefficiency. This is operationalised as follows:

Consider a stochastic production frontier model:

$$y_i = \beta' x_i + v_i - u_i \quad (13)$$

$$u_i \sim N^+(\mu_i, \sigma^2{}_{u_i}) \quad (14)$$

$$v_i \sim N(0, \sigma^2{}_{v_i}) \quad (15)$$

$$\mu_i = c_0 + \delta' z_i \quad (16)$$

$$\sigma_{u_i} = \exp(c_1 + \gamma' z_i) \quad (17)$$

$$\sigma_{u_i} = \exp(c_2 + \rho' z_i) \quad (18)$$

As per Jondrow et al. (1982), it can be shown that the conditional distribution of u_i given the composed error term $\varepsilon_i = v_i - u_i$, is the normal distribution truncated at zero, with mean $\tilde{\mu} = (\mu_i \sigma^2{}_{v_i} - \varepsilon_i \sigma^2{}_{u_i})/\sigma^2{}_i$ and standard deviation $\sigma_{*i} = \sigma_{u_i}\sigma_{v_i}/\sigma_i$, where $\sigma^2{}_i = \sigma^2{}_{u_i} + \sigma^2{}_{v_i}$. Thus, the point estimator of u_i is given by the conditional mean, i.e.:

$$E(u_i/\varepsilon_i) = \tilde{\mu}_i + \sigma_{*i} \frac{\phi(\tilde{\mu}_i/\sigma_{*i})}{\Phi(\tilde{\mu}_i/\sigma_{*i})} \quad (19)$$

where ϕ and Φ denote the standard normal density and distribution functions respectively. Lastly, the marginal effects of the inefficiency variables are computed from $\frac{\partial E(u_i/u_i>0)}{\partial z_{li}}$, where z_{li} is the l-th element of the inefficiency variables (z_i).

4. FINDINGS AND DISCUSSION

Stochastic Frontier Estimation

The results of the stochastic frontier estimation are presented in Table 3, which includes the results of the frontier function, and the inefficiency and error components. The results of the frontier function estimation show that the level of per capita income has a significant and positive effect on the tax effort (tax to GDP). The level of income constitutes a key variable (the tax base), from which the tax administration extracts taxes. Likewise, the level of capital formation and openness have positive and significant effects on tax effort under different model specifications. Capital formation and openness also relate to the tax base.

Shadow economy size was found to have a negative and significant effect in different model specifications. These results support the results of previous studies (e.g., Gupta, 2007; Kodila-Tedika & Mutascu, 2013) that find that the size of shadow economy reduces tax effort. This is particularly the case because it is difficult to enforce compliance in an environment where rampant informality exists. Informality is high in developing countries, where a sizable number of economic agents undertake transactions in the underground economy (unregistered by any authority), cash transactions are made in cash, and business entities are very small and scattered (which makes them difficult to reach and tax). Thus, efforts to reduce informality are likely to boost revenue mobilisation efforts in countries in SSA. This may require a number of interventions to take place, such as the identification and registration of taxpayers, the provision of support for growth, and fostering full tax compliance among taxpayers. In the same vein,

tax administrations may need to enhance their use of ICT and implement measures to reduce the number of cash transactions taking place (see, for example, Awasthi & Engelschalk, 2018).

The provision of credits to the private sector has a positive and significant effect on tax effort. Credits play an important role in the stimulation of economic activities and, hence, expanding the tax base. The provision of credits to the private sector is also associated with a reduction in informality, especially when these credits are provided by a formal registered financial agent. From this, it can be deduced that different forms of support for business growth, such as the provision of infrastructure for small informal businesses, are likely to improve the tax effort in countries in SSA.

ODA has a negative and significant effect under different model specifications, which conforms to the results of some previous studies that found that high levels of ODA are associated with a reduction in tax efforts; countries which receive high levels of ODA tend to relax their efforts to mobilise domestic revenue. However, there is a strand of studies that show that certain levels of ODA have a positive effect on tax effort, which is channelled through the provision of aid for the improvement of economic structures and tax administration modernisation in developing countries.

The implementation of governance practices, such as executive constraint, has a positive and significant effect on tax effort. Executive constraint, for example, limits corruption amongst public officials. Regulatory quality has a positive and significant effect on tax effort. This is because regulation improves business formalisation and compliance with various regulations, including the tax codes.

Determinants of Technical Inefficiency

The results of the determinants of technical inefficiency are also presented in Table 3 (above). They indicate that an increase in the proportion of staff employed in core tax administration functions, such as tax audit, has a negative and significant effect on the reduction of technical inefficiency. It is interesting that a report by the ATAF (2019) indicates that, in many ATO member countries, tax auditors account for less than 15 per cent of total tax, while the international benchmark is 30 per cent. Low tax recovery rates from tax audits are an indicator of tax administration inefficiency in tax collection.

In addition, organisational inefficiencies, as depicted by the cost of tax revenue collection, increases technical inefficiency. The cost of tax collection may be affected by organisational arrangements, technology utilisation, and staff efficiency. For instance, when a large proportion of a tax administration's staff are inexperienced, it is likely to drive up the cost to revenue ratio. Low utilisation of ICT limits a tax administration's scope for reaching and detecting transactions for the purposes of taxation, while ineffective internal organisation, such as the existence of a poor organisational structure, may hinder some core functions and, therefore, increase inefficiencies.

Furthermore, the results indicate that an increase in the number of taxpayers relative to tax administration staff is associated with an increase in technical inefficiency. Conversely, an increase in number of staff relative to the number of taxpayers reduces technical inefficiency. An increase in the number of staff working for the tax administration is likely to increase efficiency due to the fact that most tax administrations have limited human resources with which to administer a large population of taxpayers who have low compliance attitude. In the

same vein, tax administrations need to capacity-build, i.e. train staff to handle complex tax issues in order to curb tax evasion. In addition to staff numbers, tax administrations also face issues in terms of staff retention, recruitment quality, and staff motivation and progression. When these challenges are dealt with effectively, it can have a positive effect on organisational efficiency.

Table 3: Results of the Stochastic Frontier Estimation

Variables	True Fixed Effect		True Random Effect	
	TFE 1	TFE 2	TRE 3	TRE 4
Frontier function				
Log. GDP per capita	0.34388**	4.215595***	0.190289	3.98576***
	(0.1781)	(0.002476)	(0.154182)	(0.340895)
Shadow economy	-0.14006***	-0.07966***	-0.16826***	-0.0273019
	(0.02191)	(0.000561)	(0.023918)	(0.047605)
ODA	-0.03133**	-0.01644***	-0.04005***	0.0017294
	(0.011396)	(0.000282)	(0.011586)	(0.017922)
Capital formation	0.038718***	0.07962***	0.034401***	0.061887**
	(0.011324)	(0.000341)	(0.010971)	(0.022058)
Openness	0.019334***	0.059896***	0.023254***	0.101861***
	(0.004991)	(0.000145)	(0.004852)	(0.008565)
Private credit	0.060966***	0.000779***	0.054142***	0.0418412**
	(0.011286)	(0.000177)	(0.010032)	(0.016906)
Regulatory quality	0.045148	-3.4597***	0.487465*	
	(0.319254)	(0.010003)	(0.284431)	
Executive constraint	0.308756***	0.136535***	0.399306***	
	(0.074062)	(0.002382)	(0.068931)	
Constant			20.70305***	-16.54205***
			(1.636077)	(3.321857)
Inefficiency				
Staff in core		-0.63199**		-0.7072678**
functions		(0.292031)		(0.344812)
Cost to revenue		0.565196***		0.3494928**
		(0.207552)		(0.153842)
Taxpayers to tax staff		0.002272***		0.002772***
		(0.000421)		(0.000471)
Arrears to revenue		-0.01001*		-0.0010467
		(0.006164)		(0.007288)
Constant		0.243157		
		(0.568928)		
U_σ	1.558383***		1.518309***	
V_σ	0.734687***	-25.11938	0.935871***	-0.391242
σ_u	2.179709***		2.136469***	
σ_v	1.443894***	0.000004	1.596695***	0.8223235***
$\lambda = \sigma_u / \sigma_v$	1.509605***		1.338058***	
θ			6.776677***	4.899666***
Wald Chi2	439.40***	9.66e+08***	699.71***	693.15***
Log-likelihood	-2476.93	-375.32	-2637.52	-475.26
Mean Efficiency (%)	79.6%	74.4%	81.6%	77%
Observations	1073	209	1073	211
Countries	42	23	42	23

*** p<0.01, ** p<0.05, * p<0.1

Arrears recovery has a negative effect, implying that it reduces technical inefficiency. Effectiveness in respect of the actual collection of the assessed taxes is crucially important. A tax administration that has a large log of uncollected arrears is inefficient and ineffective. As the results in Table 3 suggest, tax administrations that are more capable of collecting arrears have higher technical efficiencies. However, it is important to note that, in some cases, arrears data is not well reported as, in practice, these figures are usually included within those for the taxes collected during the period.

Technical Inefficiency Estimates

The true fixed effect and true random effect models produce, more or less, the same results. Most of the parameter estimates for both models conform to the variable specifications, as suggested by economic theory, and are in line with the findings of previous studies. The basic models, which only fit the frontier (i.e. model TFE1 and TRE3), have inefficient estimates that are highly correlated with a Spearman's correlation of 0.9349. Likewise, the two models which include the inefficiency determinants (i.e. model TFE2 and TRE4) have estimates of technical inefficiencies which are highly correlated, with the Spearman´s rank correlation coefficient being 0.7450. In both cases, the correlation coefficients were statistically significant.

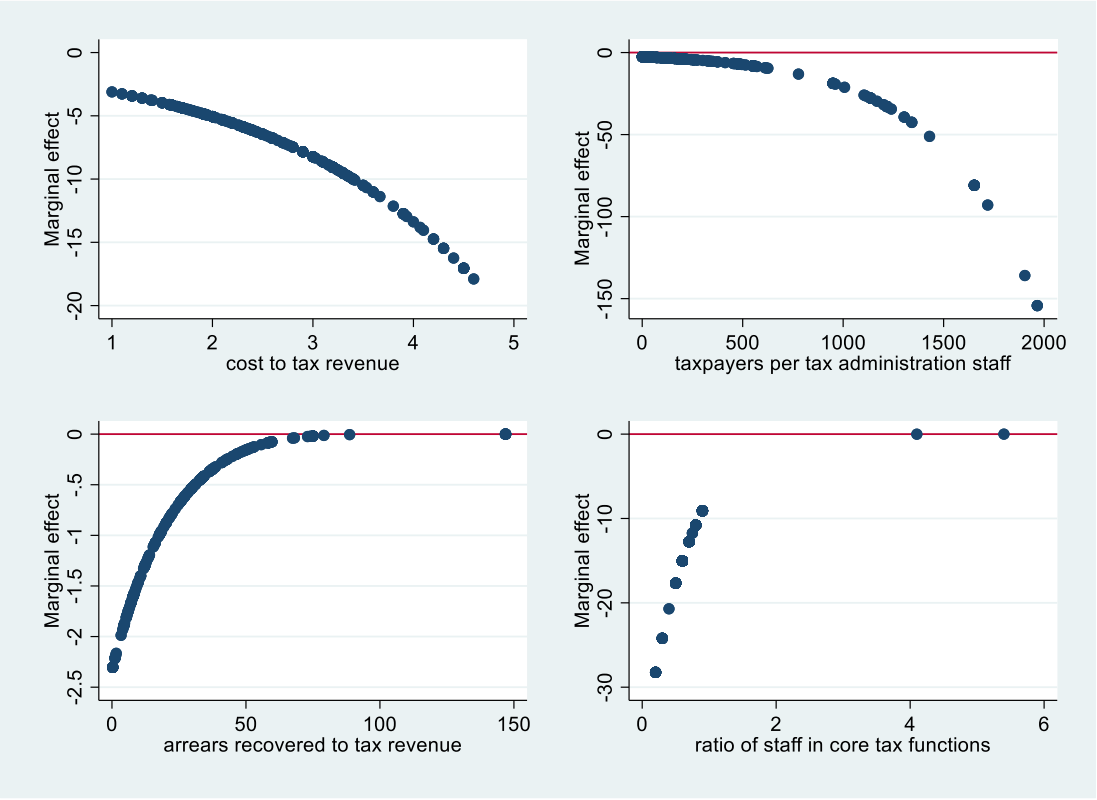
The estimates of average technical inefficiencies are included as an appendix. They show that technical inefficiency varies considerably between the 42 countries in SSA that were studied. The five most technically inefficient countries have average technical inefficiencies of at least 27 per cent, while the least technical inefficient have average technical inefficiencies of, at most, 17.6 per cent. The almost ten percentage points difference in average technical inefficiencies observed between the most and the least inefficient countries are explained by differences in terms of resource allocation, and operational efficiency and effectiveness across countries; these are explored using a marginal effect analysis.

Marginal Effects of the Determinants of Technical Inefficiency

The analysis of the determinants of technical inefficiency is extended to include their marginal effects. When the marginal effect is negative, it implies that an increase in a particular factor is associated with a decrease in technical inefficiency, while a positive marginal effect implies the opposite. The marginal effects of the inefficiency variables were estimated from the stochastic panel frontier and were summarised in scatter plots in four panels (one for each variable) to aid visualisation (Figure 1). The scatter plots show the marginal effects of each inefficiency variable against itself, holding all other variables constant.

The top left and top right panels in Figure 1 reveal that, for higher ratios of cost to revenue and higher numbers of taxpayers per members of tax administration staff, the marginal effects move towards higher negative values. This implies that the size of technical inefficiency is larger when these variables increase. The bottom left and bottom right panels reveal that the marginal effects of arrears recovery and staff in core functions tend towards zero at the higher levels of these variables. This implies that technical inefficiency fades as these variables increase.

Figure 1: Marginal Effects of Inefficiency Variables



5. SUMMARY AND IMPLICATIONS

This study examines the capabilities of tax administrations in SSA countries in relation to technical efficiency in tax revenue extraction. We set out to assess their capabilities and inefficiency in order to address the observed, persistent problem of low tax revenue extraction in these countries. We contribute to the literature by extending the analysis so as to examine how various capability measures affect these tax administrations' technical inefficiencies. We postulate that a tax administration's capabilities play an important role in a country's ability to extract adequate tax revenue. These capabilities include the resourcing of the tax administration, the allocation of resources to core tax administration functions, the utilisation of technologies, the internal organisation of revenue administration functions, internal efficiency, and the level of autonomy. However, due to data limitations, only some of these capabilities are examined.

We take a rigorous approach, involving the estimation of a panel stochastic production frontier and technical inefficiencies, and later derive the marginal effects of the technical inefficiency variables.

We obtain strong evidence that tax administration capabilities affect tax revenue extraction efficiency. The allocation of resources to core tax administration functions reduces technical inefficiency. Likewise, the overall resourcing of the tax administration, as measured by the number of taxpayers to each member of tax staff, reduces technical inefficiency. Internal efficiency, as measured by the cost of revenue collection, reduces technical inefficiencies. Inefficient tax administrations incur high revenue collection costs and are low on technical efficiency. Effective arrears recovery reduces technical inefficiency.

Some measures that could be used to reduce technical inefficiency in tax administrations in order to boost revenue extraction capabilities and achieve higher levels of revenue are suggested. The first is the resourcing of the tax administration, both in terms of human resources and the allocation of these resources to the core functions. The issue of quality of staff is equally important. While we address the issue of employee numbers, it is important to note that greater efficiency can be achieved by recruiting high-calibre staff. These aspects, at some point, require the tax administration to have a reasonable level of autonomy. However, some tax administrations lack this.

In the same vein, it is imperative that the internal efficiency of tax administrations is improved in order to reduce revenue extraction costs and to achieve higher levels of technical efficiency in respect of revenue extraction. This may require the enhanced utilisation of technologies, such as self-service applications, that can enhance taxpayer compliance. This is also likely to impact aspects such as audit effectiveness, integrity of staff, and the convenience of paying taxes which, in turn, will promote greater compliance and reduce technical inefficiency.

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APPENDIX

Average Technical Inefficiencies

S/N	Country	Mean	Std. Dev	S/N	Country	Mean	Std. Dev
1	Rwanda	0.27298	0.06983	22	Tanzania	0.25669	0.12980
2	Cent. Afr. Rep.	0.27166	0.08053	23	Gambia	0.25580	0.13678
3	Ivory Coast	0.27062	0.08094	24	Togo	0.25445	0.14017
4	South Africa	0.27062	0.08430	25	Sierra Leone	0.24968	0.15012
5	Senegal	0.27040	0.08348	26	Burundi	0.24403	0.16220
6	Burkina Faso	0.26775	0.09846	27	Congo*	0.24370	0.16435
7	Ethiopia	0.26551	0.11049	28	Guinea	0.23989	0.17111
8	Comoros	0.26487	0.10839	29	DRC**	0.23763	0.17748
9	Cameroon	0.26370	0.11446	30	Mauritius	0.23714	0.15949
10	Uganda	0.26351	0.11683	31	Namibia	0.23343	0.18204
11	Madagascar	0.26220	0.12163	32	Botswana	0.23122	0.18020
12	Liberia	0.26201	0.12248	33	Malawi	0.21649	0.20918
13	Niger	0.26120	0.11680	34	Gabon	0.21562	0.21476
14	Ghana	0.26071	0.12064	35	Nigeria	0.20880	0.19648
15	Mali	0.26036	0.12344	36	Eq. Guinea***	0.19715	0.22784
16	Zambia	0.25928	0.13102	37	Swaziland	0.19369	0.23952
17	Mauritania	0.25880	0.12894	38	Mozambique	0.17634	0.24057
18	Cape Verde	0.25844	0.12992	39	Angola	0.17566	0.24247
19	Kenya	0.25791	0.12191	40	Chad	0.16772	0.24855
20	Guinea-Bissau	0.25714	0.13789	41	Lesotho	0.15010	0.24883
21	Benin	0.25681	0.13064	42	Zimbabwe	0.14575	0.19688

*The Republic of the Congo. **The Democratic Republic of the Congo.** The Republic of Equatorial Guinea.

THE IMPACT OF TAX HAVEN USE ON TAX ACCRUAL QUALITY

Stephanie Walton[1]

Abstract

A firm's decision to utilize subsidiaries in tax haven jurisdictions is often a complexity increasing, discretionary, tax planning choice. Adding to the tax haven debate, this study examines the relationship between tax haven use and tax accrual quality—i.e., the degree of mapping between cash tax payments and tax expense (Choudhary et al., 2016). While tax haven use is not found to directly impact tax accrual quality, all tax havens are not created equal. Based on signaling theory, firms could use tax accrual quality to signal their intentions to external stakeholders when the subsidiary jurisdiction is a low-quality information environment. Using the Financial Secrecy Index (FSI) to capture the information environment quality of a firm's subsidiaries, I find a positive association between tax haven use and tax accrual quality. That is, tax haven use can assist in decreasing the level of managerial tax accrual estimation error being made despite the fact that tax haven activities are associated with additional complexity.

Keywords: Tax Havens, Subsidiaries, Tax Accrual Quality, Information Environment, Management Estimation Error, Jurisdictions.

1. INTRODUCTION

Financial reporting for income taxes is an area of increasing concern for U.S. investors, standard-setters, and regulators. Investors generally perceive that accounting for income taxes under the United States' generally accepted accounting principles (GAAP) is complex and often opaque, potentially reducing the informativeness of these disclosures, particularly in respect of the analysis of the cash effects of income taxes (Financial Accounting Foundation [FAF], 2012, 2013; Graham et al., 2012; Linebaugh et al., 2013). In response to this widely held perception, the Financial Accounting Standards Board (FASB) has renewed its focus on clarifying the calculation and disclosure of income taxes for U.S. firms (FASB, 2016).[2] Similarly, the Securities and Exchange Commission (SEC) has focused on improving and enhancing the disclosures related to income taxes in corporate filings, as shown by the increasing frequency at which tax-related comment letters are issued to U.S. firms (Kubick et al., 2016; Whalen & Usvyatsky, 2014).[3] Thus, the United States provides an important institutional setting for the examination of financial accounting for income taxes.

The informativeness of tax expense disclosures could be reduced through certain corporate activities. Specifically, anecdotal and academic evidence suggests that a corporation's presence

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[2] Accounting Standards Update (ASU) 740 updates add new tax disclosures and promote greater disaggregation for some existing disclosures, including unrecognized tax benefits, valuation allowance changes, and carryforwards (FASB, 2016).

[3] In 2017, approximately 10 percent of SEC comment letters related to a tax issue, resulting in tax being the seventh most frequently commented area (EY, 2017).

in foreign tax haven jurisdictions is generally associated with increased tax aggressiveness, opportunities for tax-related earnings management, and reduced financial reporting and geographical disclosure transparency (see, for example, Akamah et al., 2018; Dyreng et al., 2012; Dyreng & Lindsey, 2009).[4] The use of tax haven subsidiaries inserts an additional layer of complexity into financial reporting for income taxes via increased secrecy, reduced information sharing with regulators and tax authorities in other countries, greater long-term tax strategy uncertainty, and potentially fewer shareholder protections, regulations, and enforcement activities (e.g., Fan, 2008; Krull, 2004; Thomas, 1999). Importantly, the use of tax subsidiaries can affect tax-related financial reporting through the tax accrual via deferred tax activities that alter the computation of taxes payable versus income tax expense. In contrast to overall financial reporting quality, tax accrual quality—i.e., the degree of mapping between a firm's income tax expense and cash tax payments (Choudhary et al., 2016)—focuses exclusively on tax reporting.[5] The use of tax havens can spur companies to make more decisions regarding the reinvestment of earnings in particular jurisdictions, tax-motivated transfer pricing, income shifting, multi-jurisdictional tax information agreements, and tax reserves than firms with foreign operations that do not use tax havens. Accordingly, in this study, I investigate the following research question: How does subsidiary tax haven use by firms impact tax accrual quality?

While the working capital accrual quality and earnings metrics provide a holistic view, the tax accrual quality specifically isolates the effect of the use of tax havens on the informativeness of existing tax disclosures. My focus on the tax accrual, via income tax expense, is motivated by the fact that higher tax accrual quality serves as a positive signal to the market about a firm's ability to properly estimate its tax obligation and, therefore, provides information beyond overall profitability data (Choudhary et al., 2016). Despite the inherent complexity involved in accounting for income taxes, the extant research shows that income tax expense disclosures provide information on the persistence and growth of current and future earnings, future tax payments, and the extent of earnings management through the tax accrual, incremental to the information contained in pre-tax income (e.g., Ayers et al., 2009; Beardsley et al., 2020; Hanlon, 2005; Hanlon & Heitzman, 2010).

A U.S. firm's use of tax haven subsidiaries could impact the degree of management estimation error in its tax accrual. The use of tax havens not only allows businesses to reduce explicit taxes (Hanlon & Heitzman, 2010), but enables tax haven subsidiaries to change the likelihood that

[4] Tax havens are most often countries outside those in which a firm normally operates, and are characterised by their low tax rates and heightened secrecy laws (Tax Justice Network, 2010-2022). They typically have small populations, few natural resources that can be used for production and sales, and little to entice firms to operate within them beyond the financial opportunities that they provide (Akamah et al., 2018). A list of haven jurisdictions is located in the appendix. While no exact amount of tax haven holdings is available, experts estimate that there is between $21 and $32 trillion of wealth located in tax haven jurisdictions (Clarke-Billings, 2016). At the corporate level, Apple has reported that $181 billion in cash is held by foreign subsidiaries versus about $16 billion held in the United States (Fernández Campbell, 2016).

[5] Although utilizing working capital accrual quality as a measure of overall transparency provides some evidence that tax planning via tax havens yields tax savings while simultaneously increasing financial and organizational complexity, it does not specifically address the tax account (Balakrishnan et al., 2019). After controlling for size and volatility of pre-tax earnings, the correlation between working capital accrual quality and tax accrual quality is 0.14, indicating that the two measures are not equivalent. Additionally, working capital accruals are expected to reverse within a year, whereas some of the estimation error in the tax accrual is expected to reverse over the long term. Tax accrual quality is not highly correlated with tax avoidance, tax risk, and tax-related earnings management proxies (Choudhary et al., 2016). Results found using the above constructs are not guaranteed to hold when tax accrual quality is also measured.

tax payments will be made. Managers could intentionally or unintentionally affect the precision of tax expense estimation when there is greater reliance on tax haven jurisdictions among all disclosed subsidiaries.

Although foreign earnings tend to be more persistent than domestic earnings, tax haven use could introduce regulation, uncertainty, and potential tax planning opportunities that could directly affect the tax accrual. Specifically, Schmal et al. (2021) note that firms report higher income tax expenses after being implicated in a tax haven data leak, suggesting that the use of havens provides an opportunity for greater tax planning when under a firm's managers' control and when this activity will not cause reputational concerns. The authors suggest that less readable tax footnotes following a leak could be attributable to a deflection of attention from operations in critical tax havens (Schmal et al., 2021). Thus, without taking each tax haven jurisdiction's information environment into consideration, greater haven use could either increase estimation error, as it results in greater compliance costs and uncertainty, or reduce estimation error, as it provides greater tax planning opportunities.

Although the perception exists that tax havens can act as "treasure islands" (Peretti, 2016), it is unlikely that all of these jurisdictions do so. According to the signaling theory (see Spence, 1973), the quality of the overall informational environment of the subsidiary could create an incentive for managers to strategically signal their intentions when subsidiaries are located in tax haven jurisdictions associated with reduced transparency. For instance, Dyreng et al. (2012) note that tax haven subsidiaries in strong information environments constrain some tax-related earnings management. Lewellen (2016) notes that when a firm based in the United States incorporates in a tax haven, financial reporting transparency can improve if that firm's primary corporate operations are located in a strong information environment jurisdiction with regulations that promote greater transparency.[6] Firms could use tax accrual quality as a mechanism by which to signal their strategic intent when using tax haven subsidiaries in particular jurisdictions. By increasing the certainty that tax positions will be upheld and confirming whether any tax payments are due, firms can signal that their foreign subsidiary operations have positive intentions, despite the fact that they use tax havens.

To investigate whether firms' tax haven use is associated with tax accrual quality, I utilize a sample of 14,259 U.S. domiciled firm-year observations from 1999-2014 obtained by merging Exhibit 21 Significant Subsidiary Disclosures[7] and Compustat data (Dyreng & Lindsey, 2009). When considering only the impact of tax haven subsidiary use, I do not find evidence that their use is associated with tax accrual quality. However, subsidiary information environment quality could have a moderating effect on the relationship between tax haven use and tax accrual quality. Utilizing financial secrecy (the extent of cross-border refusal to share financial information with legitimate regulatory and judicial entities) as a proxy for subsidiary information environment quality, I find a positive association between tax haven use, financial secrecy, and tax accrual quality. That is, firms with greater tax haven use and operations in

[6] Financial reporting transparency is measured by the author through overall accrual quality, earnings informativeness, and analyst forecast accuracy.

[7] U.S. public firms must report all significant subsidiaries in Exhibit 21 when filing a 10-K annual report with the SEC. 10-K filings contain annual audited financial statements, notes, and management's discussion. A significant subsidiary is one that has more than ten percent of total assets, earns at least ten percent of total net income, or is the parent of other subsidiaries that together could be considered significant. If the subsidiaries are continuing the same line of work as the parent company, the specific subsidiaries do not have to be identified and the number of foreign subsidiaries will suffice (17 CFR 229.601).

jurisdictions with higher financial secrecy report higher tax accrual quality despite the additional uncertainty created by participating in tax haven activities.

An examination of the conditional model effects provides further evidence that there is higher tax accrual quality—and greater informativeness of the tax expense disclosure—with greater tax haven use after considering subsidiaries' information environments. U.S. domiciled firms do appear to use tax accrual quality as a mechanism for signaling discretion over foreign subsidiary operations and have the ability to estimate tax implications with greater certainty, leading to more precise mapping between cash tax payments and the tax accrual. Subsequent analyses further suggest that the incentive to provide a signal to external stakeholders about tax haven use depends on auditor involvement, the extent of tax planning, and how the information environment quality is captured.

This study contributes to the tax haven literature by showing that the use of tax haven subsidiaries can provide additional tax-related information to external stakeholders, contributing to a firm's overall financial reporting quality and the utility of existing disclosures. Results suggest that managers are incentivized to provide additional tax accrual information when tax haven subsidiaries are in jurisdictions with less transparency. Further, the study contributes to the signaling theory literature by examining the distinct decision to disclose significant foreign subsidiaries and the discretionary choice to form, maintain, and disclose tax haven subsidiaries. The information content of the tax expense depends on the overall quality of the information environment of the subsidiary. Distinct from a firm's overall financial reporting quality, tax accrual quality attempts to isolate the specific effect of tax haven subsidiaries on tax expense disclosure and, in particular, management estimation error. This study also acts as a natural extension to Choudhary et al. (2016) by examining how tax havens affect tax accrual quality in a different way to non-haven foreign operations.

In addition to examining tax haven use through a tax minimization lens, this study provides evidence of the way in which firms' financial reporting is affected. The results provide timely evidence to investors, tax fairness campaigners, and other interested stakeholders of the role that tax haven subsidiaries and their information environments play in tax reporting quality. In particular, this study provides guidance on the FASB's continued project: updating ASC 740. While there have been recent legislative changes in the United States—as part of the Tax Cuts and Jobs Act of 2017—that increase complexities for firms when reporting tax information to the Internal Revenue Service and create uncertainties about foreign operations, tax reporting quality does not necessarily suffer due to foreign haven operations. In light of renewed attention towards low-taxed intangible assets and base erosion, this study also provides greater context to the larger discussion surrounding country-by-country reporting. Although the FASB has backed away from incorporating such disclosures as part of firms' annual reports, country-by-country reporting still provides the IRS with an opportunity to gather additional information about the extent of firm subsidiaries' operations globally. The focus of the current study provides initial evidence of how tax haven jurisdiction use can impact U.S. firms' financial reporting. However, it may not be possible to generalize the use of foreign subsidiaries disclosures to other jurisdictions.

The remainder of the paper is as follows: Section 2 develops hypotheses, while Section 3 describes the research design. Section 4 discusses results and Section 5 concludes.

2. PRIOR RESEARCH AND HYPOTHESES

Tax Haven Use

Tax haven jurisdictions incrementally add to the complexity and uncertainty faced by a firm. It is necessary for firms to consider regulations, compliance activities, and long-term tax strategies and, simultaneously, to determine how to treat tax haven-related transactions (Krull, 2004). While the use of tax havens can increase firm value, operating in tax haven jurisdictions could also create additional risk and lead to managerial opportunism (Desai & Dharmapala, 2006). Tax sheltering firms engaging in the most aggressive tax strategies do tend to have more foreign operations and tax haven subsidiaries than non-sheltering firms (Lisowsky, 2010; Wilson, 2009). Additionally, Dyreng and Lindsey (2009) note that the use of tax haven subsidiaries is associated with a 1.5 percentage point reduction in the global tax burden and a reduction of $64 billion in current tax expense over a 12-year period. Changing regulatory costs likely increase the appeal of using tax haven jurisdictions and the degree of profit shifting out of the United States (Klassen & Laplante, 2012).

Similarly, research suggests that firms' tax haven use is associated with lower quality geographical earnings disclosures and, ultimately, reduced reporting transparency in respect of global operations and true investment risk (e.g., Hope et al., 2013). Firms that disclose fewer geographical segments tend to have lower foreign earnings prices than firms with increased segment disclosures. This is consistent with findings that geographical disclosures improve transparency and investors' monitoring capabilities (Hope et al., 2008). Tax shaming incidents in the media reinforce the link between tax havens and immoral, secretive activities (Barford & Holt, 2013). U.S. institutional investors, such as the California Public Employees' Retirement System (known as CalPERS), have even threatened to divest and block the stock and bond purchases of firms that use foreign tax havens (Hanlon & Slemrod, 2009). Negative public perceptions about tax haven use potentially impact the quality of tax disclosures related to tax haven subsidiaries (O'Donovan et al., 2019).

Whether tax haven subsidiaries impact financial reporting transparency or income tax expense disclosure is unknown. While two studies—Lewellen (2016) and Lewellen et al. (2021)—examine strategic parent entity incorporation in tax havens, they do not examine the characteristics of the tax havens themselves. Moreover, these studies find that the decision to incorporate in a tax haven is associated with greater financial transparency if the firm actually operates in a different jurisdiction with a strong information environment.[8] The financial reporting decision to locate a firm's legal parent entity in a tax haven shifts the focus away from recurring, operating firm activities, which are often conducted through the creation and use of subsidiaries in multiple jurisdictions. Examining the placement and disclosure of subsidiaries, which could be located in tax haven jurisdictions, can provide incremental knowledge about the tax implications of a firm's operations. Transparent disclosures about the location of a firm's operations could facilitate an assessment of its income tax expense relative to its tax-related payments, especially if tax havens are used. As the intricacies of the income tax expense disclosure are not captured through overall financial reporting quality, examining

[8] Lewellen (2016) measures transparency through accrual quality, earnings informativeness, and analyst forecast accuracy, while Lewellen et al. (2021) focus on the cost of capital premium resulting from haven incorporation. Lewellen et al. (2021) find that the equity capital premium is reduced for operations located in a strong information environment jurisdiction.

the relationship between tax haven subsidiaries and the informativeness of the tax expense disclosure can provide incremental information about the impact of foreign tax haven use.

Tax Accrual Quality

Tax accrual quality—the degree of mapping between a firm's income tax expense and cash tax payments (Choudhary et al., 2016)—specifically targets the oft opaque income tax expense disclosure located in firms' 10-K annual filings. Although tax haven subsidiaries are associated with tax minimization and less financial reporting transparency, there is not an automatic link between the quality of a firm's tax accrual and tax haven operations. A firm could choose to engage in aggressive tax planning, including tax haven-facilitated income shifting, yet still provide a precise estimate of its tax accrual as it maps into past, present, and future cash tax payments. Choudhary et al. (2016) explain that permanent book tax differences do not affect tax accrual quality because the total income tax expense and cash income taxes paid are the same for these amounts. Rather, temporary book tax differences affect tax accrual quality. Choudhary et al. (2016) describe tax accrual quality as being comprised of two components: management estimation error and GAAP-induced mismapping. A large portion of management estimation error in the tax accrual is caused by the idiosyncratic complexities of the tax account, as tax practices are often tailored to suit a firm's unique circumstances. The application of technical U.S. GAAP standards and knowledge to the financial reporting of income taxes can result in GAAP-induced mismapping. While GAAP-induced mismapping applies across firms, estimation error is contingent on the specific decisions made by a firm. Thus, the current study focuses on the estimation error component of tax accrual quality.

Tax expense estimation error is costly because it decreases earnings informativeness (Choudhary et al., 2022). Additional estimation errors relating to tax haven use can further decrease the utility of existing tax disclosures. When there is a higher degree of precision between financial reporting for income taxes and tax-related cash payments, the tax accrual provides information that is incremental to pre-tax financial income. Ayers et al. (2009) note that there is an inverse relationship between the extent of a firm's tax planning and the incremental information content of estimated taxable income over book income, suggesting that there is a need to examine the impact of tax haven subsidiaries on tax accrual quality in order to better understand their impact on tax reporting.

Tax haven subsidiaries could impact management estimation error—whether intentional or unintentional—in several ways: through the designation of reinvested earnings, tax-motivated transfer pricing and income shifting, multi-jurisdictional tax information agreements, and the designation of tax reserves. Greater tax haven use could exacerbate the effect that such subsidiaries have on tax accrual estimation error. Without taking each tax haven jurisdiction's information environment into consideration, greater haven use could either increase estimation error as a result of the higher compliance costs and greater uncertainty involved, or reduce estimation error as a result of the greater tax planning opportunities that would be provided.

First, reinvested earnings can affect the estimation of the extent of deferred tax activities. Profits from tax havens can be designated as permanently reinvested and, if so, are subject to lower U.S. taxation rates, even following the introduction of the Tax Cuts and Jobs Act of 2017. While permanent book tax differences do not affect tax accrual quality, the designation of permanently reinvested earnings reduces the extent of temporary book tax differences that could create uncertainties between tax expense and cash tax payments. Reinvested earnings

provide greater certainty as to the tax treatment of those earnings (e.g., Krull, 2004). Any amount of haven earnings not deemed to be permanently reinvested would increase the total income tax expense and the income taxes payable but would not necessarily increase the cash payments, which could affect tax accrual quality. As such, greater haven use could either result in greater certainty coming from reinvesting earnings, or greater potential tax payments if the income is eventually subject to the full U.S. corporate tax rate. More (less) reinvested earnings could thus increase (decrease) tax accrual quality by reducing (increasing) temporary book tax differences.

Second, greater tax haven use could spur greater tax-motivated transfer pricing. Taylor et al. (2015) find that tax haven use is positively associated with transfer pricing aggressiveness. As a tax planning opportunity, tax-motivated transfer pricing enables firms to obtain a tax benefit and, at the same time, increases international tax enforcement challenges related to international tax enforcement efforts. The downward management of tax payments by means of the allocation of profits and losses among firm entities located in different tax jurisdictions through transfer prices could increase or decrease tax accrual estimation error (Hanlon & Heitzman, 2010). Reallocating taxable income (such as service fees, royalties, and dividends) or expenses (such as research and development, intangible asset, and advertising costs) that are well founded, or less likely to be questioned by regulators and tax authorities, could increase tax accrual quality. In particular, the greater certainty gained in relation to tax-motivated transfer pricing when there is economic substance behind each transaction could be reflected in the relationship between tax expense and tax payments.

However, if tax-motivated transfer pricing is a part of a riskier tax strategy, there could be additional uncertainty about the merit of such actions. Greater uncertainty relating to transfer pricing activities could increase complexity when estimating the income tax accrual and increase overall risk.

Third, tax haven use can have implications for multi-jurisdictional tax information agreements. Further consideration of legislation in multiple jurisdictions, potential legal implications, and whether additional taxes will be owed could directly impact tax accrual estimation. By operating in additional jurisdictions, firms could renew attention to the question of which tax authorities have access to underlying tax haven information. The existence of agreements to share information between different jurisdictions could cause concerns to arise about transparency in relation to tax haven use and discourage firms from relying heavily on tax haven operations (Bennedsen & Zeume, 2016; Schmal et al., 2021).

Reputational concerns surrounding the spread of the tax repercussions of operating in haven jurisdictions could cause greater uncertainty and result in tax planning opportunities being reined in. While tax planning opportunities are expected to persist in these jurisdictions (see, for example, Schmal et al., 2021), less aggressive opportunities provide a better understanding of deferred tax implications. As a result, there could be greater estimation precision between the tax accrual and cash tax payments if managers are aware that tax haven operation information will be shared with multiple tax authorities.

Fourth, greater haven use could result in changes being made to the assessment and recording of tax reserves. Although the accrual may not reverse in the short term, tax accrual quality captures management estimation error over the long term. A firm could recognize a tax accrual for income shifted into a tax haven subsidiary by creating a deferred tax liability or a reserve

for an uncertain tax position given the strategy used to shift income (Gleason & Mills, 2011; Krull, 2004). While the creation of a deferred tax liability or an increase in reserves could affect financial reporting for income taxes, it also increases uncertainty when determining whether any cash tax payments will occur. Uncertainty surrounding the eventual settling of a tax position and any inquiries made by various tax authorities further exacerbate the difficulty in assessing the probability of tax payments being required. However, the secrecy provided by haven jurisdictions could reduce the likelihood that a tax position will eventually be questioned by a tax authority, reducing future tax payments and mitigating the impact of reserves on the financial accounting of income taxes. In turn, tax reserves relating to haven use could benefit or hinder the estimation of the tax accrual in the current period.

The decision to use and maintain subsidiaries in tax haven jurisdictions extends beyond pure tax or financial reporting purposes. Due to the uniqueness of tax accrual quality, tax haven subsidiaries could impact the tax expense disclosure positively or negatively. Tax haven subsidiaries could enable more precise estimations between cash tax payments and tax expense to be made. Greater precision could come from greater tax position certainty or greater management discretion over tax planning activities. As tax haven operations are not required to operate in a multinational environment, managers have greater discretion with regard to the extent to which their firm operates in such jurisdictions and the extent to which they use haven-related tax planning (Dyreng & Lindsey, 2009; Holzer, 2013). Precise tax accrual estimates could indicate that tax haven use does not hinder a firm's ability to estimate its tax obligation, despite the fact that the use of havens can cause reduced geographical transparency and, potentially, provide more tax planning opportunities (Akamah et al., 2018; Dyreng et al., 2012). Conversely, greater haven use could result in additional uncertainty about the tax outcomes of haven operations, leading to greater estimation error. Lower tax accrual quality would support the preexisting perception that the additional complexity afforded by tax havens could be harmful to a firm and its stakeholders, who rely on existing tax disclosures. Hence, the first hypothesis posits that tax haven use is associated with tax accrual quality.

H1: Tax haven use is associated with tax accrual quality.

Certain tax havens, such as the Cayman Islands, actively attempt to disassociate corporate activities within their borders from tax evasion (Peretti, 2016). These jurisdictions claim that they are not actually tax havens and that there are legitimate reasons for operations to have a presence there, such as to facilitate international trade (Peretti, 2016). Furthermore, some tax havens and foreign subsidiaries have more stringent laws and financial regulations than other jurisdictions, so tax-related activities that take place within them have more definitive outcomes. Financial reporting and tax disclosure requirements differ across jurisdictions, with some jurisdictions requiring firms to make additional disclosures in order to provide evidence of the legitimacy of their operations and the extent of any tax-motivated transfer pricing taking place. Jurisdictions with stronger information environments—such as those that use common law, have stable governments, grant investor rights, and/or are conducive to ownership concentration—can limit managerial decisions and some private gains (Atwood, Drake, & Myers, 2010; Blaylock et al., 2012). Stronger information environments across subsidiary jurisdictions could impact the creation of reserves in respect of uncertain tax positions, affect discretion when determining a deferred tax liability, and reduce estimation error in relation to a firm's tax expense. Dyreng et al. (2012) note that tax haven subsidiaries located in jurisdictions with weak information environments facilitate increased levels of earnings management.

Thus, the overall information environment of a firm's subsidiaries could incentivize managers to communicate additional tax information with external stakeholders through tax accrual quality. Signaling theory notes that not all agents share the same information and that some agents (e.g., managers) have more information about a firm's future prospects than others (Spence, 1973). Managers can use additional privileged information to provide signals to stakeholders about a firm's future prospects. Multiple subsidiaries can be created and operated in a variety of jurisdictions. While GAAP-induced mismapping is expected to persist, the extent of tax accrual estimation error for firms that use tax haven operations more extensively is more likely to be affected by information environment quality than it is for firms with foreign operations in non-tax haven jurisdictions.

Since the use of tax havens creates more incremental uncertainty than the use of other foreign operations, managers can signal their strategic intentions about tax haven operations when the quality of the information environments of subsidiary jurisdictions is poorer. If subsidiaries are located in high transparency jurisdictions, tax accrual quality would likely be guided by existing rules and disclosures. However, in jurisdictions with less transparency, managers have greater insight into the operations than external stakeholders. The provision of higher quality tax accrual information through smaller estimation error can signal that there is an underlying business purpose for a firm's tax haven operations. Furthermore, higher tax accrual quality signals that tax haven operations in reduced transparency operations do not adversely affect a firm's financial reporting quality.

Firms could, therefore, use tax accruals to enable their shareholders to gain a better understanding of the tax implications of using havens and to produce more precise tax estimates. Greater reliance on tax haven operations could allow a firm to create a long-term strategy where its managers are able to better estimate income tax expense and predict with greater certainty whether tax payments will be made. The idiosyncratic nature of subsidiaries is likely to impact the tax accrual in a different way than it impacts firm-level financial reporting quality. Therefore, I expect that the managers' incentive to signal higher quality tax information depends on the quality of the subsidiary information environment. As such, information environment quality is expected to act as a moderating factor between tax haven use and tax accrual quality. The second hypothesis states:

> **H2:** Subsidiary information environment quality impacts the association between tax haven use and tax accrual quality.

3. RESEARCH DESIGN

Sample Selection

Sample selection began with the universe of observations and Compustat data was used to estimate Model 1 (70,700 firm-years). 50,763 firm-year observations generate TaxAQ values from 1999 through 2014 after requiring at least five years of consecutive data and 20 observations per industry-year. The sample begins in 1999 to ensure that all changes due to the implementation of SFAS 109 (Accounting for Income Taxes)[9] are consistently applied and ends prior to the implementation of the Tax Cuts and Jobs Act of 2017, which could impact

[9] Issued by the FASB, SFAS 109 establishes the financial accounting and reporting of the impact of income taxes, including current and deferred tax liabilities and assets.

firms' use of tax havens and add tax reporting complexities, such as issues relating to the change in the statutory corporate income tax. Furthermore, the sample period ends prior to the Panama Papers tax data leak that took place on April 3, 2016 in order to ensure that firms have the same reporting incentives for haven subsidiaries. The examination of Exhibit 21 significant subsidiaries necessitated a focus on firms that file 10-K reports with the SEC (i.e., firms domiciled in the United States). The requirement for no missing values for Exhibit 21 data and control variables resulted in a final sample of 14,259 observations (2,543 unique multinational firms).[10] Table 1 provides additional details about the sample selection criteria.

Table 1: Sample Selection

	TaxAQ
Universe of firm-year observations with tax accrual quality determinant variables between 1999 and 2014	70,700
Less: Observations with fewer than five years of consecutive data and at least 20 observations per industry-year	(19,937)
	50,763
Less: Firm-year observations with missing Exhibit 21 data (only U.S. domiciled firms are retained)	(27,310)
	23,453

Research Design

To examine the association between firms' tax haven operations and tax accrual quality, I use Exhibit 21 Significant Subsidiary Disclosures from 1999 to 2014, which provide data on firms' significant subsidiary operations and confirm whether the jurisdictions within which these operations are based are considered to be tax havens.[11] Tax accrual ($TaxACC_{jt}$) is measured as the difference between total income tax expense and income-related cash outflows using the statement-of-cash-flows approach. Cash tax payments (CTP) from *t*-1 through *t*+1 and current period changes in long-term deferred tax assets and losses (ΔDTA_LT_{jt} and ΔDTL_LT_{jt}) are included in Model 1, with all variables scaled by total assets (Choudhary et al., 2016; Choudhary et al., 2021). $TaxAQ_{jt}$ is then calculated as the standard deviation of firm *j*'s residuals from *t*-4 through *t* using Fama-French 48 industry-year regressions, multiplied by negative one, such that a larger number indicates higher quality. A minimum of 20 observations per industry-year is required.[12]

[10] Results are qualitatively similar if utilities and financial firms are removed from the sample.

[11] While Exhibit 21 Significant Subsidiary Disclosures are public as part of Form 10-K, the disclosures are not easily compiled. Dyreng and Lindsey (2009) leverage a text search program to identify more subsidiaries in distinct countries for a larger range of corporations than would be possible if the data were collected by hand. I thank the authors for making this data available. Firms must have at least one foreign (non-U.S.) subsidiary to be included in this dataset. The designation of a jurisdiction as a tax haven occurs when a jurisdiction appears on at least two of four tax haven lists (Akamah et al., 2018). The full list of tax haven jurisdictions can be found in the appendix.

[12] The tax accrual quality (TaxAQjt) measure requires tax accrual information from *t*-4 through *t* and, as a result, needs input information from *t*-5 through *t*+1. Therefore, the initial Compustat sample extends five years prior to the Exhibit 21 data. A firm must have a minimum of five years of data to calculate rolling windows of $TaxAQ_{jt}$.

$$TaxACC_{jt} = \beta 0 + \beta_1 CTP_{jt-1} + \beta_2 CTP_{jt} + \beta_3 CTP_{jt+1} + \beta_4 \Delta DTL\_LT_{jt} + \beta_5 \Delta DTA\_LT_{jt} + \varepsilon_{jt} \quad (1)$$

Given partial observability in the setting (e.g., Phillips, 2003), I use a two-stage Heckman approach to control for the strategic decision to have and disclose a haven subsidiary. Model 2 presents the first stage model of the strategic disclosure decision. HIGH_SUB is a dichotomous variable set equal to one for firm-years with an above industry median amount of Exhibit 21 subsidiaries and to zero for below median amounts. HIGH_SUB captures whether a firm is willing to disclose a greater number of subsidiaries, regardless of whether these subsidiaries are located in tax haven jurisdictions. If firms have a greater number of disclosed subsidiaries, there is greater strategic subsidiary disclosure and there could be a greater willingness to disclose haven use. Based on Dyreng and Lindsey (2009) and Dyreng et al. (2020), the decision to have and disclose subsidiaries is driven by firm size (SIZE), payment of taxes on foreign operations (FOREIGN), profitability (LEV, ROA, NOL), ownership of intangible assets (INTANG), capital intensity (PPE), and industry differences (IND). Fitted values from the first stage regression are used to calculate the Inverse Mills Ratio (IMR_{jt}), which is then included in each second stage model.[13]

$$HIGH\_SUB_{jt} = \beta_0 + \beta_1 SIZE_{jt} + \beta_2 FOREIGNjt + \beta_3 LEV_{jt} + \beta_4 ROA_{jt} + \beta_5 NOL_{jt} + \beta_6 INTANG_{jt} + \beta_7 PPE_{jt} + \beta_8 k\Lambda IND_{jt} + \varepsilon_{jt} \quad (2)$$

I then estimate a second stage ordinary least squares (OLS) regression with $TaxAQ_{jt}$ as the primary dependent measure and tax haven use ($HAVEN_{jt}$) as the primary independent variable of interest. I use the percentage of tax haven countries to total unique countries (HAVEN%) and the percentage of tax haven subsidiaries (HAVENINT) as measures of tax haven use (Dyreng & Lindsey, 2009).

Industry and year fixed effects are also included (Balakrishnan et al., 2019). All continuous variables are winsorized at the 1st and 99th percentiles and are mean centered. The standard error is corrected.[14]

$$TaxAQ_{jt} = \beta_0 + \beta_1 HAVEN_{jt} + \beta_2 SIZE_{jt} + \beta_3 FOREIGN_{jt} + \beta_4 TAX\_LOSS_{jt} + \beta_5 PTBI\_VOL_{jt} + \beta_6 AQ_{jt} + \beta_7 BIG4_{jt} + \beta_8 MTB_{jt} + \beta_9 LEV_{jt} + \beta_{10} ROA_{jt} + \beta_{11} NOL_{jt} + \beta_{12} SUBMAT_{jt} + \beta_{13} INTANG_{jt} + \beta_{14} RDjt + \beta_{15} ADV_{jt} + \beta_{16} PPE_{jt} + \beta_{17} ESO\_INDUSTRY_{jt} + \beta_{18} DISC\&EXTRA_{jt} + \beta_{19} IMR_{jt} + \varepsilon_{jt} \quad (3)$$

I include control variables based on the extant tax research. First, factors that are associated with tax accrual quality, as noted by Choudhary et al. (2016, 2022), including working capital accrual quality, employee stock options, and discontinued and extraordinary items. Based on Francis et al. (2005), working capital accrual quality (AQ) is measured in a similar way to TaxAQ, and maps past, present, and future working capital accruals into cash flows from operations. AQ is included to control for overall financial reporting quality and to further differentiate any additional informational value of TaxAQ. AQ is expected to be positively associated with TaxAQ. Following Choudhary et al. (2016), I control for GAAP-induced

[13] Results are robust to the removal of IMR in the second stage model.
[14] The standard error is corrected through the HECKIT option of PROC QLIM procedure in SAS.

mismapping between book and tax reporting, using the presence of employee stock options (ESO_INDUSTRY), and discontinued and extraordinary items (DISC&EXTRA). Therefore, TaxAQ captures management estimation error, both intentional and unintentional, when mapping cash tax payments to the tax accrual.

I also include four firm characteristic variables identified by Choudhary et al. (2016) that are associated with increased complexity when applying tax-related GAAP: firm size (SIZE), taxable foreign operations (FOREIGN), the presence of a tax loss (TAX_LOSS), and pre-tax earnings volatility (PTBI_VOL). Balakrishnan et al. (2019) note that factors associated with tax planning could affect a firm's decision to use tax haven subsidiaries. Thus, the current study takes a similar approach and proxies for tax planning opportunities through the presence of a Big 4 auditor (BIG4), firm growth (MTB), net operating loss (NOL), leverage (LEV), and return on assets (ROA). Hope et al. (2013) find that the decision to use a tax haven can also be influenced by the amount of intangible assets held by a firm (INTANG), as well as research and development (RD) costs, property, plant and equipment (PPE) expenses, and advertising (ADV) spend. I further control for the materiality of subsidiaries presented (SUBMAT) and the Inverse Mills Ratio from Model 2 (IMR).

I then test the association between subsidiary information environment quality and the HAVEN measures. The Financial Secrecy Index (FSI) developed by the Tax Justice Network—a prominent organization that campaigns for tax fairness—provides static indices for 92 unique countries, including most tax haven jurisdictions and the United States (Tax Justice Network, 2016). The index quantifies the size of the jurisdiction with regard to the provision of offshore financial services and comprises 15 criteria relating to the transparency of beneficial ownership, corporate regulation, tax and financial regulation efficiency, and international standards and cooperation.[15] Higher indices are synonymous with higher financial secrecy within the jurisdiction. Firm-year information environment quality is measured as the average FSI score for all unique subsidiary jurisdictions. That is, the FSI captures the information environment quality of all of a firm's subsidiaries. All continuous variables are mean centered.

$$\begin{aligned} TaxAQ_{jt} = {} & \beta_0 + \beta_1 HAVEN_{jt} + \beta_2 FSI_{jt} + \beta_3 HAVEN_{jt}*FSI_{jt} + \beta_4 SIZE_{jt} + \\ & \beta_5 FOREIGN_{jt} + \beta_6 TAX\_LOSS_{jt} + \beta_7 PTBI\_VOL_{jt} + \beta_8 AQ_{jt} + \beta_9 BIG4_{jt} + \\ & \beta_{10} MTB_{jt} + \beta_{11} LEV_{jt} + \beta_{12} ROA_{jt} + \beta_{13} NOL_{jt} + \beta_{14} SUBMAT_{jt} + \beta_{15} INTANG_{jt} + \\ & \beta_{16} RD_{jt} + \beta_{17} ADV_{jt} + \beta_{18} PPE_{jt} + \beta_{19} ESO\_INDUSTRY_{jt} + \beta_{20} DISC\&EXTRA_{jt} + \\ & \beta_{21} IMR_{jt} + \varepsilon_{jt} \end{aligned} \quad (4)$$

[15] Developed by a team of economists, accountants, and journalists at the Tax Justice Network, the Financial Secrecy Index has a specific focus on tax haven jurisdictions and offshore financial services. The index is politically neutral and specifically isolates the effect of *financial* regulations and secrecy laws, rather than *overall* jurisdiction laws and regulations, on firm activities. While previous index iterations have been developed (in 2009, 2011, and 2013), these cannot be directly compared due to methodological differences. However, the secrecy criteria used in the development of the index have not significantly changed and many of the top FSI jurisdictions are well known tax havens, alleviating some concerns. Furthermore, tax haven secrecy is sticky, with few significant changes having taken place during the last decade despite the fact that the subject has attracted increasing media and political attention. As the setting could also be affected by the 2008 financial crisis, in an untabulated analysis, I drop all observations in 2008 and 2009. The results are robust.

4. RESULTS

Descriptive Statistics

Table 2, Panel A presents descriptive statistics for Model 4 variables. On average, 19.9 percent of all disclosed subsidiary jurisdictions are located in tax havens (HAVEN%) and 18.9 percent of all subsidiaries are in tax havens (HAVENINT). Since firms may have foreign operations without paying or reporting tax payments on foreign income, as evidenced by only 68.8 percent of firms reporting foreign tax payments, the inclusion of FOREIGN in the first stage model alleviates concerns about multinational firms' aggressive tax planning and/or transfer pricing activities. Firms are also more likely than not to have a tax loss (TAX_LOSS) and to use a Big 4 auditor (BIG4).[16]

In Panel B, I present the FSI scores and the rule of law—an alternative subsidiary information quality measure—average scores for each jurisdiction. Tax haven jurisdictions are shown separately from non-tax haven jurisdictions. I find that tax haven jurisdictions have a higher average FSI score than non-tax haven jurisdictions (t=2.159) while there is no jurisdictional difference utilizing average rule-of-law scores, i.e., a high FSI does not automatically correspond with weaker rule of law. Panel C presents Spearman correlations. FSI score is weakly positively associated with the HAVEN variables and is negatively correlated with TaxAQ. This is consistent with increased secrecy resulting in lower reporting quality.

Table 2: Descriptive Analyses

This table provides summary statistics relating to key characteristics of the firm-year observations in the 1999 to 2014 sample. Tax accrual quality (TaxAQ) is presented along with two measures of tax haven use: the percentage of subsidiary countries that are tax haven jurisdictions (HAVEN%) and the percentage of all subsidiaries that are located in tax haven jurisdictions (HAVENINT). Details of the variable definitions are provided in the Appendix. All continuous variables are winsorized at the 1% and 99% levels. Bolded correlation coefficients are statistically significant at the 5% level.

Panel A: Descriptive Statistics

Variable	N	Mean	25th Pctl	Median	75th Pctl	Std Dev
TaxAQ	14,259	-0.016	-0.021	-0.012	-0.007	0.012
HAVEN%	14,259	0.199	0.000	0.167	0.286	0.230
HAVENINT	14,259	0.189	0.000	0.127	0.263	0.238
FSI	14,259	362.289	230.933	309.030	431.140	218.026
RULE_OF_LAW	13,033	1.029	0.705	1.062	1.456	0.529
SIZE	14,259	6.402	5.057	6.378	7.742	2.103
TAX_LOSS	14,259	0.213	0.000	0.000	0.000	0.409
PTBI_VOL	14,259	0.112	0.026	0.054	0.112	0.206
FOREIGN	14,259	0.688	0.000	1.000	1.000	0.463
AQ	14,259	-0.065	-0.077	-0.046	-0.029	0.066
ROA	14,259	0.031	-0.016	0.0573	0.121	0.190
MTB	14,259	2.528	1.160	1.929	3.185	3.551
LEV	14,259	0.217	0.019	0.183	0.331	0.216
BIG4	14,259	0.803	1.000	1.000	1.000	0.398
INTANG	14,259	0.228	0.400	0.153	0.341	0.243

[16] 80 percent of firms use a Big 4 auditor. In the main analyses, BIG4 is consistently negatively associated with the TaxAQ suggesting that using a Big 4 auditor does not necessarily result in more precise tax accrual estimates.

RD	14,259	0.046	0.000	0.009	0.066	0.076
ADV	14,259	0.012	0.000	0.000	0.007	0.031
NOL	14,259	0.482	0.000	0.000	1.000	0.500
PPE	14,259	0.501	0.192	0.373	0.689	0.522
SUBMAT	14,259	2.231	1.333	1.857	2.579	1.485
ESO_INDUSTRY	14,259	0.589	0.000	1.000	1.000	0.492
DISC&EXTRA	14,259	0.029	0.000	0.000	0.000	0.168
CASH_ETR	10,797	0.251	0.100	0.223	0.335	0.211

Panel B: Jurisdictions' Information Environment Quality

	Financial Secrecy Index	**Rule of Law (Average)**
Mean		
Tax haven jurisdictions	281.61	0.74
Non-tax haven jurisdictions	193.73	0.84
t-stat.	2.159 (p<0.05)	-0.599
Tax Haven Jurisdictions		
Switzerland	1,466.1	1.87
Hong Kong	1,259.4	1.43
Singapore	1,147.1	1.63
Cayman Islands	1,013.1	1.09
Luxembourg	816.9	1.81
Lebanon	760.2	-0.53
Bahrain	471.3	0.47
Macao	420.1	0.65
Panama	415.6	-0.15
Marshall Islands	405.5	-0.07
Jersey	354.0	1.74
Guernsey	339.3	
British Virgin Islands	307.6	
Barbados	298.3	1.18
Mauritius	297.0	0.94
Bahamas	273.0	1.00
Malta	260.9	1.37
Uruguay	255.5	0.57
Isle of Man	228.5	
Liberia	218.2	-1.35
Bermuda	217.7	1.01
Cyprus	213.9	1.02
Liechtenstein	202.3	1.47
Ireland	187.4	1.66
Vanuatu	142.8	0.17
U.S. Virgin Islands	118.2	0.89
Samoa	117.5	0.81
Gibraltar	109.3	
Aruba	99.5	1.14
Latvia	92.7	0.59
Belize	92.4	-0.27
Botswana	90.5	-0.43
Anguilla	89.3	1.25
St. Vincent & the Grenadines	79.6	0.76
Antigua & Barbuda	79.5	0.84
Costa Rica	74.9	0.51

St. Kitts & Nevis	68.4	0.66
Curaçao (Dutch Antilles)	67.8	0.88
Seychelles	60.8	0.19
Monaco	53.6	0.89
St. Lucia	51.6	0.71
Brunei	47.4	0.56
Grenada	42.1	0.18
San Marino	33.2	0.89
Andorra	27.3	1.28
Dominica	21.3	0.65
Cook Islands	17.8	0.09
Montserrat	10.8	
Non-Tax Haven Jurisdictions		
United States of America	1254.7	1.56
Germany	701.8	1.66
United Arab Emirates (Dubai)	440.7	0.57
Japan	418.3	1.33
United Kingdom	380.2	1.69
Malaysia (Labuan)	338.7	0.51
Turkey	320.9	0.03
China	312.1	-0.41
Austria	295.3	1.86
Brazil	263.6	-0.26
Canada	251.7	1.75
Russia	243.2	-0.86
France	241.9	1.42
Belgium	181.2	1.33
Guatemala	177.1	-1.07
Israel	173.7	0.96
Netherlands	168.3	1.78
Chile	166.6	1.28
Saudi Arabia	163.8	0.18
Australia	148.0	1.76
India	148.0	0.06
Philippines	146.0	-0.42
Ghana	139.1	-0.06
Korea	124.2	0.91
Mexico	117.0	-0.52
Norway	110.6	1.93
New Zealand	109.3	1.87
Sweden	100.8	1.89
Italy	98.6	0.51
South Africa	90.8	0.09
Spain	77.4	1.15
Turks & Caicos	72.4	
Iceland	67.1	1.78
Slovakia	60.1	0.42
Macedonia	59.5	-0.36
Poland	57.3	0.61
Estonia	52.9	0.98
Portugal (Madeira)	52.5	1.12
Czech Republic	44.2	0.90

Denmark	38.2	1.92
Hungary	37.3	0.77
Greece	37.2	0.67
Slovenia	22.4	0.98
Finland	19.4	1.96

Table 2: Descriptive Analyses (cont.)

Panel C: Pearson\Spearman Correlations

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	TaxAQ	-	-0.00	-0.00	**-0.04**	**0.13**	**-0.11**	**-0.33**	**-0.04**	**0.19**	0.00	0.00	**0.14**	-0.00	**0.07**	**-0.09**	**-0.05**	-0.01	**0.09**	**0.07**	**-0.09**	**-0.03**
2	HAVENINT	-0.00	-	**0.94**	**0.31**	**0.22**	0.00	**-0.03**	**0.11**	**0.09**	**0.07**	**0.06**	-0.00	**0.12**	-0.01	**0.03**	0.01	-0.01	0.00	**0.11**	-0.01	0.00
3	HAVEN%	-0.01	**0.94**	-	**0.34**	**0.20**	0.01	**-0.04**	**0.08**	**0.07**	**0.05**	**0.04**	0.02	**0.11**	0.01	-0.01	0.01	-0.01	0.01	**0.14**	-0.01	-0.00
4	FSI	**-0.07**	**0.31**	**0.33**	-	**-0.14**	0.01	**0.11**	0.00	**-0.06**	**-0.05**	**-0.02**	**-0.12**	**-0.06**	-0.01	**0.16**	**0.05**	0.01	**-0.14**	**-0.04**	**0.13**	-0.02
5	SIZE	**0.18**	**0.09**	**0.09**	**-0.19**	-	**-0.10**	**-0.44**	**0.24**	**0.41**	**0.26**	**0.17**	**0.32**	**0.48**	**0.26**	**-0.26**	**-0.05**	0.02	**0.17**	**0.42**	**-0.22**	0.02
6	TAX_LOSS	**-0.11**	**0.02**	**0.02**	**0.02**	**-0.09**	-	**0.17**	**-0.25**	**-0.10**	**-0.24**	**-0.14**	**0.03**	**-0.05**	**-0.11**	0.01	**-0.06**	-0.00	**0.05**	**-0.03**	-0.01	**0.05**
7	PTBI_VOL	**-0.15**	-0.01	-0.01	**0.08**	**-0.35**	**0.09**	-	**-0.13**	**-0.40**	**-0.35**	**-0.10**	**-0.14**	**-0.21**	**-0.21**	**0.25**	**0.03**	**0.07**	**-0.12**	**-0.18**	**0.11**	**0.03**
8	FOREIGN	**0.02**	**-0.04**	**-0.05**	**-0.09**	**0.25**	**-0.25**	**-0.17**	-	**0.16**	**0.19**	**0.14**	**-0.09**	**0.18**	**0.15**	**0.14**	**0.05**	**0.05**	**-0.06**	**0.20**	**0.10**	**-0.03**
9	AQ	**0.16**	**0.03**	**0.02**	**-0.09**	**0.33**	**-0.06**	**-0.41**	**0.18**	-	**0.19**	**0.09**	**0.07**	**0.22**	**0.18**	**-0.06**	0.02	**-0.10**	**0.16**	**0.12**	0.00	**-0.04**
10	ROA	**0.03**	**0.02**	**0.02**	**-0.08**	**0.34**	**-0.17**	**-0.49**	**0.23**	**0.28**	-	**0.40**	**-0.16**	**0.17**	**0.12**	**-0.08**	**0.03**	**-0.10**	**0.06**	**0.07**	**-0.06**	**-0.07**
11	MTB	-0.01	0.02	0.01	**-0.04**	**0.09**	**-0.05**	**-0.09**	**0.07**	**0.05**	**0.19**	-	**-0.12**	**0.14**	**0.13**	**0.19**	**0.08**	-0.00	**-0.03**	0.01	**0.03**	**-0.05**
12	LEV	**0.10**	-0.02	0.00	**-0.06**	**0.17**	**0.03**	**0.12**	**-0.13**	**-0.08**	**-0.21**	**-0.13**	-	**0.10**	**0.17**	**-0.32**	**-0.07**	**0.04**	**0.26**	**0.18**	**-0.25**	**0.03**
13	BIG4	**0.04**	**0.04**	**0.05**	**-0.13**	**0.48**	**-0.05**	**-0.22**	**0.18**	**0.21**	**0.21**	**0.07**	**0.04**	-	**0.11**	**-0.07**	**-0.11**	**-0.04**	**0.10**	**0.17**	**-0.05**	-0.00
14	INTANG	**0.07**	**-0.06**	**-0.04**	**-0.04**	**0.20**	**-0.09**	**-0.07**	**0.09**	**0.01**	**0.07**	**0.04**	**0.13**	**0.07**	-	-0.01	**0.13**	**0.08**	**-0.31**	**0.14**	**0.08**	**-0.03**
15	RD	**-0.08**	0.00	**-0.02**	**0.08**	**-0.32**	**0.02**	**0.27**	**0.02**	**-0.13**	**-0.30**	**0.11**	**-0.17**	**-0.11**	**-0.03**	-	**0.11**	**0.08**	**-0.21**	**-0.19**	**0.38**	**-0.03**
16	ADV	**-0.05**	0.01	0.01	0.01	-0.00	**-0.04**	**0.04**	-0.00	**-0.04**	0.01	**0.07**	-0.01	**-0.05**	**0.10**	-0.01	-	**0.03**	**-0.18**	**-0.07**	**0.03**	-0.01
17	NOL	**-0.02**	**-0.04**	**-0.03**	-0.01	-0.00	-0.00	**0.06**	**0.05**	**-0.03**	**-0.10**	-0.01	**0.04**	**-0.04**	**0.07**	**0.07**	0.01	-	**-0.05**	**0.05**	**0.05**	0.00
18	PPE	**0.08**	0.01	0.00	**-0.08**	**0.09**	**0.04**	**0.04**	**-0.09**	**0.05**	**-0.05**	**-0.05**	**0.22**	**0.04**	**-0.20**	**-0.09**	**-0.09**	**-0.02**	-	**0.08**	**-0.20**	**-0.02**
19	SUBMAT	**0.10**	**-0.04**	-0.00	**-0.08**	**0.37**	**-0.02**	**-0.08**	**0.11**	**0.05**	**0.07**	-0.01	**0.13**	**0.12**	**0.10**	**-0.20**	**-0.02**	**0.03**	**0.05**	-	**-0.12**	**0.03**
20	ESO_INDUSTRY	**-0.10**	**-0.04**	**-0.02**	**0.07**	**-0.23**	-0.01	**0.03**	**0.10**	**0.04**	**-0.04**	0.00	**-0.21**	**-0.05**	**0.06**	**0.26**	**-0.06**	**0.05**	**-0.20**	**-0.16**	-	**-0.04**
21	DISC&EXTRA	**-0.04**	0.00	-0.00	-0.01	**0.02**	**0.05**	0.01	**-0.03**	**-0.05**	**-0.05**	**-0.03**	**0.03**	-0.00	**-0.02**	**-0.02**	-0.00	0.00	-0.01	**0.04**	**-0.04**	-

Main Analyses

In Table 3, I test the association between tax accrual quality and tax haven use. Panel A presents the results of the first stage model. I find that firm size (SIZE) and the presence of foreign tax payments (FOREIGN) are both positively associated with the likelihood of having and disclosing a higher than industry median number of subsidiaries on Exhibit 21. Conversely, firms with greater intangible assets (INTANG) are less likely to report having more subsidiaries. The results suggest that the model increases observability in the current setting.

In Panel B, the second stage Model 3 results indicate that neither HAVEN% nor HAVENINT are significantly related to TaxAQ. Without taking subsidiary information environment quality into consideration, the use and disclosure of tax haven subsidiaries does not appear to impact the degree to which cash tax payments map into income tax expense. That is, having and disclosing the use of tax havens does not appear to affect tax reporting quality.[17] Columns 3

[17] In an untabulated analysis, a median FSI split is used to partition the sample in order to further examine the relationship between the two HAVEN main effects and tax accrual quality. In the below median FSI sample, there is no significant relationship between each HAVEN measure and TaxAQ, although the relationship is negative in nature. However, in the above median FSI sample, there is a positive and significant relationship between haven use and tax accrual quality (HAVEN%, t=1.61; HAVENINT, t=2.56). The additional results provide greater confidence in the underlying relationship between tax haven use and tax accrual quality.

and 4 test the effect of HAVEN on TaxAQ when FSI scores are considered.[18] Columns 5 and 6 use prior year haven use ($HAVEN_{t-1}$), as there could be a time variant impact on the income tax expense. Since all continuous variables are mean centered, HAVEN reflects the impact of tax haven use on tax accrual quality when there is an average value of subsidiary financial secrecy. HAVEN% and HAVENINT are not associated with TaxAQ at the mean value of the FSI score. Thus, the use of tax havens is not associated with tax accrual when the subsidiary information environment quality is held constant. However, the interaction term between HAVEN and FSI reflects a positive association with TaxAQ. The results provide support for the second hypothesis, which predicts that the association between tax haven subsidiary use and tax accrual quality depends on subsidiary information environments. I find that as the FSI scores increase for firm-years with greater tax haven use, there is greater mapping between the current period tax accrual and associated cash tax payments. When considering prior year tax haven subsidiary use, the results are consistent, providing further support for the underlying theory of the relationship between strategic subsidiary choice and income tax expense. The results suggest that managers signal additional tax accrual information when operating in jurisdictions with greater financial secrecy.

Table 3: Tax Accrual Quality and Tax Haven Use

This table tests the relationship between tax haven use and tax accrual quality (TaxAQ) without considering the information environment of the subsidiaries presented on Exhibit 21. Panel A presents the first stage Heckman model results, representing the strategic decision to have and disclose a haven subsidiary.

HIGH_SUB is a dichotomous variable set equal to one for firm-years with an above industry median amount of Exhibit 21 subsidiaries and to 0 for below median amounts. Panel B presents the second stage ordinary least squares (OLS) model. GAAP-induced complexity is controlled for by the presence of stock options (ESO_INDUSTRY) and discretionary and extraordinary items (DISC&EXTRA). Haven use is measured using both the percentage of tax haven jurisdictions (HAVEN%) and the percentage of tax haven subsidiaries (HAVENINT). Current and prior year (*t*-1) haven use is shown. All continuous variables are mean centered. The symbols *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level respectively (two-tailed). Industry and year fixed effects are included but not reported.

Panel A: First Stage Heckman Model

	[1] Y=HIGH_SUB	
Variables	Coeff.	t-stat.
Intercept	-2.8332***	*-28.85*
SIZE	0.3537***	*44.45*
FOREIGN	0.7941***	*27.18*
LEV	0.2475***	*3.79*
ROA	-0.1389*	*-1.78*
NOL	0.1376***	*5.71*
INTANG	-0.1708***	*-3.09*
PPE	-0.1634***	*-4.22*
Industry Fixed Effects	Y	
Adjusted R^2	0.229	
N	14,259	

[18] Removing ESO_INDUSTRY and DISC&EXTRA from Tables 4 and 5 results in qualitatively similar conclusions. Removing these two measures captures tax accrual quality due to financial standard complexity and management estimation error. However, isolating management estimation error provides greater detail about the role of tax havens.

Table 3: Tax Accrual Quality and Tax Haven Use (cont.)

Panel B: Second Stage Models

	[1] Y=TaxAQ		[2] Y=TaxAQ		[3] Y=TaxAQ		[4] Y=TaxAQ		[5] Y=TaxAQ		[6] Y=TaxAQ	
Variables	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.
HAVEN%	0.0652	*0.73*			-0.1159	*-1.12*						
HAVENINT			0.1147	*1.40*			-0.0147	*-0.16*				
$HAVEN\%_{t-1}$									-0.0648	*-0.66*		
$HAVENINT_{t-1}$											0.0199	*0.23*
FSI					0.0003**	*2.31*	0.0002	*2.14*	0.0002**	*1.81*	0.0002**	*1.65*
HAVEN*FSI					0.0010**	*2.30*	0.0011**	*2.51*				
$HAVEN_{t-1}$*FSI									0.0010**	*2.05*	0.0009**	*2.10*
SIZE	0.1933***	*5.26*	0.1925***	*5.23*	0.2044***	*5.53*	0.2038***	*5.51*	0.2489***	*6.03*	0.2474***	*5.99*
FOREIGN	0.3783***	*3.80*	0.3786***	*3.80*	0.3932***	*3.94*	0.3985***	*3.99*	0.4700***	*4.26*	0.4714***	*4.27*
TAX_LOSS	-0.1498***	*-4.69*	-0.1519***	*-4.75*	-0.1481***	*-4.64*	-0.1498***	*-4.69*	-0.1640***	*-4.90*	-0.1666***	*-4.97*
PTBI_VOL	-1.2139***	*-14.21*	-1.2182***	*-14.25*	-1.2082***	*-14.20*	-1.2090***	*-14.20*	-1.3146***	*-14.05*	-1.3161***	*-14.05*
AQ	2.9791***	*12.16*	2.9721***	*12.13*	3.0270***	*12.34*	3.0219***	*12.31*	3.0021***	*10.94*	2.9997***	*10.93*
BIG4	-0.0932**	*-2.18*	-0.0919**	*-2.15*	-0.0868**	*-2.04*	-0.0858**	*-2.02*	-0.0678	*-1.58*	-0.0663	*-1.54*
MTB	0.0035	*0.96*	0.0034	*0.94*	0.0037	*1.00*	0.0037	*1.01*	-0.0001	*-0.03*	-0.0001	*-0.02*
LEV	0.3104***	*3.86*	0.3096***	*3.85*	0.3329***	*4.11*	0.3268***	*4.04*	0.3646***	*4.14*	0.3576***	*4.07*
ROA	-0.4761***	*-4.50*	-0.4776***	*-4.51*	-0.4702***	*-4.43*	-0.4723***	*-4.45*	-0.3962***	*-3.34*	-0.4009***	*-3.38*
NOL	0.0467	*1.53*	0.0474	*1.55*	0.0499	*1.62*	0.0480	*1.56*	0.0856**	*2.39*	0.0837**	*2.34*
SUBMAT	0.0215***	*2.63*	0.0223***	*2.72*	0.0202**	*2.47*	0.0210**	*2.56*	0.0094	*1.06*	0.01	*1.13*
INTANG	0.2210***	*3.44*	0.2252***	*3.51*	0.2120***	*3.29*	0.2133***	*3.30*	0.2472***	*3.33*	0.2494***	*3.35*
RD	-0.8847***	*-3.94*	-0.8907***	*-3.97*	-0.9025***	*-4.01*	-0.8907***	*-3.97*	-0.8022***	*-3.37*	-0.7972***	*-3.35*
ADV	-1.3248***	*-3.05*	-1.3102***	*-3.02*	-1.3068***	*-3.01*	-1.2805***	*-2.95*	-1.5005***	*-3.26*	-1.4761***	*-3.21*
PPE	0.0689	*1.39*	0.0675	*1.36*	0.0772	*1.55*	0.0774	*1.55*	0.0355	*0.63*	0.036	*0.63*
ESO_INDUSTRY	-0.1906**	*-2.33*	-0.1944**	*-2.37*	-0.1760**	*-2.15*	-0.1772**	*-2.16*	-0.1749**	*-2.03*	-0.1773**	*-2.05*
DISC&EXTRA	-0.1831***	*-2.72*	-0.1840***	*-2.73*	-0.1794***	*-2.67*	-0.1809***	*-2.69*	-0.0966	*-1.37*	-0.0974	*-1.39*
IMR	0.8963***	*4.90*	0.8977***	*4.90*	0.9231***	*5.03*	0.9282***	*5.06*	1.0850***	*5.64*	1.0839***	*5.64*
Industry FE	Y		Y		Y		Y		Y		Y	
Year FE	Y		Y		Y		Y		Y		Y	
Adjusted R^2	0.176		0.176		0.177		0.177		0.182		0.182	
N	14,259		14,259		14,259		14,259		13,302		13,302	

Table 3: Tax Accrual Quality and Tax Haven Use (cont.)

Panel C: Propensity Matched Sample

	[1] Y=TaxAQ		[2] Y=TaxAQ		
Variables	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.
HAVEN%	0.1424	*1.21*	-0.007	*-0.05*	
HAVENINT					0.2309
FSI			0.0003**	*2.08*	
HAVEN*FSI			0.0010**	*2.12*	
Control Variables	Y		Y		
IMR	Y		Y		
Industry & Year FE	Y		Y		
Adjusted R^2	0.185		0.186		
N	8,035		8,035		

As it is possible that the impact of tax haven subsidiaries on tax accrual quality is driven by systematic differences between firms with and without disclosed tax haven subsidiaries, I also use propensity score matching. Specifically, I use one-to-one propensity score matching without replacement to match similar firms with and without disclosed tax haven subsidiaries (Shipman et al., 2017). Using Model 5, propensity score matching results in a sample of 8,035 firm-year observations, comprised of 4,010 without a haven subsidiary and 4,025 with a haven subsidiary. HAVENPRES is an indicator variable set equal to 1 if a firm has a disclosed tax haven subsidiary and to 0 otherwise. The balance comparison shows that, between the groups of firms with and without disclosed tax haven subsidiaries, the means of the control variables are not statistically different, with the exception of firm size. Firms with tax haven subsidiaries are larger than firms without haven subsidiaries.

$$HAVENPRES_{jt} = \beta_0 + \beta_1 SIZE_{jt} + \beta_2 FOREIGN_{jt} + \beta_3 TAX\_LOSS_{jt} + \beta_4 PTBI\_VOL_{jt} + \beta_5 AQ_{jt} + \beta_6 BIG4_{jt} + \beta_7 MTB_{jt} + \beta_8 LEV_{jt} + \beta_9 ROA_{jt} + \beta_{10} NOL_{jt} + \beta_{11} SUBMAT_{jt} + \beta_{12} INTANG_{jt} + \beta_{13} RD_{jt} + \beta_{14} ADV_{jt} + \beta_{15} PPE_{jt} + \beta_{16} ESO\_INDUSTRY_{jt} + \beta_{17} DISC\&EXTRA_{jt} + \beta_{18k} \Lambda IND_{jt} + \beta_{19k} \Lambda YEAR_{jt} + \varepsilon_{jt} \quad (5)$$

Table 3, Panel C presents the propensity score matching results. In columns 1 and 3, there is some evidence of a positive and significant association between tax haven use and tax accrual quality (HAVENINT, *t*=1.99). Furthermore, there continues to be a robust relationship between haven use, FSI score, and tax accrual quality. Specifically, HAVEN%*FSI is positively associated with TaxAQ (*t*=2.12) and HAVENINT*FSI is positively associated with TaxAQ (*t*=2.20). Collectively, the propensity score matched sample provides additional assurances about the robustness of the relationship between tax haven subsidiary use and tax accrual quality.

Since both HAVEN and FSI are continuous measures, the interaction effect could reflect a "less negative" TaxAQ rather than an improvement in tax accrual quality. Therefore, I further test the conditional effect of HAVEN on TaxAQ. Following Burks, Randolph, and Seida (2019), I present the conditional effect plot of the impact of HAVEN on TaxAQ at different FSI score levels in Figure 1. At each different FSI score level, the interaction effect reflects an improvement in TaxAQ, providing additional support for the second hypothesis. I also present

the conditional slope plot indicating the conditional slope (β_1HAVEN + β_3HAVEN*FSI) and confidence intervals for the regression coefficient estimate on HAVEN conditional on the level of FSI score. The conditional slope plot indicates that there is a positive conditional slope, within 95 percent confidence intervals, across the entire range of FSI values. As such, as the FSI score increases, there is a greater conditional slope for the relationship between HAVEN and TaxAQ. The results suggest that the use and disclosure of tax havens could prompt managers to pay greater attention to tax reporting, resulting in strategic signaling to external stakeholders. That is, the tax accrual could reflect the attention that a firm pays to tax haven-related activities.

Additional Analyses

Rule of law as an alternative measure of subsidiary information environment

As the utilization of the FSI scores could bias the classification of a subsidiary's jurisdictional information environment quality, I also use rule of law as an alternative proxy for subsidiaries' information environments. Rule of law captures perceptions that the rules of society are followed and of the quality of institutions, such as contract enforcement, property rights, the police, and the courts, as well as the likelihood of incidences of crime and violence occurring (Dyreng et al., 2012). Rule of law would, in turn, directly affect a firm's financial reporting and the disclosures that the firm makes with regard to its tax haven activities. These differences are objectively captured by the World Bank Governance Indicator dataset at the country-year level, and go beyond differentiating between common law and civil law jurisdictions. Rule of law (RULE_OF_LAW) captures four broad World Bank objectives: democracy promotion, economic development and good governance, human rights and social development, and law enforcement. An average rule of law score for all unique subsidiary jurisdictions is computed for each firm-year.[19] RULE_OF_LAW is updated annually and covers 214 countries. FSI and RULE_OF_LAW are modestly correlated, with a Spearman correlation coefficient of 0.36 ($p<0.05$, untabulated).

In Table 4, Panel A, I examine the relationship between tax haven use and TaxAQ when RULE_OF_LAW is included to capture overall subsidiary information environment quality.

[19] Rule of law is presented as an estimate in units of a standard normal distribution ranging from approximately –2.5 to 2.5, with higher rule of law noted by a higher estimate. High rule of law represents greater democratic protections and greater law enforcement, including the creation of additional civil protections and greater human rights. Low rule of law captures weaker law enforcement, greater allowance of secretive activities, and fewer democratic and social protections. Since the measure is comprised of a variety of individual factors, rule of law goes beyond designating a jurisdiction as being a common law or civil law jurisdiction. For example, both Canada and the Cayman Islands are common law jurisdictions but, in 2014, Canada had a rule-of-law estimate of 1.9 while the Cayman Islands had an estimate of 0.6. Therefore, Canada has a higher rule-of-law score than the Cayman Islands.

Fig. 1: Conditional Effects

Fig. 1a: Plot of Conditional Effects

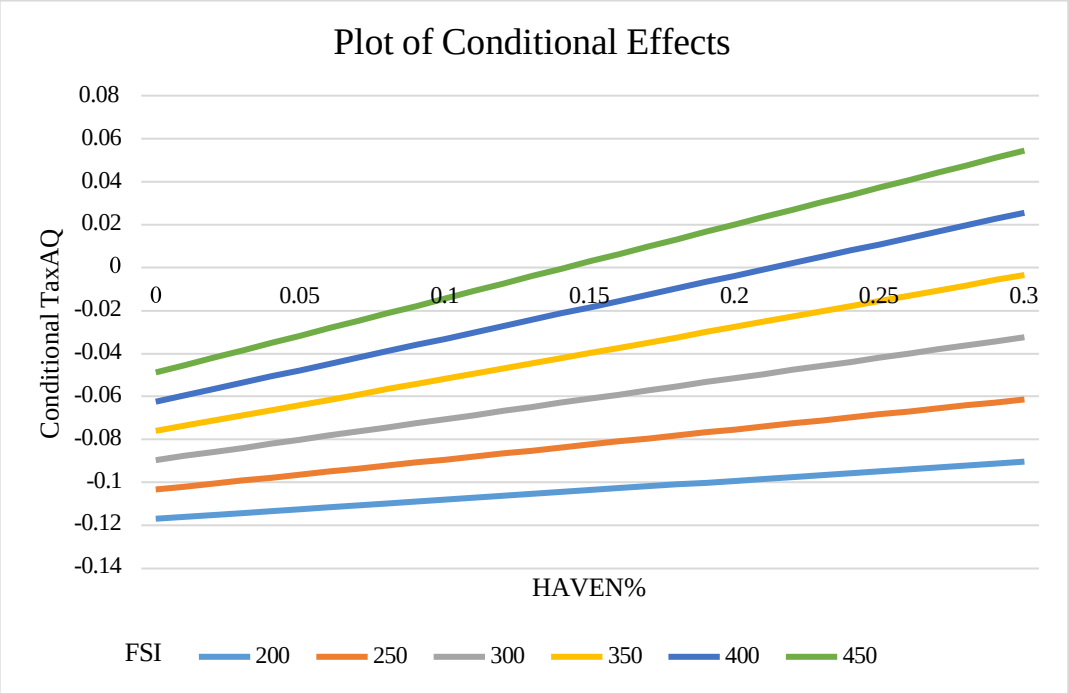
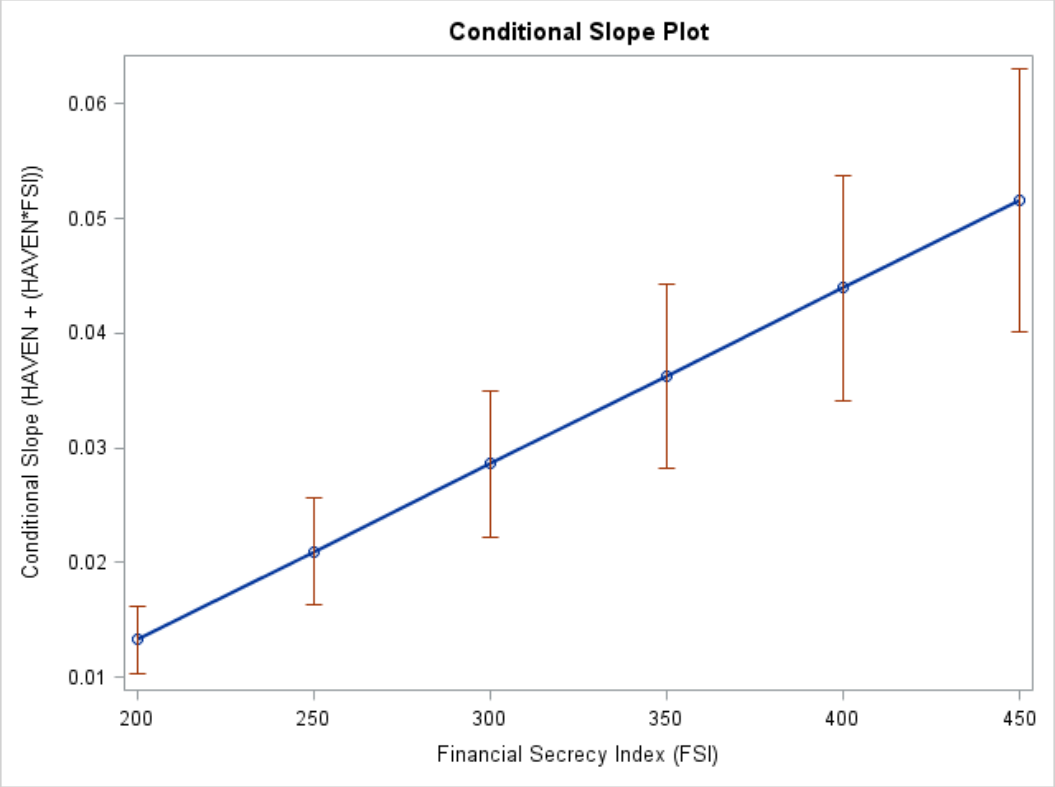


Fig. 1b: Conditional Slope Plot



Although neither HAVEN measure is associated with TaxAQ at the mean level of RULE_OF_LAW, I find that the interaction terms HAVEN%*RULE_OF_LAW and HAVENINT*RULE_OF_LAW are positively associated with TaxAQ. The existence of a positive relationship suggests that, as there is greater tax haven use and subsidiaries are located in a higher rule-of-law jurisdiction, there is a smaller tax accrual estimation error and higher quality tax reporting. The results conform with, and expand upon, those of Dyreng et al. (2012), who find that having subsidiaries in tax havens in high rule-of-law jurisdictions constricts foreign earnings management, which results in higher quality financial reporting. While RULE_OF_LAW focuses on societal expectations, FSI focuses only on the attributes of financial secrecy that would be directly faced by firms with haven operations and could increase managers' incentives to provide additional information about the tax accrual.[20]

Table 4: Additional Analyses

This table shows the results of testing the relationship between tax haven use and tax accrual quality (TaxAQ) in several different situations. In Panel A, subsidiary information environment (RULE_OF_LAW) is measured by the average rule of law in each subsidiary jurisdiction. Panel B examines the presence of auditor-provided tax services (APTS). Panel C uses the extent of foreign income (FOREIGN_INC) as a measure of foreign involvement. Panel D utilizes an industry-year median split of current cash effective tax rates (CASH_ETR). HIGH_CETR=1 reflects a higher than industry-year, cash effective, tax rate. All continuous variables are mean centered. The symbols *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level respectively (two-tailed). Industry and year fixed effects are included but not reported.

Panel A: Rule of Law

	[1] Y=TaxAQ		[2] Y=TaxAQ	
Variables	Coeff.	t-stat.	Coeff.	t-stat.
HAVEN%	0.0748	*0.80*		
HAVENINT			0.1200	*1.41*
RULE_OF_LAW	-0.0675*	*-1.95*	-0.0636*	*-1.83*
HAVEN*RULE_OF_LAW	0.4271**	*2.26*	0.4092**	*2.26*
Control Variables	Y		Y	
IMR	Y		Y	
Industry & Year FE	Y		Y	
Adjusted R^2	0.166		0.167	
N	13,033		13,033	

Panel B: Auditor-Provided Tax Services

	[1] APTS=1		[2] APTS=1		[3] APTS=0		[4] APTS=0	
Variables	Coeff.	t-stat.	Coeff.	t-stat.	C	t-stat.	Coeff.	t-stat.
HAVEN%	-0.4158***	*-3.45*			0.4	*2.34*		
HAVENINT			-0.2186**	*-2.10*			0.3711**	*1.97*
FSI	0.0006***	*4.63*	0.0005***	*4.00*	-0.	*-1.68*	-0.0003	*-1.13*
HAVEN*FSI	0.0008*	*1.59*	0.0010**	*1.95*	0.(	*1.56*	0.0012*	*1.32*
Control Variables	Y		Y				Y	
IMR	Y		Y				Y	
Industry & Year FE	Y		Y				Y	
Adjusted R^2	0.190		0.190				0.163	
N	9,264		9,264				4,995	

[20] In an untabulated analysis, I partition the sample between high and low rule-of-law firm-years using a median split. The association between tax haven use, financial secrecy, and tax accrual quality exists only when there is low average rule of law. That is, the positive association between HAVEN*FSI is significant only when there is low rule of law among firm subsidiary activities. The results suggest that when a firm's subsidiary is located in a lower rule-of-law environment, it provides managers with a greater incentive to signal higher quality tax accrual information to external stakeholders where there is lower existing transparency.

Panel C: Extent of Foreign Income

	[1] Y=TaxAQ		[2] Y=TaxAQ		[3] Y=TaxAQ		[4] Y=TaxAQ	
Variables	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.
HAVEN%	-0.1081	*-1.04*			0.0976	*1.04*		
HAVENINT			-0.0067	*-0.07*			0.1356	*1.58*
FSI	0.0003**	*2.41*	0.0002**	*2.24*				
RULE_OF_LAW					-0.0696**	*-2.00*	-0.0651***	*-1.87*
HAVEN*FSI	0.0010**	*2.18*	0.0010***	*2.38*				
HAVEN*RULE_OF_LAW					0.4221**	*2.20*	0.4179**	*2.30*
FOREIGN_INC	-0.0002	*-0.18*	-0.0002	*-0.19*	-0.0002	*-0.18*	-0.0002	*-0.18*
Control Variables	Y		Y		Y		Y	
IMR	Y		Y		Y		Y	
Industry & Year FE	Y		Y		Y		Y	
Adjusted R^2	0.177		0.177		0.165		0.165	
N	14,259		14,259		14,259		14,259	

Panel D: Extent of Tax Planning

	[1] HIGH_CETR=1		[2] HIGH_CETR=1		[3] HIGH_CETR=0		[4] HIGH_CETR=0	
Variables	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.
HAVEN%	0.0656	*0.46*			-0.2108	*-1.46*		
HAVENINT			0.0129	*0.10*			0.0033	*0.03*
FSI	0.0002	*1.11*	0.0002	*1.49*	0.0004**	*2.55*	0.0003**	*2.11*
HAVEN*FSI	0.0010*	*1.42*	0.0006	*0.94*	0.0010**	*1.67*	0.0011**	*1.98*
Control Variables	Y		Y		Y		Y	
IMR	Y		Y		Y		Y	
Industry & Year FE	Y		Y		Y		Y	
Adjusted R^2	0.199		0.198		0.176		0.176	
N	5,358		5,358		8,901		8,901	

Auditor-provided tax services (APTS)

One possible explanation for some of the variation in the above results is auditor involvement. In particular, the use of APTS could impact the extent to which a firm's tax haven operations can be understood and promote higher tax reporting quality. APTS can create a knowledge spillover between audit and tax functions such that the auditor has a broader understanding of a client (e.g., Gleason & Mills, 2011; Kinney et al., 2004; Robinson, 2008). In turn, when an auditor has greater knowledge of a client, it could foster a more precise tax accrual. In Panel B, I partition the sample into firm-years where ATPS were utilized (APTS=1) and where they were not (APTS=0). At the mean-centered value of FSI, I find that when the auditor provides tax services, there is a significantly negative association between tax haven use and tax accrual quality, providing additional evidence of the overall impact of tax havens. I also note a weak positive association between the interaction terms HAVEN%*FSI and HAVENINT*FSI, and TaxAQ. When the auditor does not provide tax services, tax haven use is positively associated with tax accrual quality, both with and without taking the effect of subsidiary information environment quality into consideration. The results suggest that although auditor involvement can facilitate higher quality tax reporting, it is not a clear influencing factor for the impact of tax haven use on tax accrual quality.

Extent of foreign income

As an alternative measure of foreign operations, I replace FOREIGN with the ratio of pre-tax foreign income to total income (FOREIGN_INC) in Panel C. Utilizing a continuous measure of the extent of foreign operations engenders additional confidence that firms' foreign operations are controlled for in the model, including their potential impact on management tax accrual estimation error. Columns 1 and 2 examine the relationship between HAVEN, FSI, and TaxAQ using FOREIGN_INC as a control variable. While FOREIGN_INC is not significant, I continue to find a positive interaction term between HAVEN and FSI. Likewise, in columns 3 and 4, I continue to find a positive interaction term between HAVEN and RULE_OF_LAW. The results suggest that the association between a firm's use of tax haven subsidiaries, information environment quality, and tax accrual quality is not contingent on how foreign operations are captured.

Extent of tax planning

In Panel D, I partition the sample on the extent of tax planning utilizing an industry-year median split of current cash effective tax rates (CAH_ETR). Overall, firm-years in the sample have a median cash effective tax rate of 22.3 percent. Firm-years with greater tax planning could have a different relationship with tax haven subsidiaries than other firm-years. Although Models 3 and 4 contain control variables for the availability of tax planning opportunities, directly testing the role of tax planning can provide more direct evidence of the relationship. Columns 1 and 2 examine the relationship between HAVEN, FSI, and TaxAQ for firm-years with above median cash effective rates. No significant association exists between tax haven use and overall subsidiary information environment quality when there are high effective rates. Conversely, in columns 3 and 4, the previously noted positive association between HAVEN*FSI and TaxAQ is seen for firm-years with below median cash effective tax rates. The results indicate that tax haven use and information environment quality play larger roles when firms engage in more tax planning, possibly reflecting the opportunities afforded by tax haven jurisdictions.

5. CONCLUSION

This study examines the association between firms' use of subsidiaries in tax haven jurisdictions and tax accrual quality, a measure of tax reporting quality. While haven-based subsidiaries provide secrecy and potential tax payment savings for firms, it is unknown whether their use affects tax reporting quality. Increasing regulatory focus on financial reporting for income taxes prompts greater attention to the information provided by the tax accrual in firms' annual reports. While tax haven use could increase uncertainty in relation to the extent and timing of taxable foreign earnings, the additional discretion could allow management to reduce estimation error in certain situations and improve tax accrual quality. Based on signaling theory, I predict and find that managers communicate additional tax accrual information to external stakeholders through higher tax accrual quality when their firms have subsidiaries in tax haven jurisdictions with higher financial secrecy. That is, not all tax haven jurisdictions impact financial reporting in the same way.

The findings contribute to the tax haven literature by providing initial evidence that strategically choosing where to have subsidiary operations could impact tax-related financial reporting. While the literature primarily focuses on the tax aggressiveness implications of tax havens and the direct impact on tax disclosures, this study provides evidence of how the tax accrual itself could also be affected. Although haven subsidiaries can be used to minimize a firm's tax burden, this intent does not necessarily impair tax reporting quality. Furthermore, tax accrual quality can be utilized as a signaling mechanism. Policymakers and regulators can benefit from gaining a greater understanding about how havens are used by U.S. firms. The recent increase in incidents of tax shaming and heightened regulatory interest in devising a global minimum tax rate underscore the importance of first understanding the impact of havens. Imposing new international regulations surrounding disclosure on a country-by-country basis could further improve transparency, although stricter global taxation could result in additional tax accrual mapping estimation error.

As in all studies, limitations exist that provide opportunities for future research. First, this study only examines U.S. firms in order to access Exhibit 21 Significant Subsidiary Disclosures. As such, the results may not generalize directly to disclosure regimes in other jurisdictions. Future research could examine whether different financial reporting regulations affect the implications of tax haven subsidiaries.

Second, the sample period is curtailed by recent developments in U.S. tax law and international tax data leaks. Future research could explore international settings that are not subject to changes affecting the determination of income tax expense and cash tax payments. Future studies could also explore whether the disclosure of country-by-country reporting information has impacted the relationship between tax haven use and tax accrual quality. If firms must disclose financial information on a per-jurisdiction basis, there could be greater transparency about the mapping between income tax expense and tax payments.

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APPENDIX

Variable Definitions

Variable	Definition
Tax Accrual Quality	
CTP_{jt}	Cash taxes paid related to income taxes ($TXPD_{jt}$), scaled by total assets (AT_{jt}).
ΔDTA_LT_{jt}	Change in the long-term portion of the deferred tax asset ($TXDBA_{jt}$ - $TXDBA_{jt-1}$), scaled by total assets (AT_{jt}). SFAS 109 permits firms to net short-term DTAs/DTLs and long-term DTAs/DTLs and, in practice, many firms do, so missing values of $TXDB_{jt}$ are set equal to net DTA/DTL ($TXNDB_{jt}$) less short-term DTL ($TXDBCL_{jt}$) less short-term DTA ($TXDBCA_{jt}$), with missing values of $TXDBCL_{jt}$ ($TXDBCA_{jt}$) reset to zero when $TXDBCA_{jt}$ ($TXDBCL_{jt}$) is not missing. If $TXDBA_{jt}$ is missing and $TXDB_{jt}$ is not missing, $TXDBA_{jt}$ is reset to zero, as in Choudhary et al. (2016).
ΔDTL_LT_{jt}	Change in the long-term portion of the deferred tax liability ($TXDB_{jt}$ - $TXDB_{jt-1}$), scaled by total assets (AT_{jt}). SFAS 109 permits firms to net short-term DTAs/DTLs and long-term DTAs/DTLs and, in practice, many firms net their short-term net DTA/DTL and long-term DTA/DTL, so missing values of $TXDB_{jt}$ are set equal to net DTA/DTL ($TXNDB_{jt}$) less short-term DTL ($TXDBCL_{jt}$) less short-term DTA ($TXDBCA_{jt}$), with missing values of $TXDBCL_{jt}$ ($TXDBCA_{jt}$) reset to zero when $TXDBCA_{jt}$ ($TXDBCL_{jt}$) is not missing. If $TXDB_{jt}$ is missing and $TXDBA_{jt}$ is not missing, $TXDB_{jt}$ is reset to zero, as in Choudhary et al. (2016).
$TaxACC_{jt}$	Total tax accrual, defined as $TTE_{jt} - CTP_{jt}$.
$TaxAQ_{jt}$	Standard deviation of firm *j*'s residuals from Fama-French 48 industry year. estimates of Model 1 ($TaxACC_t = \beta_0 + \beta_1 CTP_{t-1} + \beta_2 CTP_t + \beta_3 CTP_{t+1} + \beta_4 \Delta DTL\_LT_t + \beta_5 \Delta DTA\_LT_t + \varepsilon_t$) from year *t*-4 to *t*, multiplied by -1 so larger values indicate better tax accrual quality. A minimum of 20 observations per industry year is required to estimate TaxAQ.
TTE_{jt}	Total tax expense (TXT_{jt}) scaled by total assets (AT_{jt}).
Firm Characteristics Related to Tax Accrual Quality	
PTBI_VOL	Standard deviation of pre-tax book income ($PTBI_t$) scaled by total assets (AT_{jt}), measured from years *t*-4 through *t*.
TAX_LOSS	1 (0 otherwise) if current tax expense (TXC_{jt}) is less than zero.
FOREIGN	1 (0 otherwise) if a firm reports nonzero foreign tax expense ($TXFO_{jt}$).
ESO_INDUSTRY	1 (0 otherwise) if a firm operates in an industry with potentially large tax deductions from the exercise of options (defined as industry Standard Industrial Codes 30-39 and 70-89).
DISC&EXTRA	1 (0 otherwise) if a firm reports a large discretionary/extraordinary item [defined as discontinued and extraordinary items from the statement of cash flows ($XIDOC_{jt}$) > 1% of revenue ($REVT_{jt}$)].
SIZE	Natural log of total assets (AT_{jt}).
Tax Haven Use	
HAVEN%	Percentage of foreign countries classified in Exhibit 21 as tax havens. Tax haven locations, as designated in Dyreng and Lindsey (2009), include: Andorra, Anguilla, Antigua and Barbuda, Aruba, Bahamas, Bahrain, Barbados, Belize, Bermuda, British Virgin Islands, Brunei, Botswana, Cape Verde, Cayman Islands, Cook Islands, Costa Rica, Cyprus, Dominica, Gibraltar, Grenada, Guernsey and Alderney, Hong Kong, Ireland, Isle Of Man, Jersey, St. Kitts and Nevis, Latvia, Lebanon, Liberia, Liechtenstein, Luxembourg, Macau, Maldives, Malta, Marshall Islands, Mauritius, Monaco, Montserrat, Nauru, Netherlands Antilles (or Dutch Antilles), Niue, Palau, Panama, Samoa, San Marino, Seychelles, Singapore, St. Lucia, St. Vincent and the Grenadines, Switzerland, United States of America. Virgin Islands, Uruguay, and Vanuatu.

HAVENINT	Percentage of all disclosed subsidiaries that are in countries classified in Exhibit 21 as tax havens
Information Environment Quality	
FSI	The Tax Justice Network has developed the Financial Secrecy Index for 92 countries including both tax haven and other countries (Tax Justice Network, 2016). The index comprises 15 different criteria relating to the transparency of: beneficial ownership (banking secrecy, trust and foundations register, recorded company ownership); corporate regulation (public company ownership, public company accounts, country-by-country reporting); efficiency of tax and financial regulation (fit for information exchange, efficiency of tax administration, avoids promoting tax evasion, harmful legal vehicles); and international standards and cooperation (anti-money laundering, automatic information exchange, bilateral treaties, international transparency commitments, international judicial cooperation). The higher the index, the more financial secrecy exists within a jurisdiction and this, in turn, weakens the information environment. An average score is calculated per firm-year.
RULE_OF_LAW	Rule of law captures perceptions of the extent to which agents have confidence in, and abide by, the rules of society and, in particular, of the quality of institutions, such as contract enforcement, property rights, the police, and the courts, as well as the likelihood of incidences of crime and violence occurring. See the World Bank (n.d.) for a full listing of factors utilized. An average rule-of-law score is calculated per firm-year. Higher rule of law is represented by a higher ratio.
Control Variables	
BIG4	1 (0 otherwise) if the firm is audited by a top four accounting firm (AU).
MTB	Ratio of market value (PRCC_F × CSHO) to book value (CEQ).
NOL	1 (0 otherwise) if the tax loss carryforward (TLCF) is negative at the beginning of the year.
ROA	Pre-tax book income (PTBI) divided by lagged total assets (AT_{jt-1}).
LEV	Total debt divided by total assets [$(DLTT_{jt}+DLC_{jt})/AT_{jt}$].
ADV	Advertising expense (XAD) divided by lagged total revenue (REVT).
RD	Research and development expense (XRD) divided by lagged total assets (AT).
INTANG	Intangible assets (INTAN) divided by lagged total assets (AT).
PPE	Property, plant, and equipment divided by lagged total assets (AT).
SUBMAT	Number of foreign subsidiaries divided by number of countries listed in Exhibit 21.
AQ	Standard deviation of firm *j*'s residuals from Fama-French 48 industry year estimates of $\Delta WC_t = \alpha + \beta_1 CFO_{t-1} + \beta_2 CFO_t + \beta_3 CFO_{t+1} + \beta_4 \Delta REV_t + \beta_5 PPE_t + \varepsilon_t$ from year *t*-4 to *t*, multiplied by -1, so larger values indicate better working capital accruals quality. Following Francis et al. (2005), ΔWC_t is the change in working capital accruals [Δ current assets (ACT_t - ACT_{t-1}) – Δ current liabilities (LCT_t - LCT_{t-1}) – Δ cash (CHE_t - CHE_{t-1}) + Δ current portion of long-term debt (DLC_t - DLC_{t-1})]. CFO_t is cash flows from operations ($OANCF_t$), ΔREV_t is Δ revenue ($REVT_t$ – $REVT_{t-1}$), and PPE_t is gross plant, property, and equipment ($PPEGT_t$). All variables are scaled by average total assets ((AT_t + AT_{t-1}) ÷ 2). A minimum of 20 observations per industry year is required to estimate AQ.
IMR	Inverse Mills Ratio (Heckman, 1979) added to second stage models from the following first stage model representing the strategic decision to have and disclose a haven subsidiary: $HIGH\_SUB_{jt} = \beta_0 + \beta_1 SIZE_{jt} + \beta_2 FOREIGN_{jt} + \beta_3 LEV_{jt} + \beta_4 ROA_{jt} + \beta_5 NOL_{jt} + \beta_6 INTANG_{jt} + \beta_7 PPE_{jt} + \beta_8 kSIND_{jt} + \varepsilon_{jt}$. HIGH_SUB is a dichotomous variable set equal to 1 (0 otherwise) if a firm discloses a higher than industry median amount of subsidiaries on Exhibit 21.

THE INTERNATIONAL ECONOMIC DOUBLE TAXATION OF DIVIDENDS: ITS HANDLING IN THE CONVENTION BETWEEN ECUADOR AND SPAIN

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Abstract

This article analyzes the effects of the international economic double taxation of dividends. For this purpose, a conceptual distinction is made between legal and economic double taxation. The term "dividends" is defined and possible tactics that could be adopted when drafting double taxation agreements in order to resolve any potential issues, with specific reference to the case of Ecuador, are discussed.

It was necessary to conduct a thorough review of the doctrine and a comprehensive analysis of possible methods by which international economic double taxation could be avoided or corrected. The paper includes a study of the 1993 double taxation agreement between Ecuador and Spain, and a simulation exercise in which the effects of the agreement's application are determined.

We find that that the existence of international economic double taxation affects businesses' management policies, indebtedness, and location decisions, as they often look to invest in jurisdictions with lower levels of taxation. Moreover, it affects the evolution of foreign investments and, therefore, the development capacity of countries, especially the least developed ones.

Keywords: Dividends, Double Taxation Conventions (DTCs), Economic Double Taxation, Business Taxation.

1. INTRODUCTION

The Concept of Dividends in Comparative Tax Regulations

A taxable event is defined as the factual circumstance, of a legal or economic nature, which, under the law creates tax obligation, that is, may require the payment of tax. In accordance with Article 2 of the Law of the Internal Tax Regime of Ecuador, taxable income is defined as:

1. Ecuadorian-sourced income obtained from labor, capital, or both sources, in the form of cash, services, or payment in kind.

2. Income obtained abroad by individuals domiciled in Ecuador or by national companies.

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In accordance with the first paragraph, the criterion of territoriality, also known as the "source principle", is adopted in order to establish the link between the tax obligation and the source. This approach is based on the idea that all income earned within the territory of Ecuador must be subject to taxation there, regardless of the taxpayer's country of tax residence.

The second paragraph refers to the personal criteria of domicile and nationality, also known as the "residence principle". This approach is based on the idea that all of the income that a taxpayer earns worldwide must be subject to taxation in the country where the taxpayer resides.

According to Article 8.5 of the Law of the Internal Tax Regime Law of Ecuador, the profits and dividends distributed by companies registered or established in the country are considered to be income earned in Ecuador. Therefore, this type of capital income (dividends) is subject to taxation in Ecuador, no matter who the beneficiary of the dividend is or where their tax residence is.[3]

Definitions of "Dividend" in Internal Legislation and Economic Double Taxation

As mentioned by Pérez (2012), in order to analyze the tax treatment of dividends, it is necessary to establish the existing difference between profit and dividend, since the right to profits arises from the nature of the corporate business and is unavailable by the corporate bodies (p. 220). The dividend, on the other hand, depends on the existence of distributable profits and on the Assembly (i.e., the Shareholders' General Meeting) agreeing on the distribution among the partners of the profits resulting from the previously approved balance sheet; it is, therefore, a right that the Assembly can dispose of (Pérez, 2012, p. 220).

In the opinion of Salamanca (1976), the right to the dividend is to be understood as the right that every shareholder has to participate in the profits. Salamanca (1976) notes that the right to the dividend is one, but its exercise, that is, its enforceability, is carried out in several stages, through a series of facts and legal acts. The right to the dividend, in fact, requires a materialization of assets, which is made effective in each period through the establishment of the surplus or net profit determined by the reliable balance sheet approved at the Shareholders' General Meeting (p. 69).

On the other hand, Litzenberger and Van Horne (1978) describe how shareholders were subject to double taxation in the United States at the time:

> With the present tax system, the investor pays personal income taxes on cash dividends distributed to him and, in addition, his portion of the total earnings of the company is subject to the corporate tax rate. Thus, unlike other sources of income, corporate source income is taxed under two different income taxes - personal and corporate (p. 737).

They argue that there are a number of methods by which the double taxation of dividends could be eliminated, including "the deduction of dividends at the corporate level, the stockholder credit method, or some combination of the two" (Litzenberger & Van Horne, 1978, p. 727).

[3]Servicio de Rentas Internas (SRI), 2020, 1-6

In their research on the economic effects of dividend taxation and how these affect the decisions of companies and their shareholders, Poterba and Summers (1985) argue that "dividend taxes reduce corporate investment and exacerbate distortions in the intersectoral and intertemporal allocation of capital" (p. 5).

In his analysis of dividends and their relationship with double taxation, Vega Borrego (2002) concludes that dividends, on the other hand, are susceptible to double economic taxation because the profit from which they derive is taxed both at the headquarters of the paying company and at the partner. The systems articulated by Spanish legislation do not completely eliminate, in all cases, the economic double taxation that occurs (p. 92).

Similarly, Bustos Gisbert and Pedraja Chaparro (1999) indicate that:

> The question is not whether dividends are taxed twice, nor the alleged bias in favor of undistributed profits, but whether or not the income from the company, whether distributed to shareholders or not, is taxed according to the marginal personal income tax rates. Therefore, the root of the problem is not so much the existence of a corporation tax, but what connection can be established between it and personal income taxation (p. 57).

For Gota Losada (1988), the conceptual requirements for the double economic taxation of dividends are as follows:

a) the companies must have a legal-tax personality distinct from that of their partners or shareholders;
b) the companies must pay corporate income tax on the total income obtained;
c) the partners must pay personal income tax on the dividends received, which are included in their overall income;
d) there should be no option in favor of the companies to stop paying corporate income tax in exchange for the partners paying personal income tax on the total corporate profit, whether distributed or not; and
e) it is necessary that the entities do not pass on income tax to the companies in the sale price of the products, nor in the acquisition prices of the raw materials or of the production factors (p. 33).

Morck (2005) considers that:

> the arguments for eliminating the double taxation of dividends apply only to dividends paid by corporations to individuals. The double (and multiple) taxation of dividends paid by one firm to another—intercorporate dividends—was explicitly included in the 1930s as part of a package of tax and other policies aimed at eliminating U.S pyramidal business groups (p.135).

Jugurnath et al. (2008) describe the tax reforms implemented in Australia in 1987 in order to "eliminate the distortions of double taxation" (p. 209). They explain that the country "adopted a dividend imputation system" (Jugurnath et al., 2008, p. 209). Their empirical results show that the allocation of dividends "is an effective way to reduce the distortions caused by the traditional system of taxation" and has been "able to positively stimulate corporate capital investment" (Jugarnath et al., 2008, p. 209).

In her analysis of the Belgian tax system, Lamensch (2009) notes that, in order to avoid:

> the double taxation of dividends, the Belgian 'definitively taxed income' rules allow parent companies to deduct the dividends received from their subsidiaries resident in another Member State but only up to the amount of their taxable profits in the same taxable period, which potentially limits the deductibility of the dividends received (p.473).

According to Kao and Chen (2011), in Taiwan, the double taxation of dividends was eliminated. They note that, as a result, companies now tend to pay larger dividends.

In his research on the U.S. tax system, Berner (2003) analyzes "the irregular slide in the dividend-payment ratio from fifty-five percent to sixty percent in the 1960s to only thirty percent to thirty-five percent" at the date of his research (p. 58). He explains that this is, in part, "because of the treatment tax of dividends compared to that of capital gains: corporate income is taxed once at the corporate level—thus decreasing what is available to pay out to shareholders—and again to the shareholder on receipt of a dividend" (Berner, 2003, p. 58).

Ahmad and Xiao (2013) examine "the effectiveness of the "end of double taxation" (on dividends) policy in stabilizing an economy", taking "both announced and unannounced policies" into account (p. 928). They state that "a reduction in double taxation stimulates investment and improves welfare, but its impact on output is moderate and it has a negative effect on work hours" (Ahmad & Xiao, 2013, p. 928).

The Organisation for Economic Co-operation and Development (OECD) defines the double economic taxation of dividends as "the simultaneous taxation of the company's profits at the level of the company and of the dividends at the level of the shareholder" (OECD, 2019, p. 196).

In the same sense, the OECD (2007) considers the terms of legal double taxation and economic double taxation from an international point of view, referring to the first one as the situation in which the same benefit accrued to a taxpayer is taxed by two jurisdictions. On the other hand, a double economic taxation occurs when the same benefit accrued to two economically related entities is taxed twice, by two jurisdictions (OECD, 2007).

Cross (n.d., as cited by Montaño Galarza, 2006) points out that the term economic double taxation usually refers to the situation in tax law in which the same tax source is taxed by two (or more) identical or analogous taxes in the hands of different people (p. 91). Montaño Galarza (2006) also mentions some of the cases in which economic double taxation occurs:

a) double taxation on dividends (as a company and as an individual);
b) double inter-company taxation (the company distributes dividends to individuals);
c) economic double taxation arising from tax adjustments in transactions between related companies (p.119).

Meanwhile, in his analysis of the Constitutive Treaty of the European Community (TCCE), Marín Benitez (2005) notes that if the possibility of the same taxable event being taxed twice constitutes one of the most serious obstacles to the internationalization of economic activities, and this internationalization is essential to the achievement of a single European market, the

double taxation of cross-border dividends constitutes a serious interference with the achievement of the objectives sought by the TCCE (p.4).

Gale (2016) states that, in the United States, the "classical tax system" employed means that "corporate profits are subject to double taxation, once at the corporate level when they are earned, and again at the individual level when they are paid out as dividends" (p. 839). He notes that the Bush administration, at the time, was "reportedly considering corporate tax reform options in part because of concerns about double taxation" (Gale, 2016, p. 839). He adds that "dividends are not taxed twice if they are paid to nonprofit institutions or foundations; federal, state or local governments, public or private pension funds; and 401(k) plans or Individual Retirement Accounts" (Gale, 2016, p. 839).

In this context, we assume that economic double taxation has a negative impact on the principle of tax neutrality by influencing various decisions in the society (for example, dividend distribution policies, the decision to capitalize, accumulate, or to distribute those benefits, the sources of financing and even the development of aggressive tax strategies to divert resources into jurisdictions with less taxation. According to this principle, the application of tax should not change the economic behavior of taxpayers, unless this tax-induced change reduces the inefficiency of the market equilibrium. Therefore, measures taken towards the elimination of double taxation facilitate tax neutrality.

When discussing tax neutrality, Furman (2008) claims that "the basic concept is simple: generally, the tax system should strive to be neutral so that decisions are made on their economic merits and not for tax reasons" (p. 1). He adds that:

> Examining ways that the tax system approximates or departs from neutrality can be a helpful lens for thinking about a range of tax policy and economic problems.
>
> Tax neutrality is a widely accepted concept in principle. In practice, however, tradeoffs between different concepts of neutrality and different goals can be difficult to resolve. But in several cases this concept can provide a useful way to cut through some of the debates about tax policy and identify a more economically efficient way to organize the tax system. (Furman, 2008, p. 1)

Kleist (2012), elaborating on the concept of neutrality, writes that:

> the concept of tax neutrality is sometimes used to describe an ideal situation where a taxpayer's choices are unaffected by tax laws. However, tax neutrality in the sense of CIN[4] and CEN[5] does not require that the taxation is optimal with regard to freedom from distorting effects in the marketplace. Rather, the word *neutrality* in CIN and CEN refer to the fact that a cross border investment is taxed equal (uniform) to domestic investment or investments made within the other state. Although this does not meet the criteria for tax neutrality in a narrow sense, it would be reasonable to assume that CIN or CEN (or a tax burden in between these two) will generally result in less distortion in the marketplace than if a cross border

[4] Capital import neutrality.
[5] Capital export neutrality.

> transaction is subject to a higher or lower tax burden than the range set by CIN and CEN (p. 41).

In accordance with the OECD (2011) guidelines on the neutrality of taxation, a tax system can only be considered to be neutral with respect to business decisions when two requirements are met:

a) a certain social benefit before taxes creates the same profitability after taxes for partners independently of the form that the remuneration takes (for example, the payment of dividends);
b) the joint tax burden must be equal for all benefits, whether distributed or reserved.

From this point of view, if the issue of double taxation is not resolved, the behavior of the company will be influenced by tax issues and indebtedness (which is deductible) will be preferred. For that reason, retention of profits will place the continuity of the company in jeopardy and be detrimental to the efficient allocation of capital.

2. INTERNATIONAL DOUBLE TAXATION AND THE METHODS ESTABLISHED IN THE CONVENTIONS TO COUNTERACT IT

The appearance of double taxation is also remarkable because of the discrepancies in the specification of the adopted approach. Although most of the laws make the residence the determining connection point for the tax application, different definitions of the constituent elements of the residence make it possible for cases of double residence to occur: for example, the head office where the activity is performed and from which the income comes, and the location of the income source, rather than the location of the payer of the income.

As regards international economic double taxation, there is identity of taxable object and similarity of tax (income taxation), but the requirement of subjective identity proper to international legal double taxation is missing. It can occur if the ownership of the patrimonial elements or of the factors of production from which the taxed income derives are attributed by the domestic legislation of the states to different people, or when the regime of qualification and attribution of income is different (Vallejo Aristizábal, 2019, pp. 91-92).

This type of double taxation is directly related to the economic capacity that can be perceived from the performance of the taxable event. This can be verified when the same income, transaction, or assets are taxed in two or more countries during the same tax period, but in respect of different taxpayers. As claimed by Borrás Rodriguez (1974), the causes for double taxation could be systematized as follows:

1. As a consequence of the adoption, by the two different states, of two opposing criteria to determine their tax competence.

2. When two countries adopt the same criterion to determine their tax competence.

3. As a result of the existence between two countries of different criteria for determining the tax base (pp. 124-125).

As the problems arising from fiscal sovereignty have been presented at international level, various general solutions have been proposed and used by different states according to their

economic and fiscal policies. These solutions can be summarized as the exemption method and the imputation (or attribution) method.

The Exemption Method

The country of residence will not tax the income that was already taxed in the host country. Therefore, the country of residence will consider it as exempt income.

The exemption method constitutes an exception to the principle of the taxation of the global income of the residents, since it supposes that the country of residence refrains from taxing income that was created in the other country. This method is also known as a distribution system, since it involves the distribution of tax between the country of residence and the host country.

According to the international tax planning studies carried out by de Arespacochaga (1998), when this method is used in the hypotheses of concurrence of real and personal taxation criteria of two states, in which the source country taxes the taxpayer on the income obtained in its territory and the state of residence taxes them on their worldwide income (subject to the same taxable event), this mechanism corrects the effects of the juxtaposition of fiscal sovereignties through the granting by the latter of a tax exemption in relation to the taxable events subject to double taxation (p. 369).

The use of the exemption method causes overseas investments to become more attractive than investments made within the country of residence. This often occurs in developing countries, which usually apply lower tax rates than developed countries, and provide tax exemptions or incentives in respect of such investments.

Calderón Carrero (1997) specifies that as long as the eventual tax sacrifice made by an underdeveloped state to attract or retain investment is not prejudiced, it seems feasible that the following are among certain conditions to be met for the application of the exemption technique:

- The resident taxpayer must have obtained foreign source income.
- The foreign source income must be subject to taxation by the taxpayer granting the application of the exemption (p. 150).

The exemption method can be classified in two ways:

• **Full exemption:** The country of residence will not tax income which comes from the source country.

• **Exemption with progression:** The country renounces the taxation of income created abroad, excluding this from the tax base. However, the amounts involved are taken into consideration when determining the corresponding progressive rate that is applied to the remaining income, whether internal or external.

The Imputation (or Attribution) Method

When the imputation method is used, the country of residence maintains the principle of taxation on global income and takes foreign income into consideration when determining the tax base of its residents. The problem of double taxation is then solved by way of a tax credit; the tax administration has the capacity to subtract income tax that has already been paid abroad from the amount of tax due.

There are two types of imputation:

- **Full imputation:** The country of residence allows for a deduction corresponding to the total amount of tax paid in the host country to be made without limitation.

- **Ordinary imputation:** The tax credit granted by the country of residence in terms of the deduction of foreign tax is limited to the portion of the tax that corresponds to income earned abroad.

According to de Arespacochaga (1998), total or integral imputation occurs when the state of residence allows the deduction of the totality of the tax previously paid by the taxpayer in the state of source for the same income or wealth that is now intended to be taxed again; and partial or limited imputation is the formula in which the state of residence deducts the tax previously paid, but up to the maximum limit of what would be payable if the income had not been obtained in that state (p. 370). In short, de Arespacochaga (1998) adds, the deduction of the foreign tax is limited to the amount resulting from applying the average tax rate of the state of residence to the income obtained in the other state (p. 370).

When using the ordinary, or limited, imputation method, the deduction of foreign taxes cannot exceed the level of tax that would need to be paid in the country of residence if the income or assets obtained abroad were of national origin. This is the method that is used most frequently by countries, since it allows them to mitigate or eliminate double taxation at the level of taxation of the countries involved, according to the tax principles of equity and equality.

3. EXAMPLES OF THE APPLICATION OF THE ECUADOR-SPAIN AGREEMENT (OECD MODEL)

Article 425 of the Constitution of the Republic of Ecuador (2008) states that the hierarchical order of the application of regulations should be as follows: "the Constitution; international treaties and conventions; organic laws; ordinary laws; regular laws; regional regulations and district ordinances; decrees and regulations; ordinances; agreements and resolutions; and the other actions and decisions taken by public authorities" (República del Ecuador Asamblea Nacional, 2008, p. 121).

Some examples[6] are presented below in order to analyze the effects of double taxation and the application of the current convention between Ecuador and Spain that was designed to regulate it).[7]

[6] All examples in this article are for the illustrative purpose only. Any coincidence of names and financial information is unintentional.

[7] Published in Registro Oficial No. 253 on August 13, 1993, and applicable from 1994. https://www.sri.gob.ec/fiscalidad-internacional2

In 2020, M&K (a company resident in Ecuador) recorded a profit before labor costs and interest, taxes, depreciation and amortization (EBITDA) of $ 1,500,000. After fulfilling its tax obligations to the Ecuadorian tax administration, the company had profits of $820,000 available for its shareholders. M&K's corporate structure consisted of the shareholders detailed in Table 1.

At the shareholders' general meeting, it was decided that 100% of the $820,000 profit mentioned previously would be distributed in the form of dividends, as shown in Table 2.

According to Tables 1 and 2, Q&Z is a company that holds a 10% stake in the Ecuadorian company M&K, for which it is entitled to the sum of $82,000 in concept dividends. This income has already been taxed in Ecuador, although Q&Z is resident in Spain for tax purposes.

Table 1: M&K Corporate Structure

Shareholder	Taxpayer	Tax residence	Shares
Interpex C.A.	Legal entity	Ecuador	10%
Printad S.A.	Legal entity	Canada	30%
Q&Z	Legal entity	Spain	10%
Carlos Herrera	Individual	Ecuador	30%
Ana Gonzalez	Individual	France	20%

Source: Prepared by the authors.

Table 2: M&K Dividend Distribution

Shareholder	Tax residence	Shares	Dividends
Interpex C.A.	Ecuador	10%	$82,000.00
Printad S.A.	Canada	30%	$246,000.00
Q&Z	Spain	10%	$82,000.00
Carlos Herrera	Ecuador	30%	$246,000.00
Ana Gonzalez	France	20%	$164,000.00

Source: Prepared by the authors.

The tax treatment of the distribution of dividends as detailed in the Double Taxation Convention (DTC) signed between Ecuador and Spain[8] is based on Article 10 of the OECD's (2017) model tax convention on income and on capital, which states:

[8] International Taxation [Conventions to avoid double taxation]. https://www.sri.gob.ec/fiscalidad-internacional2

1. Dividends paid by a company that is a resident of a Contracting State to the resident of the other Contracting State may be taxed in that other State.

2. However, dividends paid by a company which is a resident of a Contracting State may also be taxed in that State according to the laws of that State, but if the beneficial owner of the dividends is a resident of the other Contracting State, the tax so charged shall not exceed:

a) 5 per cent of the gross amount of the dividends if the beneficial owner is a company which holds directly at least 25 per cent of the capital of the company paying the dividends throughout a 365 day period that includes the day of the payment of the dividend (for the purpose of computing that period, no account shall be taken of changes of ownership that would directly result from a corporate reorganisation, such as a merger or divisive reorganisation, of the company that holds the shares or that pays the dividend);

b) 15 per cent of the gross amount of the dividends in all other cases.

The competent authorities of the Contracting States shall by mutual agreement settle the mode of application of these limitations. This paragraph shall not affect the taxation of the company in respect of the profits out of which the dividends are paid.

3. The term "dividends" as used in this Article means income from shares, "jouissance" shares or "jouissance" rights, mining shares, founders' shares or other rights, not being debt-claims, participating in profits, as well as income from other corporate rights which is subjected to the same taxation treatment as income from shares by the laws of the State of which the company making the distribution is a resident.

4. The provisions of paragraphs 1 and 2 shall not apply if the beneficial owner of the dividends, being a resident of a Contracting State carries on business in the other Contracting State of which the company that paying the dividends is a resident through a permanent establishment situated therein and the holding in respect of which the dividends are paid is effectively connected with such permanent establishment. In such case the provisions of Article 7 shall apply.

5. Where a company which is a resident of a Contracting State derives profits or income from the other Contracting State, that other State may not impose any tax on the dividends paid by the company, except insofar as such dividends are paid to a resident of that other State or insofar as the holding in respect of which the dividends are paid is effectively connected with a permanent establishment situated in that other State, nor subject the company's undistributed profits to a tax on the company's undistributed profits, even if the dividends paid or the undistributed profits consist wholly or partly of profits or income arising in such other State" (pp. 35-36).

When the Ecuadorian company (M&K) distributes dividends to the Spanish entity (Q&Z), three different scenarios can be presented in which the Spanish entity is considered as a non-resident foreign company in Ecuador:

Scenario 1: Without Applying the DTC Regulations

The Ecuadorian company (M&K) pays 25% withholding tax on the 40% of the distributed dividend according to the current internal regulations regarding the payment of dividends, in accordance with Article 39.4 of the Law of the Internal Tax Regime.

- Value of the dividend: $82,000
- Percentage of withholding tax in Ecuador for non-residents: 25%
- Calculation of the withholding tax determined in Ecuador: $82,000 * 40% * 25% = $8,200
- Net value to be received by the company resident in Spain: $73,800.

Table 3: Accounting Journal for the Distribution of Dividends - Scenario 1

Description	Debt	Credit
Paid Dividends	$82,000.00	
Withholding tax		$8,200.00
Cash and cash equivalents		$73,800.00

If Spain applies tax of 25% to the dividends received by its residents, the total amount of tax to be paid by Q&Z would be $18,450 plus $8,200, that is, $26,650, and the after-tax dividend received would be $55,350.

In Ecuador, when the source principle is applied, distributed dividends are considered as taxable income regardless of the tax residence of its shareholders, except when the dividends are distributed to a company resident in Ecuador. In this scenario, since the shareholder is a Spanish company, the respective withholding is made.

Meanwhile, in Spain, when the residence principle is applied, dividends obtained abroad by a resident in Spain are considered to be part of their global income, which means that this income must be taxed again. In this way, the same income will have been taxed in two different countries.

In this scenario, economic double taxation of dividends takes place because the corporate profit made by the company resident in Spain (Q&Z) is taxed when it is distributed in the country in which the dividend is received and again in Spain.

Scenario 2: The DTC Regulations are Applied while Ignoring the Residence of the Beneficial Owner

Ecuador does not tax the dividends to be distributed since it is known that they must be taxed in Spain.

Table 4: Accounting Journal for the Distribution of Dividends - Scenario 2

Description	Debt	Credit
Paid dividends	$82,000.00	
Cash and cash equivalents		$82,000.00

Consequently, Spain applies 25% withholding tax to companies' foreign-earned income, as follows:

• Calculation of tax value applied in Spain: $82,000 * 25% = $20,500
• Net value to be received by the company resident in Spain (Q&Z): $82,000 - $20,500 = $61,500.

In Ecuador, when the source principle is applied, distributed dividends should be considered as taxable income. However, as the result of a unilateral mechanism and/or bilateral agreement made with the purpose of encouraging foreign investors, there is an exception to this regulation. Ecuador considers income earned by non-resident companies and/or companies that maintain permanent establishments in the country to be tax exempt. Therefore, all income is expected to be taxed in the resident country (in this case, Spain) through the exchange of tax information between the two tax administrations.

Under these conditions, the country of residence taxes the income earned in its territory and, applying the exemption method, totally or partially excludes any income received from dividends abroad. This system of exemption of income obtained in the country where the investment is made is highly attractive to developing countries, which have traditionally been importers of capital. Some developing countries, on the other hand, have criticized this method since, with the constant mobility of capital, they are almost always the lenders and investors.

Developing countries have benefited from this method, either through unilateral mechanisms after they have reformed their domestic legislation, or through the negotiation and signing of agreements or treaties aimed at minimizing international double taxation.

In reality, a tax treaty is required because nothing will prevent capital from going to other developed countries that offer better conditions for investors if the exemption relating to income earned abroad is not limited.

Specifically, in the field of taxation of capital income (such as dividends) and in an era of international financial mobility, neutrality requires that when taxes are levied on capital, this does not result in a change of the location for these investments, i.e., the investments would still have taken place in the same location had the taxes not have been levied on the capital.

For this reason, it is argued that the exemption methods achieve so-called neutrality in the importation of capital: i.e., when a country receives foreign investment, all investments made in its territory are subject to the same degree of effective taxation regardless of their origin. This favors foreign investment.

Ecuador imports capital and, from its perspective as a country receiving foreign investment, it must ensure that its tax system is efficient. Fair competition must be favored and discrimination must be avoided.

Scenario 3: The DTC Regulations are Applied Based on the Residence of the Beneficial Owner

Ecuador withholds tax of a maximum of 5% of the gross value of the undistributed dividend, in accordance with the provisions of the DTC.

- Value of the dividend: $82,000
- Percentage withheld by Ecuador as a result of applying the DTC: 5%
- Calculation of the amount withheld by Ecuador: $82,000 * 5% = $4,100
- Net value to be received by the company resident in Spain: $77,900

Table 5: Accounting Journal for the Distribution of Dividends - Scenario 3

Description	Debt	Credit
Paid dividends	$82.000.00	
Withholding tax		$4,100.00
Cash and cash equivalents		$77,900.00

The Spanish tax administration will apply tax of 25% to foreign-earned income (i.e., that earned in Ecuador) but, in order to avoid double taxation, it must use the limited imputation method[9] when dealing with this income. The amount paid in Ecuador would represent a tax credit on the global income tax paid.

Table 6: Withholding Tax - Ecuador – Spain DTC

Ecuador	Spain
Corporate income tax rate: 25% Dividend: $82,000.00 DTC rate 5%: $4,100.00	Corporate income tax rate: 25% Dividend: $82,000.00 Tax 25%: $20,500.00 Withholding tax: ($4,100.00) Tax payable: $16,400.00

In this case, the net dividend to be received in Spain would be: $82,000 - $16,400 = $65,600. In this scenario, the tax collected ($20,500) is distributed between the public finances of the two countries involved. Most of that amount goes to Spain ($16,400) and the rest ($4,100) goes to Ecuador. This is a similar tax load to that in the scenario in which there was no agreement to regulate double taxation. It generates revenue for both the country obtaining the dividend

[9] Within the limit of 15% of the amount of benefits.

(Ecuador) and the recipient's country of residence (Spain). However, it allows the recipient to retain more of the dividend ($65,600 rather than $61,500).

The model for the type of agreement applied to avoid double economic taxation between Ecuador and Spain is that of the OECD, where the residence principle and the concept of permanent establishment are applied. In Ecuador, a withholding tax of 5% is applied to non-resident companies, as this percentage is used as a tax credit in Spain (according to the imputation method), where a rate of 25% is applied to the taxpayer's global income. The fact that Spain uses the imputation method in its domestic legislation implies tax equality in residency; however, it provides an incentive not to repatriate income. From a taxation point of view, it does not generate tax collection costs. From an economic point of view, it generates neutrality in the export of capital, as it makes no difference to the exporting country where it invests.

If another Andean Community of Nations-type agreement, based on Decision 578 of the Andean Community[10], were to be applied, the source principle would apply, which means that income of any nature obtained by residents or non-residents would only be taxable in the country in which the income was generated. Along these lines, 25% of the dividends received by the Spanish company (Q&Z) would be withheld directly in Ecuador, while this income would be excluded from the taxable base in Spain and, therefore, would be exempt from tax.

From a tax point of view, when Spain uses the exemption method in its domestic legislation, it is beneficial for the capital exporter, as this method reinforces the capital exporter's tax policy. From a tax collection point of view, this method results in a tax loss or waiver for the country that applies the method. Finally, from an economic point of view, it leads to neutrality in the import of capital. A local investor does not repatriate income, so does not pay. A foreign investor should pay as they repatriate income—however, when this method is used, they do not pay. The method favors the repatriation of profits.

4. DISCUSSION

We believe that the international economic double taxation of dividends violates the principle of tax neutrality by affecting the decisions adopted by companies regarding the distribution of dividends by two means: first, it influences the suitable management of dividends by conditioning the preference for certain forms of financing (indebtedness and reinvestment of profits) over other forms (shareholders); and second, it has an impact on the origin of their investors, favoring those coming from jurisdictions with lower tax loads.

To the best of our knowledge, this is the first study to analyze the effects of the economic double taxation of dividends that are obtained in Ecuador and distributed to a resident in Spain in several scenarios: in the absence of a specific convention between these countries, and when the same agreement exists in two different modalities (without or with taking residence into account).

We believe that the international tax treatment of dividends is of major importance as it influences the location choices of companies that look for tax advantages, especially in the contexts of globalization and heavily delocalized production systems.

[10] International Taxation [Conventions to avoid double taxation]. https://www.sri.gob.ec/fiscalidad-internacional2

We have learned that the different solutions adopted domestically by the different countries produce different results, depending on whether the regulations of the recipient's country of residence or the host country are used as a criterion for taxation.

We assume that the absence of a uniform tax regime at the international level does not encourage equal treatment of corporate profits or of shareholders' dividends. For this reason, it is necessary to analyze the bilateral agreements signed between the different countries.

Our opinion is that the multiple solutions provided by the bilateral conventions on this subject do not contribute to the standardization of the treatment of dividends at international level. The use of the solutions agreed by the signatory countries in order to avoid double taxation may lead to discrepancies depending on the solution choice.

Thus, use of the solution based on the exemption (either in full or progressively) of the dividends that have already been paid in the host country, which is often adopted by developing countries, makes internal investments even more difficult and penalizes their economic growth.

The imputation method, whether full or ordinary (the tax credit granted that allows the total or partial deduction of the dividend from the total tax paid in the country of origin), is more sophisticated and less damaging to the interests of the country of residence of a recipient of international dividends.

The analysis conducted shows that the result, both in terms of taxation and the effective perception of the dividend, differs dramatically according to the assumptions considered. The scenario that results from the current DTC between Ecuador and Spain and includes the application of the regulations based on the residence of the beneficiary is far more advantageous for investors. In addition, the distribution of the tax collected between the host country (Ecuador) and residence country (Spain) results in an increase in the total effective tax to which the dividend is subjected.

Finally, the OECD's CFA has indicated that there is no exclusive right to tax dividends either in the state of residence of the dividend recipient or in the state of residence of the company paying the dividends.

The exclusive taxation of dividends in the source country is not acceptable as a general principle. Moreover, there are a number of countries that do not tax dividends at source whereas, as a general rule, all countries' impose taxes on dividends that their residents receive from non-resident companies.

It is also impossible to establish the exclusive taxation of dividends in the beneficiary's country of residence as a general rule. Residence-based taxation would be more appropriate, especially when dividends are generated by a highly mobile capital. However, it would be unrealistic to expect that the taxation of dividends at source would be totally waived. For this reason, the solution is restricted to stating that dividends may be taxed in the beneficiary's country of residence.

5. CONCLUSIONS

In view of the preceding analysis, we can conclude that:

• Dividends represent income (earnings) for their beneficiaries and are regulated according to the allocation criteria (source and residence). In the case of Ecuador, this regulation is combined, either by the tax obligation that falls on the company at the time of distribution, or according to the shareholder that is taxed upon receiving them.

• Under the principle of residence, all global income is taxed (i.e., income generated in Ecuador and income obtained abroad by individuals or by companies domiciled in Ecuador. Under the principle of source, also known as the principle of territoriality, taxation is applied to income generated in Ecuador (for example, those free of charge or for onerous title, capital or both sources, or consisting of cash, payment-in-kind or services).

• The application of the principle of territoriality means that all income generated in Ecuadorian territory (including dividends) is subject to tax regardless of the residence of the recipient of the income. Hence, double economic taxation occurs when the shareholder who receives the dividends resides in another country and is taxed again there.

• Similarly, prior to the payment of the income tax that corresponds to the resident company that distributes the dividend, the only exempt income will be the one distributed to resident companies in Ecuador and/or non-resident companies with permanent establishment in the country. For all other shareholders, that is, for those who do not reside in Ecuador, the dividend will be taxed and subject to income tax withholding.

• For this reason, there is a double economic taxation of dividends: first in the country where they are created (Ecuador) and, second. in the country where the recipient resides (Spain). This affects the efficiency of the allocation of resources and influences foreign investment decisions, discouraging fair competition in a globalized world. Consequently, one of the bilateral measures used to mitigate this impact is the adoption of conventions designed to avoid international economic double taxation.

• In the conventions signed by Ecuador with other jurisdictions in order to avoid double taxation in respect of income tax, the most widely used tax allocation criterion for dividends is the principle of residence. The most frequently used method to counteract it is the imputation method.

• In the case of the convention signed with Spain (published in Registro Oficial No. 253 on August 13, 1993), the residence method is used (OECD model), anticipating an exemption of a maximum of 15% on the gross amount of the profits if the recipient resides in Spain, according to the ordinary imputation method and progressive exemption.

• The case study developed in this paper allows us to conclude that, in the absence of a convention, when dealing with an amount of Ecuadorian-sourced benefits of $82,000, the recipient that resides in Spain would receive $73,800 and be taxed according to current legislation. In the scenario where the tax is applied in Spain and there is no notification of residence of the beneficiary of the dividends, the company would receive $82,000 minus the 25% that would be applied in Spain. Thus, the company would receive $61,500. In the scenario where the residence of the recipient is notified, the net value that the company would receive is $65,600, which results from imposing a tax of 25% on the profit obtained in Ecuador once taxed there ($77,900), having discounted the $4,100 already paid in the country of origin (Ecuador). In the latter case, the tax is still $20,500 but the tax collection is distributed between

both countries ($16,400 for Spain and $4,100 for Ecuador), and the dividend received is higher ($65,600 versus $61,500).

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