economies

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Tax Complexity and Firm Tax Evasion: A Cross-Country Investigation

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Abstract: This paper endeavours to investigate whether a complex tax system influences firms' propensity toward tax evasion across countries. To achieve the objectives of this study, we utilised the World Bank Enterprise Survey and the World Bank's Doing Business databases covering more than 46,000 companies from 83 countries. Our study revealed that the increased time required to pay taxes and higher total tax payments were associated with a greater extent and incidence of tax evasion among firms. The consistency of these benchmark regression results was proven through endogeneity analysis and several robustness tests. Furthermore, our heterogeneity analyses showed that the effect of tax complexity on firm tax evasion was more prominent in low- and lower-middle-income countries and also in the primary industry. These findings offer promising evidence for policymakers, particularly in low- and lower-middle-income countries where the majority of companies operate in the primary industry. Addressing the complexity of the tax system could potentially mitigate the adverse impact on tax evasion levels in these countries. Furthermore, our spatial analysis provides valuable insights, emphasising the potential impact of tax complexity in neighbouring countries and underscoring the necessity for policymakers in the home countries to strategise on harmonising and streamlining their tax systems.

Keywords: tax complexity; firm tax evasion; firm-level data; cross-country dimension

Citation: Saptono, Prianto Budi, Gustofan Mahmud, Fauzilah Salleh, Intan Pratiwi, Dwi Purwanto, and Ismail Khozen. 2024. Tax Complexity and Firm Tax Evasion: A Cross-Country Investigation. *Economies* 12: 97. https://doi.org/10.3390/economies12050097

Academic Editor: George R. G. Clarke

Received: 21 March 2024
Revised: 16 April 2024
Accepted: 19 April 2024
Published: 24 April 2024

1. Introduction

Enterprises have historically constituted a cornerstone of government revenue streams, yet paradoxically, they have also been implicated in a significant portion of tax evasion cases (Chang and Lai 2004; Crocker and Slemrod 2005; Nur-Tegin 2008). Governments continue to pay attention to their evasion behaviour, which appears increasingly complex as business affairs and market globalisation become progressively sophisticated (Beck et al. 2014; Hanlon et al. 2015), particularly after the global financial crisis and the Great Recession (Moshirian 2011; Slemrod 2019).

The pervasiveness of that issue across nations is not to be underestimated, as it erodes the government's capacity to efficiently allocate resources to provide smooth public goods that stimulate business development (Andreoni et al. 1998; Johnson et al. 2000). Furthermore, as time unfolds, an unsettling divergence emerges between those who engage in tax evasion and those who conscientiously adhere to tax laws, with the latter group shouldering an increasingly disproportionate tax burden. Consequently, this disparity fosters incentives for firms to engage in further acts of evasion (Feinstein 1991). A recent empirical study has unveiled substantial surges in revenue losses from corporate tax evasion in developing countries since the 2000s commodities boom (Cobham and Janský 2018).

Intuitively, there exists a tacit acknowledgement that a firm's willingness to meet its tax obligations is intricately entwined with its alignment with the regulatory framework established by the government. This inherent inclination to fulfil tax responsibilities, often referred to as 'tax morale', tends to diminish when businesses encounter difficulties navigating the complex landscape of tax laws. Even if willing to pay, some of them will exploit the potential for diverse interpretations of tax statutes by (usually) hiring assistance from tax advisors to choose the lowest-tax options (Frecknall-Hughes et al. 2023). Therefore, streamlining the tax system may be the most effective route to facilitate good governance, cornerstone a taxpayer-government 'fiscal contract', and curb rampant tax evasion practised by firms.

Academic papers typically provide evidence that tax complexity can lead to tax non-compliance. However, most of them are related to individual tax behaviour (e.g., Cuccia and Carnes 2001; Forest and Sheffrin 2002; Kirchler et al. 2006; Slemrod 2007; Mathieu et al. 2010; Blaufus et al. 2019; Taing and Chang 2020; e Hassan et al. 2021). A few studies bring the evidence to the business level yet focus only on one country. For example, Eichfelder and Hechtner (2018) and Musimenta (2020) found that the tax system's complexity leads to lower business taxes in Belgium and Uganda, respectively. To the best of our knowledge, no evidence is yet available from firm-level data in a cross-country dimension.

The lack of empirical investigation into corporate tax evasion in a cross-country dimension is regrettable, particularly in light of recent criticisms raised against cross-border corporations that fail to fulfil their 'fair share' of taxes (Elbra and Mikler 2017; Campbell and Helleloid 2016). This issue has contributed to the increasing societal dissatisfaction with income inequality as tax systems are often perceived to favour global companies at the expense of domestic firms (Otusanya 2011; Tørsløv et al. 2023). Moreover, as underscored by Tan and Sawyer (2003) and Torgler (2011), such a literature gap marks a permanent need for comprehensive international inquiries into the realm of tax evasion, particularly when examined through the lens of corporate entities. Hence, this paper aims to fill the void by attempting to address the question of whether a complex tax system increases the propensity of firms across countries to engage in tax evasion.

We explored the question using the World Bank's Enterprise Survey (WBES) and the World Bank's Doing Business (WBDB) databases. This study operationalised firm tax evasion through two distinct measures: a ratio and a binary dummy variable, both values of which were obtained from respondents' responses to the tax compliance-related question asked in the WBES. Tax complexity was gauged by two alternative variables provided by the WBDB: tax time and tax payment. We linked these main variables to an array of control variables (including macroeconomic, tax burden, demographic, and institutional factors), which resulted in a unique and expansive dataset spanning 83 countries and encompassing data from over 46,000 firms.

By harnessing the extensive dataset at our disposal, this study makes substantial and multifaceted contributions to the existing body of literature. First, our research synthesised two distinct yet interconnected units of analysis within the area of tax evasion, namely, the tax evasion practises of firms and the prevalence of tax evasion across different nations worldwide. This dual analytical approach allowed us to paint a comprehensive picture of tax evasion that spanned from the individual firm to the global stage.

Second, the study stands as a pioneering effort to address a crucial lacuna within academic discourse. It caters to the growing exigency within the scholarly community for a comprehensive investigation into the impact of tax-related regulatory factors, such as tax time and tax payment, on the phenomenon of tax evasion. Antecedent studies by Beck et al. (2014) and Ahamed (2016) with similar databases have only included these variables within the vector of control variables. At the same time, it is vital to have a deeper comprehension of the relationship between the intricacy of tax rules and the occurrence of tax evasion since this has exhibited its efficacy in mitigating tax evasion tendencies over an extended period.

Third, it considers various sources of endogeneity bias that might potentially undermine the validity of our empirical findings, such as omitted variables and simultaneity.

Researchers often overlook these issues while conducting empirical analyses on the link between tax complexity and tax evasion. Hence, as a distinction from previous studies, we applied regression models under the instrumental variable (IV) approaches to help mitigate concerns stemming from those potential sources of endogeneity bias and demonstrate the robustness of our empirical findings. We also executed several additional analyses by exploring the country's income level and industry differences and considering potential spatial dependencies to strengthen our empirical results.

The subsequent sections of this work are meticulously structured to provide a coherent narrative. Section 2 offers a concise yet comprehensive overview of the existing body of research that orbits the nexus between tax complexity and firm tax evasion. This literature review serves as the foundational backdrop against which the empirical analysis is framed. Moving forward, Section 3 meticulously details the data employed in the estimation process, elucidating the sampling strategies meticulously deployed. Section 4 unveils the econometric framework designed to yield empirical results. In Section 5, the study engages in an in-depth analysis and discussion, dissecting the impact of tax complexity on tax evasion. Last, Section 6 synthesises the findings and presents cogent policy implications, drawing the curtains on this comprehensive academic endeavour.

2. Literature Review

A tide of academic research on tax evasion has vastly grown, perhaps first triggered by the emergence of the seminal and pioneering deterrence model of tax evasion introduced by Allingham and Sandmo (1972). This model drew inspiration from Becker's (1968) economics-of-crime model. In this conceptual framework, taxpayers characterised by risk aversion are confronted with the intricate task of determining the extent to which they should engage in tax evasion. Algebraically, the model delineates the evasion decision as a function of tax rates and enforcement intensity, including the extent of auditing and the probability that evasion will be subject to penalties.

Allingham and Sandmo's (1972) model has been used in nearly all studies exploring various policy-related aspects of tax evasion, with a particular emphasis on assessing the impact of audit frequency and penalty rates on evasion behaviour. The results from these studies generally confirm that improvements in these enforcement variables deter evasion decisions, although the magnitude of the effects is uncertain (e.g., Kleven et al. 2011; Alm 2012; Choo et al. 2016; Carrillo et al. 2017; DeBacker et al. 2018; Li et al. 2019; Alm et al. 2020; Kogler et al. 2022; Bergolo et al. 2023).

As Slemrod (2019) noted, the success of the primary enforcement mechanisms proposed in the deterrence model of tax evasion (i.e., audit and penalty) may be closely related to the simplified tax regime. Unintelligible and ambiguous tax regulations generate arbitrary enforcement that violates the constitutional principles of the regulations themselves (Demin 2020; Calford and DeAngelo 2023). Some non-compliance may go undetected or unreported, while some reports deemed to be compliant may be disallowed and subject to penalties (Andreoni et al. 1998). This argument is somewhat supported by an actual experiment, as mentioned in Tanzi (2018), wherein inquiries seeking clarification or guidance on the handling of specific tax matters directed to distinct tax offices within the same tax administration elicited markedly disparate responses. This problem of haphazard enforcement again means that tax authorities can never escape the risk of potential revenue losses (Neck et al. 2012; Ivanyna et al. 2016).

In addition, as laid out in Kirchler et al.'s (2008) 'slippery slope' framework, tax evasion decisions are much more complicated than simply the taxpayers' calculation of the specific costs to be borne from it but also their trust in the authorities' competence in managing the problems. In this case, taxpayers frequently exhibit a proclivity to assume the legitimacy of the existing tax system, often without contemplation of the prospect of evading taxes (Dickson et al. 2022; Berkel et al. 2022). However, the complexity of the tax regime is believed to undermine trust among taxpayers in the competence and integrity of tax authorities (Kirchler et al. 2008).

As mentioned earlier, in dealing with tax regulations, taxpayers often seek help from tax advisors (Frecknall-Hughes et al. 2023). These tax advisors, possessing specialised knowledge and expertise in tax law, play a dual role as both 'exploiters' and 'enforcers' of tax regulations (Murphy 2004). Klepper et al. (1991) and Hasseldine et al. (2011) suggest that in situations where taxes are less complex, tax advisors are more inclined to ensure compliance by surmounting the numerous informational and computational barriers that typically impede tax compliance.

Conversely, when tax practitioners contend with a highly complex tax system, where tax code ambiguities are prevalent, they often guide their clients in exploiting opportunities for tax non-compliance. Taxpayers usually receive this offer mainly from aggressive tax advisors who have a good network and know what problems are being targeted by the tax authorities at that time (Sakurai and Braithwaite 2001). Aggressive tax advisors generally collaborate with tax officials to make their jobs easier. Tax officers who 'facilitate' such a taxation process seek private gain by imposing 'fees', which thus raises tax corruption (Awasthi and Bayraktar 2015). Increased opportunities for non-compliance provided by aggressive tax advisors and acts of corruption supplied by tax officials can have important consequences for perceived tax unfairness, which would undermine trust and consequently degrade compliance behaviour (Baldry 1987; Cowell 1992; Joulfaian 2009; Alon and Hageman 2013).

The theoretical predictions above provide confidence that a complex tax system increases tax evasion in two important channels: weakening enforcement and ruining public trust (Krause 2000). As in the 'slippery slope framework', the former channel will reduce enforced tax compliance, and the latter one will decrease voluntary tax compliance. Recent empirical studies largely corroborate these theoretical predictions. For example, Bellemare et al. (2019) present evidence from a laboratory experiment in Germany that in complex tax arrangements, individuals often assign unintentional filing errors as an excuse for non-compliance. Furthermore, a survey experiment conducted by Blesse (2023) in Germany supports these findings by concluding that unintentional individual tax non-compliance due to complex tax regulations gains support from society. These findings are also in line with the omission bias theory, where individuals perceive errors due to negligence as being judged less harshly than errors in carrying out actions in situations that have equivalent outcomes (Baron and Ritov 2004). Other evidence comes from Kaulu (2022), who uses data on individual taxpayers in Zambia to conclude that individual egoism strengthens the relationship between tax complexity and tax evasion.

In this study, we examine the effect of tax complexity on tax evasion activities by firms. Although the theoretical framework summarised above applies naturally to tax decisions made by individuals (Slemrod 2019), we assume that the behaviour of businesses is similar to that of individuals. This assumption is in line with what was pointed out by Slemrod (2007, p. 36): the corporate tax evasion literature "adapts the theory of tax evasion, which for the most part concerns individual decision makers, to the tax compliance decisions made by business". Therefore, the causal mechanisms underlying the relationship between tax complexity and tax evasion discussed earlier are likely also applicable at the firm level. The simple logic is that decisions regarding evasion, or compliance, are made by individual managers or entrepreneurs who are essentially acting as individuals (Arias 2005). It is especially true in this study where business owners who make compliance decisions both as individuals and as top-level managers were the primary respondents in the WBES survey. Meanwhile, their answers to questions related to tax compliance asked in the WBES were the basis for measuring corporate tax evasion in this study.

As such, it is reasonable to expect that tax complexity also increases the prevalence of tax evasion at the firm level. Moreover, recent empirical studies have proven this hypothesis. For example, Owusu et al. (2023) draw on data from micro and small businesses in Ghana to find that businesses' perceptions of tax complexity are negatively related to tax compliance intentions. Last, Hoppe et al. (2023) recently introduced an index of tax complexity faced by multinational companies in a country and found that a complex tax system reduces

the tendency of companies to comply with tax rules because administering them is costly and protracted.

3. Data and Sample

3.1. Measuring Tax Evasion

The concept of tax evasion lacks a universally accepted definition (Christians 2014). Nonetheless, tax evasion can be broadly characterised as illicit activities undertaken by taxpayers to deviate from legal norms that stipulate that taxes should be paid (Elffers et al. 1987). To evade taxes, taxpayers usually underreport their received income, inflating deductions, exemptions, or credits, neglecting to file required tax returns, or even participating in barter transactions (Alm 2012). While these actions are commonly associated with individuals, these types of actions can be applied to other levels of taxpayers, such as firms (Rice 1992). It is important to note that this paper exclusively examines instances of tax evasion observed during tax inspections conducted on firms.

To measure firm tax evasion, a few studies have analysed several applicable approaches (e.g., Elffers et al. 1987; Alm 2012; Korndörfer et al. 2014). Broadly speaking, Alm (2012) classified these approaches into traditional and modern. Traditional approaches can be based on audit samples of firm income tax returns (e.g., Joulfaian 2000) or survey evidence, where firm owners are directly questioned about their evasion behaviour (e.g., Barth and Ognedal 2018; Onu et al. 2019). Traditional approaches can also be based on measures of informal business activity (shadow economy), which reflect the gap between the estimated economic activity level and official national accounts (e.g., Schneider et al. 2010; Elgin and Oztunali 2014).

Modern approaches encompass a diverse range of innovative techniques, including controlled field experiments (e.g., Slemrod et al. 2001; Iyer et al. 2010; Kleven et al. 2011), consumption-based measures (e.g., Pissarides and Weber 1989), or even the utilisation of luminosity data derived from satellite observations to estimate real economic activity, which is then compared with official economic levels to obtain a proxy for tax evasion (e.g., Henderson et al. 2016). Interestingly, Alm (2012) emphasised that there is no universally superior method for quantifying tax evasion, as each approach possesses inherent limitations and constraints on its validity.

Amid many measurements, the question arises, which method is most appropriate, especially the one allowing the current study to compare firm tax evasion internationally? The only viable option is to employ the confidential firm-level survey responses database provided by the WBES. The survey results from 2002 to 2023 were used as our specific reference. Overall, the database contains more than 252,000 firms from 164 countries around the globe. Every country has a varying number of firms, ranging from 65 to 24,000, that serve as representatives throughout 27 different industries. None of them are fully owned by local and national governments.

The WBES team (surveyor) anonymously surveys these firms' business owners and top-level managers (respondents) to obtain information on a country's business environment, how individual firms perceive and experience it, how it evolves, and the constraints affecting performance and growth. To engender mutual trust and understanding, respondents in the survey were assured of complete and stringent confidentiality for both them and their respective firms (Beck et al. 2014). Importantly, the survey process is conducted entirely independently of government officials and financial institutions, with no access to raw data or any information that could potentially reveal the identity of individual respondents' responses (Williams 2016). This commitment to anonymity and data security is crucial in eliciting honest and unbiased responses from the respondents.

The surveyor employed a uniform sampling method (i.e., randomly stratified sampling) and standardised survey instruments to minimise measurement errors and produce data that can be compared between countries. Beck et al. (2014) and Williams (2016) stated that respondents' responses to the survey are accurate and reliable. Several empirical studies using the survey database corroborate the statements by showing that the

respondents' responses are directly related to measurable results in tax evasion, corruption, infrastructure, crime, competition, employment, obstacles to growth, and performance (e.g., Johnson et al. 2000; Djankov et al. 2003; Acemoglu and Johnson 2005; Beck et al. 2005; Ayyagari et al. 2008; Barth et al. 2009). Hence, it is natural that such a database in cross-country analysis has become increasingly popular in recent years compared with the use of aggregate country-level data (e.g., Beck et al. 2014; Awasthi and Bayraktar 2015; Ahamed 2016; Abdixhiku et al. 2018; Mason et al. 2020; Xiao et al. 2022; Khan 2023).

In this study, the tax evasion variable was constructed using respondents' responses to the following survey question: "Recognising the difficulties many enterprises face in fully complying with taxes and regulations, what percentage of total sales would you estimate the typical establishment in your area of activity reports for tax purposes?" In the WBES, this question identification code is given as c241.

Based on those responses, we can construct two variables related to tax evasion at the firm level in the cross-country dimension: tax evasion ratio and tax evasion dummy. The tax evasion ratio is calculated as one minus the numerical answer to the c241 question. Hence, the tax evasion ratio equals zero if the respondents answer that 100% of sales are reported for tax purposes. The tax evasion dummy is assigned as one if the tax evasion ratio exceeds zero. The former variable measures the extent of tax evasion, while the latter measures the incidence of tax evasion.

Following well-established survey techniques, the c241 question was phrased indirectly to elicit more honest responses. A direct question can be considered very sensitive because, after all, tax evasion is an illegal act, and respondents are expected to conceal their fraud by giving responses that are in accordance with public norms (Tourangeau and Yan 2007; Krumpal 2013).

One might argue that the indirect nature of the c241 question will produce measurement error as responses may reflect industry average perceptions and not firm behaviour. However, for several reasons, we believe this issue will not bias our results. First, the large variations found in tax evasion responses across industries within each country indicated that respondents' responses to the c241 question were based on their firms' behaviour instead of the industry's behaviour in general. Second, as mentioned previously, government officials and financial institutions were not involved in the survey—respondents were therefore highly likely to simply respond based on their experiences without considering their potential relationships with government officials and financial institutions (Johnson et al. 2000). Third, we found a significant positive correlation (p-value < 1%) between the shadow economy measures compiled by Schneider et al. (2010) and Elgin and Oztunali (2014) and the tax evasion ratio. These results at least minimised our concerns about the validity issue as Elffers et al. (1987) reported—there was no evidence of correspondence between self-reports from the survey and actual behaviour from official records in tax evasion data.

3.2. Measuring Tax Complexity

Diverse perspectives exist regarding the definition of tax complexity (Tran-Nam and Evans 2014). For instance, according to tax accountants, tax complexity pertains to the time required for preparing income tax reports, encompassing tax planning and the provision of tax advice and consultation. Tax attorneys perceive the complexity of the tax system as the difficulties of comprehending, interpreting, and translating tax laws to ensure adherence to them. Taxpayers evaluate the intricacy of taxes by considering the time required and costs incurred to comply with the relevant tax statutes. In addition, it is worth noting that tax complexity manifests in various dimensions, such as computational complexity, procedural complexity, tax return complexity, and a lack of clarity in the regulations (Pau et al. 2007; Saw and Sawyer 2010; Borrego et al. 2015). The bottom line is that the intricate nature of tax regulations poses challenges for anyone in meeting their tax responsibilities.

Given numerous definitions and forms of tax complexity, how can we obtain cross-country comparison measures? The WBDB report is the only source worth considering

in obtaining tax complexity measures that would allow international comparison. The WBDB report measured the ease of doing business for domestic, small, and medium firms in 190 economies. The report covered ten crucial topics: starting a business, dealing with construction permits, obtaining electricity, registering property, accessing credit, protecting minority investors, paying taxes, facilitating international trade, enforcing contracts, and resolving insolvency. The paying taxes topic specifically provides two indicators that can be used as proxies for tax complexity: time to comply (tax time, hereafter) and the number of payments (tax payment, hereafter). The underlying assumption is that as the time required to adhere to the tax system increases and the number of payments grows, companies face more challenges in meeting their tax responsibilities.

Specifically, the tax time is an indicator that quantifies the number of hours a business must dedicate each year to prepare, file, and fulfil its tax obligations, encompassing three primary types of taxes: corporate income tax, value-added tax (VAT) or sales tax, and labour tax. The preparation time encompasses the duration required to gather the necessary information and data for the purpose of calculating the tax obligation and completing the declaration forms. The tax regime's intricate laws, which demand the disclosure of information that may not be readily accessible to a corporation during its regular operations or in its typical financial accounting, result in increased time to comply. Additionally, the duration required to fill out declaration documents and the duration needed to process payments are both accounted for. If the declaration forms are intricate, lengthy, and monotonous, this will lead to an increased duration for compliance. If the payment processes are not easy and efficient, the time required to comply with them will grow. All these increase compliance costs for taxpayers. They provide incentives for businesses to pursue non-compliance options, which highlight the link between tax complexity and tax evasion.

Similarly, tax payment serves as a good indicator of the intricate tax payment processes. It reflects the total amount of taxes paid, the method of payment, payment frequency, and filing frequency within a specific annual period. This metric also includes taxes withheld by the firm, such as sales tax, VAT, and labour taxes paid by employees. In inefficient tax administration, taxpayers may encounter burdensome payment processes, have restricted choices for payment locations, and be required to endure lengthy queues while submitting their tax payments. The WBDB methodology encompasses all of these aspects, and it takes into account the advantages of electronic filing and payments. In the methodology, electronic filing and payment systems receive substantial weight, especially when they are both allowed and commonly utilised by firms. In such cases, taxes are calculated and paid once a year, even if the process of filing and payments occurs more frequently throughout the year. Therefore, electronic taxation systems are given enormous weight, which in turn is expected to help reduce opportunities for evasion. Based on these considerations, we see tax payment as a useful tax complexity indicator for this paper.

The collection of data related to tax time and tax payment involved a meticulous survey. The questionnaire used during the survey was based on a fictitious and standardised firm ostensibly operating in each sample economy, called 'TaxpayerCo'. TaxpayerCo's illustrative profit and loss statements were designed based on straightforward multiples of the respective country's income per capita, denominated in the local currency (Djankov et al. 2010). These illustrative financial statements were submitted to accountants and tax lawyers from some local firms in each sample economy (mainly including PricewaterhouseCoopers) who computed taxes and statutory contributions for TaxpayerCo in their respective countries and responded to several survey questions.

According to the conceptual definition and data collection methodology, it seems that for this study, tax time and tax payment were the most appropriate measures of tax complexity. These two indicators are also used to measure complexity in several cross-country studies. For example, Lawless (2013) examined the relationship between tax complexity and foreign direct investment, Liu and Feng (2015) investigated the correlation

between tax complexity and corruption, and Awasthi and Bayraktar (2015) quantified the impact of tax system simplification on tax corruption.

In addition, an external panel constituted by the president of the World Bank reviewed the WBDB report and recognised that the report is a unique source of comparable global data; is relevant to researchers, businesses, and policymakers; and has the potential to have great value for informing decision-making by governments and firms (Alfaro et al. 2021). Therefore, the report we used to measure tax complexity is considered a 'flagship' product of the World Bank (Basu 2018).

Nevertheless, the panel levelled several criticisms regarding the methodology and presentation of data collected for all ten topics covered in the WBDB report. Hence, to ensure the continuity of the report, the panel recommended a major overhaul of the project, including significant modifications to the methodology behind the data. Unfortunately, the report publication has been discontinued since September 2021, especially after data irregularities were discovered in the 2018 and 2020 WBDB reports (Machen et al. 2021). Therefore, from now on, the World Bank will seek to implement new approaches to provide similar information. However, the point is that the data listed in the report compose the only dataset available that can provide an objective worldwide comparison of indicators of tax regime complexity.

3.3. Control Variables

Our set of control variables began with macroeconomic factors that influenced a firm's operations but were beyond the firm's ability to control. Drawing from relevant empirical studies (e.g., Yamen et al. 2018; Abdixhiku et al. 2018; Islam et al. 2020), four proxies capturing national economic performance were used in the study, including real per capita gross domestic product (GDP), inflation rate, unemployment rate, and agricultural contribution as a percentage of GDP. All of them were from the World Bank's World Development Indicators (WDI) database.

Real per capita GDP is a widely recognised metric for assessing a country's economic development level (Boyd and Jalal 2012). Existing empirical studies offer diverse insights into the relationship between this macroeconomic factor and firm tax evasion. Some authors concluded that higher levels of economic development correlate with a reduced incidence and extent of tax evasion (Beck et al. 2014), aligning with the notion that more prosperous economies may exhibit lower tax evasion rates. Conversely, other studies propose that as overall prosperity increases, businesses may engage in higher levels of tax evasion (Abdixhiku et al. 2018; Mason et al. 2020). While both perspectives are represented in the literature, expecting a negative influence of real per capita GDP on firm tax evasion would be more rational.

The inflation rate is a common indicator that reflects the country's price stability (Kuncoro 2023). Some authors, such as Islam et al. (2020), consider the inflation rate a proxy for a country's monetary freedom. This paper quantifies the inflation rate as the nominal and real GDP ratio (GDP implicit deflator). The impact of inflation on tax evasion is a subject that elicits divergent perspectives, which may be broadly categorised into two contrasting categories. According to Fishburn (1981) and several other viewpoints, a positive correlation exists between inflation and tax evasion since taxpayers may be motivated to evade taxes to regain lost purchasing power. In contrast, Tanzi (1980) posits that taxpayers choose to defer their tax payments during elevated inflation, resulting in a net inverse association between inflation and tax evasion.

A higher unemployment rate is typically associated with a decline in national income, which increases the tax evasion level (Boame 2009; Torgler and Schneider 2009). Agriculture is frequently considered a 'hard to tax' sector (Mawejje 2019; Jensen 2022; Khujamkulov and Abizadeh 2023), which is sometimes due to its subsistence nature (Liu 2022). Therefore, it is rational to say that the tax evasion level rises as the dominant share of agriculture in GDP expands.

We also included a conventional determinant of tax evasion called a tax burden. Following Bittencourt et al. (2014) and Abdixhiku et al. (2018), we proxied the tax burden using the fiscal freedom index from the Heritage Foundation, which combines several key indicators: the top tax rates on individual and firm income and the overall tax revenue as a percentage of GDP. The index is presented as a percentage, with a higher percentage indicating a heavier tax burden and vice versa.

When analysing the impact of the tax burden on tax evasion, we expect an ambiguous effect considering the benefit and opportunity cost of tax evasion whenever the tax burden rises (Allingham and Sandmo 1972). On one hand, as taxes rise, the potential benefits of tax evasion increase, incentivising taxpayers to engage in evasion to maximise their after-tax income. On the other hand, a higher tax burden may result in better provision of public goods and services by the government, lowering opportunity costs for not engaging in evasion, as the benefits of tax-financed public goods become progressively substantial. In line with the theory, empirical evidence regarding the impact of the tax burden on tax evasion is quite controversial, considering that two contradictory results were found even though the same data source (i.e., the United States Tax Compliance Measurement Program) was used in their analysis. While Clotfelter (1983) reported a positive and significant effect of marginal tax burden on evasion, Feinstein (1991) found a negative relationship between marginal tax burden and evasion. Recent studies, such as Bittencourt et al. (2014) and Abdixhiku et al. (2018), who treated tax burden as a control variable when studying cross-border tax evasion, also concluded contradictory results.

To better understand the subject under study (i.e., firm tax evasion), Cuccia (1994) and Cummings et al. (2005) strongly recommend a combination of economic and non-economic tax evasion perspectives. We respected that point of view and, therefore, involved non-economic factors in an array of our control variables, such as demographic and institutional factors.

Following Richardson (2006), we used age and gender to capture demographic differences between countries. Age is measured by the percentage aged 15–24 years who provide labour for the firms' production activities, and gender is calculated as the percentage of female labour. These two variables are from the World Bank's Population Estimates and Projections and Gender Statistics database. We expect that age has a positive effect on tax evasion since multiple studies have shown that older taxpayers tend to exhibit higher compliance levels than their younger counterparts (Ritsema et al. 2003; Torgler and Valev 2006; Annan et al. 2014; Hokamp 2014). One possible explanation for this phenomenon might be attributed to the fact that younger taxpayers tend to exhibit a greater propensity for risk-taking behaviour and less sensitivity to punitive measures and manifest distinct social and psychological characteristics that are associated with the era in which they were reared. Previous studies identified that gender plays a crucial role in determining tax evasion. For instance, Barber and Odean (2001), Croson and Gneezy (2009), and Hofmann et al. (2017) have shown that female taxpayers exhibit greater compliance than their male counterparts. Therefore, we suspect that gender negatively impacts tax evasion.

Following Yamen et al. (2018) and Saptono and Mahmud (2022), we defined the institutional quality of a country using six indicators developed by Kaufmann et al. (2011): voice and accountability, political stability, government effectiveness, regulatory quality, rule of law, and control of corruption. All of them are from the World Bank's Worldwide Governance Indicators (WGI) database. These indicators provide a comprehensive determinant of tax evasion, considering the existence of a study that supports the notion that institutional quality is closely linked to the strength of the enforcement regimes (Treisman 2007).

In addition, Besley and Persson (2014) and Moore and Prichard (2020) suggested that these institutional factors play a crucial role in determining tax performance. For example, one said that a flawed institutional environment is considered an efficiency-enhancing force in tax administration by motivating tax authorities to work harder and lowering the tax evasion level. Nevertheless, Fjeldstad and Tungodden (2003) showed that such a proposition does not justify policies to downgrade the institutional quality.

Anywhere, a strong institutional environment will always be associated with a rise in tax compliance. Well-established evidence from a series of cross-country studies sheds light on this matter (e.g., Imam and Jacobs 2014; Epaphra and Massawe 2017; Arif and Rawat 2018; Allam et al. 2023). Accordingly, we expect that the higher the level of institutional quality, the lower the level of tax evasion. Table A1 provides comprehensive definitions and sources of all variables.

3.4. Sample Selection

Our sample started with respondents' responses to the c241 question in the WBES. Respondents who did not respond were considered missing information and, therefore, should be excluded from the sample. The remaining sample was further selected by considering Elffers et al.'s (1987) conclusion—tax evasion measures obtained from a survey tend to be sensitive to sample selection bias due to the subjectivity of the respondents' responses. Therefore, our tax evasion ratio should be compared with another country-level tax evasion database, such as the shadow economy. In this case, we revealed a significant correlation between these two distinct tax evasion measures (see a discussion in Section 3.1).

To further mitigate the potential risk of sample selection bias, a comparative analysis was conducted between two rankings of countries. The first ranking was based on the tax evasion ratio derived from the WBES database, while the second ranking was derived from an average of informal business activity databases developed by Schneider et al. (2010) and Elgin and Oztunali (2014). Given that the suite of the WBES database has subjective components, it is advantageous to conduct a comparison of country rankings using two variables related to tax evasion to identify countries with 'unexpected data'. In line with the preceding definition, the tax evasion ratio ranges from 0 to 100, with larger values indicating a greater level of tax evasion. Informal business activity, as estimated using the multiple indicators multiple causes (MIMIC) and dynamic general equilibrium (DGE) techniques, is expressed as a percentage of the GDP, where lower values indicate greater levels of tax evasion. Following Awasthi and Bayraktar (2015), the study applied a criterion for excluding countries from the sample. Specifically, countries were excluded if the absolute difference between their rankings in the two variables exceeded a predefined threshold of 70.

In addition, it is worth noting that the structure of the WBES procedure involved deliberate targeting of firms in most countries within our sample for re-survey during subsequent rounds of data collection. Therefore, we only used one survey sample period for each country to avoid the possibility of overlapping information. We related the selected sample to our tax complexity measures and control variables. We included observations that contained complete information for all variables and excluded any observations with missing data. This meticulous data-cleaning process resulted in a final sample of 46,046 firms drawn from a diverse set of 83 countries. Table 1 summarises our sample selection procedure.

Table 1. Sample selection procedure.

	Number of Firms	**Number of Countries**
Confidential WBES database for the 2002 to 2023 survey period	252,834	164
Missing data on tax evasion ratio	(180,019)	(58)
Countries with inconsistent rankings for two measures of tax evasion (the absolute value of the discrepancy between the two ranks exceeds 70)	(458)	(3)
Only include one sample survey period of each country	(12,941)	
Missing data on tax complexity	(9684)	(11)
Missing data on control variables	(3686)	(9)
The final number of observations	46,046	83

Table 2 provides a comprehensive overview of the mean values for the tax evasion ratio and two tax complexity indicators across each country included in our sample. Notably, there was substantial variation in the tax evasion ratio, showcasing that different countries exhibited varying levels of tax evasion behaviour. Estonia boasted a lower tax evasion ratio at a mere 3.1%, while Senegal had the highest at 79.8%. Regarding the tax complexity measures, Ukraine stood out with the highest average number of tax payments required annually, a staggering 147 times. Estonia, Kazakhstan, and Portugal had the same minimum tax payment threshold, equivalent to seven times. Ukraine exhibited the most average annual tax time, amounting to 2085 h, while Benin had the lowest tax time, totalling 52 h. These findings underscored the fact that tax evasion and perceptions of tax complexity varied significantly from one country to another.

Table 2. Sample description: tax evasion and tax complexity by country.

	Country	Number of Firms	Tax Evasion Ratio	Tax Time	Tax Payment
1	Albania	198	0.230	364	45
2	Algeria	188	0.276	451	39
3	Angola	118	0.794	284	31
4	Argentina	1894	0.175	453	62
5	Azerbaijan	349	0.139	756	37
6	Belarus	320	0.072	986.5	125
7	Benin	176	0.144	270	52
8	Bolivia	1104	0.202	1080	42
9	Bosnia and Herzegovina	195	0.118	368	55
10	Botswana	209	0.131	140	19
11	Bulgaria	290	0.135	598	29
12	Burkina Faso	131	0.219	270	45
13	Burundi	540	0.157	140	33
14	Cambodia	423	0.520	137	39
15	Cameroon	168	0.121	654	45
16	Chile	1862	0.132	316	8
17	Colombia	1840	0.171	456	70
18	Costa Rica	287	0.284	402	43
19	Croatia	211	0.075	232	40
20	Czech Republic	333	0.131	866	27
21	Dominican Republic	139	0.439	232	75
22	Ecuador	1212	0.264	600	8
23	El Salvador	1108	0.192	320	41
24	Estonia	170	0.031	81	7
25	Eswatini	584	0.579	116	33
26	Georgia	164	0.109	448	46
27	Germany	1192	0.057	196	12
28	Ghana	292	0.313	304	37
29	Greece	502	0.110	264	19
30	Guatemala	986	0.270	344	38
31	Guinea	426	0.643	416	57
32	Guinea-Bissau	41	0.280	218	46
33	Guyana	156	0.262	288	35
34	Honduras	726	0.157	424	58
35	Hungary	592	0.113	340	13
36	India	3869	0.269	252.88	60
37	Indonesia	713	0.269	266	51
38	Ireland	490	0.038	75	9
39	Jamaica	72	0.110	324	72
40	Jordan	415	0.126	136	26
41	Kazakhstan	568	0.066	261	7

Table 2. *Cont.*

	Country	Number of Firms	Tax Evasion Ratio	Tax Time	Tax Payment
42	Kenya	395	0.183	444	52
43	Kyrgyz Republic	197	0.146	222	76
44	Lao PDR	242	0.038	672	34
45	Latvia	194	0.071	280	29
46	Lebanon	292	0.344	180	20
47	Lesotho	48	0.171	564	33
48	Lithuania	172	0.103	166	11
49	Madagascar	286	0.065	400	27
50	Malawi	132	0.303	376	23
51	Mali	97	0.766	270	58
52	Mauritania	456	0.470	696	37
53	Mauritius	156	0.122	161	8
54	Moldova	321	0.105	234	53
55	Mongolia	160	0.364	204	41
56	Morocco	834	0.039	358	28
57	Namibia	644	0.254	339	37
58	Nicaragua	834	0.409	240	66
59	Niger	111	0.127	270	41
60	North Macedonia	182	0.235	192	43
61	Oman	284	0.287	52	15
62	Panama	1096	0.371	560	52
63	Paraguay	926	0.192	328	35
64	Peru	1242	0.106	424	9
65	Philippines	598	0.218	195	48
66	Poland	969	0.100	420	41
67	Portugal	502	0.082	328	7
68	Romania	577	0.066	192	108
69	Rwanda	420	0.189	168	25
70	Senegal	190	0.798	696	59
71	Slovak Republic	191	0.045	325	32
72	Slovenia	205	0.072	248	22
73	South Africa	562	0.091	346	12
74	Spain	600	0.037	298	8
75	Sri Lanka	355	0.076	262	58
76	Tajikistan	200	0.090	296	69
77	Tanzania	834	0.469	172	47
78	Turkey	1120	0.495	254	10
79	Uganda	1094	0.464	237	32
80	Ukraine	573	0.107	2085	147
81	Uruguay	736	0.147	304	55
82	Vietnam	1609	0.094	1050	32
83	Zambia	157	0.158	183	38

Table 3 offers valuable insights into the average tax evasion ratio categorised by industry. It is evident from the data that there were substantial variations in tax evasion levels among different industries. The industry with the highest tax evasion ratio was the 'other transport equipment' sector, where tax evasion stood at a significant 53.8%. In contrast, the telecommunications industry exhibited the lowest tax evasion rate at just 5.6%. While these variations were noteworthy, they were generally smaller in magnitude compared with the variations observed between different countries, as previously presented in Table 2.

Table 3. Sample description: tax evasion and tax complexity by industry.

	Industry	Number of Firms	Tax Evasion Ratio
1	Accounting and finance	3	0.510
2	Advertising and marketing	501	0.086
3	Agroindustry	346	0.375
4	Auto and auto components	248	0.207
5	Beverages	830	0.121
6	Chemicals and pharmaceutics	2558	0.167
7	Construction	2685	0.210
8	Electronics	482	0.135
9	Food	5312	0.225
10	Garments	4369	0.227
11	Hotels and restaurants	1595	0.299
12	IT services	1039	0.153
13	Leather	305	0.147
14	Metals and machinery	3420	0.186
15	Mining and quarrying	143	0.080
16	Non-metallic and plastic materials	1518	0.181
17	Other manufacturing	3546	0.216
18	Other services	2582	0.212
19	Other transport equipment	85	0.538
20	Other unclassified	269	0.283
21	Paper	650	0.146
22	Real estate and rental services	489	0.074
23	Retail and wholesale trade	8228	0.256
24	Telecommunications	106	0.056
25	Textiles	2340	0.205
26	Transport	739	0.111
27	Wood and furniture	1658	0.267

4. Econometric Model

Based on the existing literature, our baseline model posits that firm tax evasion is determined by tax complexity measures and different control variables, as represented in the following equation:

$$TEVA_{ijk} = \alpha_0 + \alpha_1 COMPLEXITY_k + \alpha_2 CONTROL_k + INDUSTRY_j + YEAR_t + \varepsilon_{ijk} \quad (1)$$

$TEVA$ is the tax evasion ratio or dummy reported by the firm i representing industry j in country k. $COMPLEXITY$ stands for two tax complexity measures in country k: tax time and tax payment. Since $COMPLEXITY$ variables are in levels while the other variables are quoted in percent or index numbers, $COMPLEXITY$ variables are expressed in log terms in Equation (1). $CONTROL$ is a vector of country-level control variables included as covariates to ameliorate omitted variable bias (i.e., economic, tax burden, demographic, and institutional variables). $INDUSTRY$ denotes a vector of 27 industry dummies that are involved in accounting for unobservable time-invariant differences between industries, which may affect firms' tax evasion decisions. We also included a year dummy, $YEAR$, in the year in which the survey was conducted to control for global business cycles. It is reasonable wisdom since we observed random differences in the survey periods for all countries sampled. Last, ε is an error term containing firm- and industry-fixed effects and, of course, a random disturbance term. The descriptive statistics, including the mean, standard deviation, minimum, and maximum, of the variables used in the regression analysis are summarised in Table 4.

To explore equation (1), we used the Tobit model (Tobin 1958) when the tax evasion ratio was employed as the dependent variable because this variable is bounded between zero and one, a situation referred to by Wooldridge (2010) as 'corner solution outcome'. Such an outcome is treated similarly to a 'censored response' dependent variable, where

using a Tobit model is most appropriate (Wooldridge 2010). The Tobit model is commonly used in accordance with studies for corner solution outcomes (e.g., percentage impairment, as conducted by Stein 2019). This model performs better than other alternatives, such as censored quantile regression models, in the case of highly censored data (Karlsson and Laitila 2014). In addition, this model is also used by several empirical studies that focus on cross-country corporate tax evasion, such as Beck et al. (2014) and Mason et al. (2020).

Table 4. Descriptive statistics.

Variables	Observations	Mean	Standard Deviation	Minimum	Maximum
Dependent Variables					
Tax evasion ratio	46,046	0.214	0.317	0	1
Tax evasion dummy	46,046	0.456	0.498	0	1
Independent Variables					
Log of tax time	46,046	3.897	0.576	1.311	4.601
Log of tax payment	46,046	3.450	0.762	1.946	4.990
Control Variables					
Log of GDP	46,046	8.159	1.129	5.667	10.807
Inflation	46,046	8.663	10.356	−2.273	100.608
Unemployment	46,046	8.078	6.081	0.774	37.25
Agriculture	46,046	11.597	8.182	0.727	42.260
Tax burden	46,046	75.713	8.905	52.4	98.5
Age	46,046	7.337	4.590	1.953	18.868
Gender	46,046	50.552	1.320	44.135	54.152
Voice and accountability	46,046	0.076	0.752	−1.767	1.624
Political stability	46,046	−0.331	0.827	−2.095	1.300
Government effectiveness	46,046	−0.115	0.674	−1.296	1.736
Regulatory quality	46,046	−0.030	0.728	−1.454	1.516
Rule of law	46,046	−0.167	0.746	−1.405	1.664
Control of corruption	46,046	−0.158	0.745	−1.326	1.885

When the tax evasion dummy was treated as the outcome, we used the Probit model suggested by Bliss (1934a, 1934b). This model is most suitable for regression analysis with a dichotomous dependent variable coded as zero and one (more precisely, as zero and non-zero) (Aldrich and Nelson 1984; Cameron and Trivedi 2010). We reported marginal effects instead of coefficient estimates to measure the statistical and economic significance of our regression results. Furthermore, we used White's (1980) variance–covariance matrix of the estimators (VCE) to overcome the heteroskedasticity problem normally arising in cross-country data. Referring to the literature review section, α_1 is expected to be positive and significant, indicating that a more complex tax system is associated with a higher incidence of firm tax evasion and a higher firm tax evasion ratio.

5. Results

5.1. Baseline Results

Table 5 shows the baseline estimation results—the impact of tax complexity on the extent and incidence of tax evasion across a sample of 46,046 firms and 83 countries. We reported the estimation results from the Tobit (Probit) models when the dependent variable was the tax evasion ratio (dummy). We had three specifications for each model. The first specification involved only two key regressors, namely, tax time (log-transformed) and tax payment (log-transformed), and some country-level control variables consisting of tax burden and macroeconomic indicators. We then gradually subsumed country-level control variables to the model, starting with demographic profiles before finally including variables that might explain cross-country variation in the institutional environment. Across all specifications, we incorporated unreported industry and year dummies and the standard errors that were robust to the disturbances being heteroskedastic (White 1980). For the estimation results, we outlined the marginal effects (d_y/d_x) rather than coefficient estimates

to demonstrate statistically and economically significant relationships between covariates and firm tax evasion variables.

Table 5. Baseline results: tax complexity and tax evasion.

Dependent Variables	**Tax Evasion Ratio**			**Tax Evasion Dummy**		
Models	**Tobit**			**Probit**		
Specifications	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Log of tax time	0.067 ***	0.061 ***	0.046 ***	0.070 ***	0.064 ***	0.053 ***
	(0.006)	(0.006)	(0.007)	(0.004)	(0.004)	(0.005)
Log of tax payment	0.042 ***	0.077 ***	0.080 ***	0.052 ***	0.063 ***	0.059 ***
	(0.005)	(0.005)	(0.006)	(0.004)	(0.004)	(0.004)
Log of GDP	−0.026 ***	−0.102 ***	−0.197 ***	−0.046 ***	−0.070 ***	−0.127 ***
	(0.006)	(0.007)	(0.009)	(0.005)	(0.006)	(0.007)
Inflation	0.004 ***	0.004 ***	0.004 ***	0.003 ***	0.003 ***	0.004 ***
	(0.0002)	(0.0003)	(0.0003)	(0.0002)	(0.0002)	(0.0002)
Unemployment	0.0017 ***	0.0001	−0.0006	−0.001 ***	−0.001 **	−0.001 **
	(0.0006)	(0.0006)	(0.0007)	(0.0005)	(0.0005)	(0.0005)
Agriculture	0.012 ***	0.011 ***	0.014 ***	0.010 ***	0.010 ***	0.012
	(0.0008)	(0.0008)	(0.001)	(0.001)	(0.001)	(0.0008)
Tax burden	−0.0002	−0.002 ***	−0.002 ***	−0.001 **	−0.001 ***	−0.001 ***
	(0.0004)	(0.0004)	(0.0005)	(0.0003)	(0.0003)	(0.0004)
Age		0.032 ***	0.041 ***		0.009 ***	0.015 ***
		(0.001)	(0.002)		(0.001)	(0.001)
Gender		0.006 **	0.046 ***		−0.007 ***	−0.021 ***
		(0.003)	(0.004)		(0.002)	(0.003)
Voice and accountability			0.079 ***			0.061 ***
			(0.008)			(0.006)
Political stability			−0.031 ***			−0.020 ***
			(0.006)			(0.005)
Government effectiveness			−0.383 ***			−0.206 ***
			(0.018)			(0.014)
Regulatory quality			0.003			−0.008
			(0.014)			(0.011)
Rule of law			0.440 ***			0.282 ***
			(0.193)			(0.015)
Control of corruption			−0.196 ***			−0.157 ***
			(0.014)			(0.011)
Observations	46,046	46,046	46,046	46,046	46,046	46,046
Countries	83	83	83	83	83	83
Pseudo-R^2	0.047	0.055	0.067	0.035	0.037	0.047
Industry and year dummies	Yes	Yes	Yes	Yes	Yes	Yes

Note: The estimation is based on cross-sectional data. The pooled sample period is from 2002 to 2010. The marginal effects (d_y/d_x) of the regressions are presented in all specifications. The marginal effect of a dummy variable is measured as the discrete change in the predicted value of the outcome variable as the value of the dummy changes from zero to one. Heteroskedasticity-robust standard errors are reported in parentheses. ** and *** represent statistical significance at the 5% and 1% levels, respectively.

We found that a larger number of hours required to pay taxes and a larger total amount of taxes paid were associated with a higher extent and incidence of tax evasion by firms. Tax time and tax payment entered positively and significantly in all specifications and were economically noteworthy. On average, a one standard deviation increase in tax time (0.576) and tax payment (0.762) would lead to a significant increase in tax evasion by about 2.62% and 6.11%, respectively. On account that the sample average of the extent of tax evasion was 21.4%, these effects were tremendously substantial, which were 12.2% (2.62/21.407) and 28.5% (6.11/21.407).

Existing works also support these baseline results. For example, Beck et al. (2014) discovered that many aspects of the tax system had a strong and positive correlation with the occurrence of corporate tax evasion in 102 countries. These aspects include the

overall tax rate, the time required to prepare and pay taxes, and the total number of tax payments. Awasthi and Bayraktar (2015) focused on the relationship between tax regime simplification and tax corruption using firm-level data from 104 different countries. They found that a convoluted tax system with ambiguous tax rules results in arbitrary and partly ad hoc tax collection procedures. It also gives taxpayers and tax inspectors extensive discretionary power to interpret tax laws, hence promoting corruption and escalating tax evasion. Furthermore, they propose a straightforward solution: if a government wants to decrease corruption and tax evasion associated with tax management, it should streamline the tax regime.

Turning to the control variables, we found that real per capita GDP, agriculture, age, political stability, government effectiveness, and control of corruption consistently appeared as expected and were always significant at the 1% level (except agriculture in specification 6). Although expected to produce ambiguous effects, we generally observed inflation and tax burden with significant positive and negative signs across all specifications (except tax burden in specification 1). In the case of inflation, firms may attempt to compensate for lost purchasing power in input markets as production costs rise (e.g., wages and raw materials prices) by engaging in more evasion practices. Regarding tax burden, firms avoid decisions containing absolute risk when their profits fall as tax rates rise. Moreover, the penalties imposed on the evaded tax will degrade the benefits of the evasion practices (Yitzhaki 1974).

Surprisingly, voice and accountability and the rule of law consistently emerged with significant unexpected signs. There are some possible explanations for these findings. For example, countries with a strong rule of law often strive to meet international standards and commitments. This may result in the adoption of intricate tax legislation to conform with global norms and treaties (Avi-Yonah 2004), prompting companies to take shortcuts or seek ways to minimise their tax liabilities. With respect to voice and accountability, although it reflects sound institutional environment quality, it may also have negative consequences for taxation. As presented in Table A1, this variable captures a country's media freedom, a situation in which journalists are most likely to scrutinise and disclose instances of tax evasion, corruption, or misappropriation of tax revenues by government officials. Extensive media coverage of incidents like these might strengthen perceptions of widespread non-compliance and corrupt trust in the tax system (Lambsdorff 2007).

In addition, the unemployment rate and gender had mixed coefficient signs. During times of high unemployment, firms may face reduced profitability, causing them to seek ways to minimise the tax burden (Clausing 2009). On the other hand, high unemployment rates, especially during a crisis, can lead to increased government supervision and enforcement of tax regulations (Gordon 2000), potentially deterring companies from carrying out these practices due to the increased risk of detection and fines. Increased women's participation in the labour market can increase corporate transparency and compliance with tax laws due to diversity in decision-making and leadership roles (Cronqvist and Yu 2017). However, if women's participation in the labour market is primarily concentrated in lower-level positions with limited decision-making authority, its impact on corporate tax evasion may be negligible (Matsa and Miller 2013). Last, regulatory quality was the only variable that was persistently insignificant.

5.2. Endogeneity Concerns

An important threat to our baseline model's validity relates to the potential endogeneity of the tax complexity, which arises from two main sources: omitted variable bias and simultaneity bias (Wooldridge 2010). As presented in Table 5, we included relevant control variables, called by Antonakis et al. (2010), as a best practice to avoid omitted variable bias. Nonetheless, we are overshadowed by a key point in Clarke (2009, p. 349): "It is impossible to include all the relevant variables in a regression equation". Thus, certain omitted variables may affect variance in tax complexity measures. If so, our tax complexity variables

(primary regressors) violate the exogeneity assumption as their potential relationship with particular omitted variables (e.g., Wooldridge 2008).

Concerning the simultaneity bias, we adhered to the subtle argument put forward by Borrego et al. (2016). They argue that tax authorities in some countries normally formulate more complex 'anti-abuse regulations' to prevent attempts at tax fraud, tax evasion, and certain ways to reduce or completely avoid taxpayer commitments to pay taxes. However, these efforts ultimately often become a springboard for taxpayers to realise various other tax non-compliance schemes by exploiting the ambiguities and loopholes that tax complexity provides. It is a 'vicious circle' where tax non-compliance and tax complexity nowadays frequently appear as causes and effects of one another, confirming the existence of reverse causality between our key variables.

To cope with the endogeneity issues, we apply an IV approach, which is widely used in the literature (Angrist and Krueger 2001; Cameron and Trivedi 2005; Wooldridge 2008; Antonakis et al. 2010; Kennedy et al. 2019; Wilms et al. 2021). Some cross-country studies dealing with the endogeneity of tax systems incorporate instruments related to the home countries (e.g., Nagac 2015; Acosta-Ormaechea et al. 2019). Although the instruments applied are usually relevant, they might violate the exogeneity constraint given their potential impact on the outcome variable in ways other than through the tax systems. Therefore, as a precaution against dwelling with 'poor' instruments, we draw upon instruments related to the neighbourhood of the home countries. However, the main challenge would be properly determining the neighbouring countries for each home country. Knowing their locations are insufficient, we linked our dataset to the shapefile of national administrative borders provided by IPUMS International. By doing this, we can map the neighbourhood by constructing the contiguity and inverse-distance matrices.

Adapting Liu and Feng's (2015) approach, our instruments were the weighted average of the tax complexity measures (tax time and tax payment) in neighbouring countries, weighted by constructed spatial weighting matrices (contiguity and inverse-distance matrices). Hence, we had four instruments for the tax complexity variables. By adopting theoretical reasoning from the conventional tax competition and tax mimicking literature, we assume that the design of a tax system in the neighbouring countries will correlate with the design of a tax system in the home countries because countries compete or imitate their taxes to attract mobile tax bases. Therefore, in terms of the complexity level of the tax system, there is pressure on each country to race to the bottom. However, the complex tax system in neighbouring countries certainly does not directly affect the level of tax evasion in the home countries without first affecting the complexity of the tax system in the home countries. Such a theoretical justification serves as an optimal building block for saying that the weighted average tax complexity measures in the neighbouring countries are relevant and exogenous instruments for tax complexity variables in the home countries.

Since our outcome variables consisted of both censored (tax evasion ratio) and dichotomous (tax evasion dummy) variables, as suggested by Chesher et al. (2023) and Guan et al. (2019), we employed the IV approach for the Tobit (IV Tobit) and the Probit (IV Probit) models. The second-stage regression results are presented in Table 6. The results were like those in Table 5—the extent and incidence of tax evasion by firms increased as a country's tax system was increasingly complex. However, in all specifications, except specification 3 for the tax payment variable, the magnitudes of the effects were now much larger compared with the baseline results, roughly five to ten times (for the tax time variable) and two times (for the tax payment variable) as large as the corresponding Tobit results and approximately eight to fourteen times (for the tax time variable) and three times (for the tax payment variable) as large as the corresponding Probit results.

Table 6. IV second-stage regression results.

Dependent Variables	**Tax Evasion Ratio**			**Tax Evasion Dummy**		
Models	**IV Tobit**			**IV Probit**		
Specifications	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Log of tax time	0.442 ***	0.588 ***	0.211 ***	0.676 ***	0.882 ***	0.413 ***
	(0.025)	(0.024)	(0.024)	(0.044)	(0.037)	(0.045)
Log of tax payment	0.092 ***	0.142 ***	0.010	0.206 ***	0.252 ***	0.094 ***
	(0.013)	(0.015)	(0.013)	(0.026)	(0.029)	(0.027)
Log of GDP	−0.074 ***	−0.017	−0.095 ***	−0.038	−0.060 *	−0.225 **
	(0.012)	(0.016)	(0.015)	(0.024)	(0.031)	(0.031)
Inflation	0.005 ***	0.006 ***	0.003 ***	0.013 ***	0.015 ***	0.008 ***
	(0.0003)	(0.0003)	(0.0003)	(0.001)	(0.001)	(0.001)
Unemployment	−0.010 ***	−0.016 ***	−0.007 ***	−0.020 ***	−0.025 ***	−0.016 ***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
Agriculture	−0.007 ***	−0.013 ***	−0.003	0.004	−0.007 **	0.003
	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.004)
Tax burden	−0.0007	−0.0008	−0.004 ***	−0.0002	−0.001	−0.005 ***
	(0.0005)	(0.0005)	(0.001)	(0.001)	(0.001)	(0.001)
Age		0.027 ***	0.030 ***		0.025 ***	0.034 ***
		(0.002)	(0.003)		(0.005)	(0.006)
Gender		−0.023 ***	−0.052 ***		−0.058 ***	−0.054 ***
		(0.005)	(0.005)		(0.010)	(0.011)
Voice and accountability			0.062 ***			0.085 ***
			(0.012)			(0.026)
Political stability			−0.036 ***			−0.070 ***
			(0.007)			(0.015)
Government effectiveness			−0.314 ***			−0.478 ***
			(0.022)			(0.045)
Regulatory quality			−0.204 ***			−0.380 ***
			(0.024)			(0.046)
Rule of law			0.511 ***			0.905 ***
			(0.030)			(0.060)
Control of corruption			−0.214 ***			−0.366 ***
			(0.018)			(0.039)
Observations	37,893	37,893	37,893	37,893	37,893	37,893
Countries	68	68	68	68	68	68
Industry and year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Wald χ^2 test: exogeneity	271.88 ***	602.85 ***	161.26 ***	130.40 ***	311.47 ***	67.24 ***

Note: The estimation is based on cross-sectional data. The pooled sample period is from 2002 to 2010. The marginal effects (d_y/d_x) of the regressions are presented in all specifications. The marginal effect of a dummy variable is measured as the discrete change in the predicted value of the outcome variable as the value of the dummy changes from zero to one. Heteroskedasticity-robust standard errors are reported in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels, respectively.

In Table 6, we also observe more control variables with the expected coefficient signs compared with the baseline results in Table 6. For example, gender and regulatory quality for the current regression (and in all specifications) aligned with our expectations—negatively and significantly impacting the extent and incidence of firm tax evasion. As discussed, gender in this study was expressed as the female participation rate in the labour market, representing the gender structure of business in an economy (Petrongolo and Ronchi 2020). The negative effect of gender thus indicated that the presence of female workers in the business, especially for strategic positions, tended to encourage firms to be more compliant with tax regulations (Damayanti and Supramono 2019) because of their perception of greater tax fines and tax investigation risks when they evaded taxes (Olsen and Cox 2001; Charness and Gneezy 2012). In addition, the negative effect of regulatory quality implied that hostile and antagonistic interactions with the government that can lead to higher levels of tax compliance would be reduced when the government could

create a healthy environment for the firms to thrive through higher regulatory quality (Hofmann et al. 2014).

On the other hand, the unemployment rate consistently had the opposite effect to that expected. This phenomenon could be attributed to the government policy agenda, which makes job creation the main priority when dealing with stubbornly high unemployment in their countries. Of the various policy instruments directly affecting business, one option is to cut corporate taxes to stimulate job creation. The enactment of a tax rate cut increases the firm's ability to pay within the same period, reducing the prevailing tax evasion practices (Madzharova 2013). However, the job creation impact of such a policy is not observed immediately, given that the business needs time to adjust to the new tax rate (Shuai and Chmura 2013).

The first-stage regression results of the IV Tobit and IV Probit regression models are presented in Table 7. The results demonstrated a significant relationship between the endogenous regressors and the corresponding instrumental variables. These findings aligned with our expectations, where tax time and tax payment in neighbouring countries played a crucial role in determining the complexity of home countries' tax systems. As discussed earlier, the adjacent countries compete to reform their tax administration system as simply as possible to create a more appealing tax world for mobile tax bases. However, once a country within the neighbourhood downgrades (intentionally or unintentionally) its tax system, the other countries will attempt to circumvent similar mistakes. This argument may be a logical reason why mixed coefficient signs of instrumental variables are observed.

Table 7. IV first-stage regression results.

Dependent Variables	**Log of Tax Time**			**Log of Tax Payment**		
Specifications	**(1)**	**(2)**	**(3)**	**(1)**	**(2)**	**(3)**
IV Tobit Model in Table 8						
Log of tax time × contiguity matrix	−0.126 ***	−0.157 ***	−0.351 ***			
	(0.009)	(0.009)	(0.013)			
Log of tax time × inverse-distance matrix	0.620 ***	1.054 ***	1.885 ***			
	(0.034)	(0.033)	(0.043)			
Log of tax payment × contiguity matrix				0.637 ***	0.556 ***	0.663 ***
				(0.008)	(0.007)	(0.006)
Log of tax payment × inverse-distance matrix				−0.652 ***	−0.075 **	−0.318 ***
				(0.039)	(0.037)	(0.037)
IV Probit Model in Table 8						
Log of tax time × contiguity matrix	−0.126 ***	−0.157 ***	−0.351 ***			
	(0.009)	(0.009)	(0.013)			
Log of tax time × inverse-distance matrix	0.620 ***	1.054 ***	1.885 ***			
	(0.034)	(0.033)	(0.043)			
Log of tax payment × contiguity matrix				0.637 ***	0.556 ***	0.663 ***
				(0.008)	(0.007)	(0.006)
Log of tax payment × inverse-distance matrix				−0.652 ***	−0.075 **	−0.318 ***
				(0.039)	(0.037)	(0.037)

Note: All control variables are included, but the estimation results are omitted for simplicity. ** and *** represent statistical significance at the 5% and 1% levels, respectively.

Table 8. Robustness test results.

Dependent Variables	Tax Evasion Ratio				Tax Evasion Dummy			
Modifications	**Using Tax Complexity Alternative Measurements**		**Adding a Control Variable**	**Including Country-Fixed Effects**	**Using Tax Complexity Alternative Measurements**		**Adding a Control Variable**	**Including Country-Fixed Effects**
Specifications	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Log of tax time			0.088 ***	0.020 *			0.065 ***	0.012 ***
			(0.013)	(0.011)			(0.010)	(0.002)
Log of tax payment			0.086 ***	0.054 ***			0.081 ***	0.138 ***
			(0.010)	(0.006)			(0.008)	(0.012)
TCI	0.214 ***				0.078 ***			
	(0.073)				(0.015)			
Tax code complexity		0.318 ***				0.478 ***		
		(0.052)				(0.108)		
Tax framework complexity		0.547 ***				1.611 ***		
		(0.111)				(0.248)		
Log of GDP	−0.210 ***	−0.211 ***	−0.246 ***	−0.239 ***	−0.404 ***	−0.405 ***	−0.166 ***	−0.475 ***
	(0.010)	(0.010)	(0.019)	(0.011)	(0.023)	(0.023)	(0.016)	(0.025)
Inflation	0.015 ***	0.016 ***	0.014 ***	0.018 ***	0.032 ***	0.034 ***	0.013 ***	0.034 ***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)
Unemployment	−0.007 ***	−0.006 ***	−0.004 ***	0.005 ***	−0.014 ***	−0.012 ***	−0.003 ***	0.009 ***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)
Agriculture	0.032 ***	0.030 ***	0.025 ***	0.031 ***	0.071 ***	0.067 ***	0.018 ***	0.070 ***
	(0.001)	(0.001)	(0.003)	(0.001)	(0.003)	(0.003)	(0.002)	(0.003)
Tax burden	−0.001	−0.001	−0.010 ***	−0.001	−0.0002	−0.0002	−0.006	−0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Age	0.029 ***	0.032 ***	0.087 ***	0.032 ***	0.021 ***	0.027 ***	0.050 ***	0.034 ***
	(0.002)	(0.002)	(0.004)	(0.002)	(0.004)	(0.004)	(0.003)	(0.004)
Gender	−0.025 ***	−0.028 ***	0.065 ***	0.028 ***	−0.025 ***	−0.033 ***	−0.029 ***	0.030 ***
	(0.005)	(0.005)	(0.006)	(0.004)	(0.009)	(0.010)	(0.005)	(0.009)
Voice and accountability	0.037 ***	0.057 ***	0.292 ***	0.013	0.043 *	0.093 ***	0.189 ***	0.014
	(0.011)	(0.011)	(0.016)	(0.011)	(0.024)	(0.025)	(0.011)	(0.023)
Political stability	−0.009	−0.012	−0.075 ***	−0.001	−0.017	−0.011	−0.007	−0.011
	(0.009)	(0.009)	(0.010)	(0.008)	(0.018)	(0.018)	(0.008)	(0.016)
Government effectiveness	−0.229 ***	−0.220 ***	−0.109 ***	−0.283 ***	−0.243 ***	−0.215 ***	−0.100 ***	−0.354 ***
	(0.023)	(0.023)	(0.031)	(0.024)	(0.049)	(0.050)	(0.025)	(0.050)
Regulatory quality	−0.081 ***	−0.150 ***	−0.199 ***	−0.070 ***	−0.119 ***	−0.285 ***	−0.095 ***	−0.067 *
	(0.017)	(0.019)	(0.025)	(0.018)	(0.035)	(0.042)	(0.019)	(0.037)
Rule of law	0.369 ***	0.427 ***	0.196 ***	0.421 ***	0.721 ***	0.848 ***	0.131 ***	0.807 ***
	(0.025)	(0.026)	(0.031)	(0.025)	(0.053)	(0.056)	(0.025)	(0.053)
Control of corruption	−0.216 ***	−0.205	−0.133 ***	−0.210 ***	−0.602 ***	−0.571 ***	−0.159 ***	−0.572 ***
	(0.017)	(0.017)	(0.024)	(0.018)	(0.040)	(0.041)	(0.020)	(0.042)
Tax morale			−0.018 ***				−0.019 ***	
			(0.003)				(0.003)	
Observations	46,046	46,046	29,712	46,046	46,046	46,046	29,712	46,046
Countries	83	83	39	83	83	83	39	83
Pseudo-R^2	0.018	0.018	0.103	0.018	0.018	0.018	0.082	0.018
Industry and year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: The estimation is based on cross-sectional data. The marginal effects (d_y/d_x) of the regressions are presented in all specifications. The marginal effect of a dummy variable is measured as the discrete change in the predicted value of the outcome variable as the value of the dummy changes from zero to one. Heteroskedasticity-robust standard errors are reported in parentheses. * and *** represent statistical significance at the 10% and 1% levels, respectively.

5.3. Robustness Test

To ensure the stability of baseline results, the replacement of explanatory variables is a common approach in robustness testing (e.g., Yang et al. 2024). In this study, the tax complexity index (TCI) developed by Hoppe et al. (2023), which measures the complexity of the corporate income tax system in a country, was used as an alternative variable for tax complexity resulting from baseline regressions measured using the WBDB database (tax time and tax payment). This index covers the complexity of tax regulations (tax code complexity) and the complexity of administrative and legislative features and processes in the tax system (tax framework complexity). The index is expressed as zero (not complicated at all) to one (very complicated). We took the average index from the years for which data were available, namely, 2016, 2018, 2020, and 2020 (see http://www.taxcomplexity.org, accessed on 12 March 2024). In Table 8, specifications 1, 2, 5, and 6 display the robustness test results after replacing the main explanatory variables with TCI, tax code complexity, and tax framework complexity, using the same Tobit and Probit models as Table 5.

Regression results from these two specifications showed that even after the explanatory variables were replaced, tax complexity still showed a positive and significant impact on

the extent and incidence of corporate tax evasion. Therefore, the robustness test was successfully passed.

Furthermore, there is a consensus in the field of econometrics that it is important to include an extra control variable when examining the validity of the initial findings (Kennedy 2008; Angrist and Pischke 2008). In this regard, as suggested by Torgler and Schneider (2007) and Alm and McClellan (2012), we used tax morale to isolate the specific impact of tax complexity on corporate tax evasion. The tax morale variable data were obtained from the World Values Survey (WVS) for the years 1999–2004, 2005–2009, and 2010–2014 (see https://www.worldvaluessurvey.org/WVSContents.jsp, accessed on 17 March 2024). These three survey waves were chosen because they overlapped with the pooled sample period used in this study (2002 to 2010). The WVS is the main data source used in studies on tax morale (Doerrenberg and Peichl 2013). The survey is conducted globally and gathers comparative data on various values and attitudes. It utilises standardised questionnaires and ensures that each country's sample size consists of at least 1000 respondents. The specific question about tax morale is as follows: "Please tell me for each of the following statements whether you think it can always be justified, never be justified, or something in between (. . .) cheating on tax if you have the chance".

The WVS used a ten-point scale index to assess the question, with one representing "never justified" and ten representing "always justified" at the opposite ends of the scale. However, in line with a previous empirical study on tax morale, such as Ciziceno and Pizzuto (2022), we modified the variable by reversing the values to facilitate the interpretation of the results. Thus, in our study, the response "never justified" for cheating on taxes was given a numerical value of ten to signify a greater level of inherent motivation to pay taxes. Given that each country sample of this study had only one sample year, we calculated the average of these values from the three survey waves.

In Table 8, specifications 3 and 7 show estimation results involving tax morale as an additional control variable. We find that tax morale had a significant negative effect on tax evasion in both specifications. It indicated that high public tax enthusiasm would reduce the incidence and extent of tax evasion by companies. These results were credible, particularly in regard to market access and business relationships, where high public tax morale might impact stakeholders' views and decisions surrounding their interactions with enterprises. For example, customers may prefer to do business with tax-compliant companies, suppliers may impose stricter contractual terms on tax-evading companies, and investors may be more hesitant to invest in companies that have a reputation for tax evasion (Cowell and Gordon 1988; Pommerehne and Weck-Hannemann 1996). Another primary point related to the findings is that our baseline results remained intact with the introduction of tax morale into the estimation model.

Moreover, although the cross-country nature of the study seemed to be lost with country-fixed effects, Table 2 underlines the fact that corporate tax evasion and their perception of tax complexity varied greatly from one country to another. Therefore, we introduced country-fixed effects in our robustness analysis, thereby allowing us to control for inherent variation between countries. In Table 8, specifications 4 and 8 present the regression results after including country-fixed effects. A comparison with the baseline regression in Table 5 shows that the data analysis results, even after controlling for cross-country variation, continued to show a significant positive relationship between tax complexity and the two measures of corporate tax evasion. Thus, the analysis results obtained from the baseline regression were robust.

5.4. Additional Analysis

5.4.1. Country Heterogeneity Analysis

As discussed in the previous section, there are variations in the calculation of the tax evasion ratio in various countries around the globe. Law enforcement and public trust in government performance are generally higher in high- and upper-middle-income countries (Tanzi and Shome 1993). It indicates that the income level of countries can play

a role in determining the perceptions of existing tax evasion. In addition, differences in factors such as technological developments, levels of access to information, and economic developments between countries can cause variations in the complexity of the tax system at the global level. Therefore, there is value in conducting additional analysis by exploring the dimensions of income level to gain an understanding of the dynamics of tax complexity and tax evasion in a country.

To test whether the positive and significant impact of tax system complexity on corporate tax evasion was consistent in various countries, the countries included in the dataset were divided into two groups. The first group included high-income and upper-middle-income (HUP) countries. The second group consisted of lower-middle-income and low-income (LLOW) countries. We followed the World Bank classification, which is based on per capita gross national income (GNI) calculated with the Atlas method, to identify the country's income groups. According to the classification, 46 countries from the dataset were included in the first and 37 countries in the second group. The average values of the tax evasion ratio and two tax complexity indicators in the two groups of countries are presented in Figure 1.

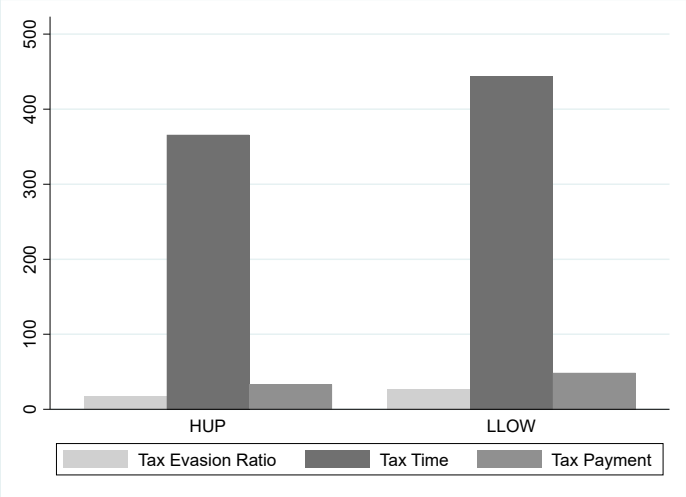

Figure 1. Tax evasion ratio, tax time, and tax payment by income group.

The regression results of the two groups are performed in Table 9. Generally, we find strong and consistent evidence that tax complexity exacerbated firm tax evasion in HUP (specifications 1 and 3) and LLOW countries (specifications 2 and 4). However, significant differences were observed between the two income groups. Tax evasion by firms was more responsive to the level of tax complexity in LLOW countries. The estimated tax time and tax payment coefficients were preponderant in magnitude for this country group. These results may be associated with the fact that the tax systems in LLOW countries are more complex (Figure 1). This group of countries also tends to have higher levels of tax corruption than HUP countries (e.g., Awasthi and Bayraktar 2015). It indicates that tax administration problems in LLOW countries are much more comprehensive than in HUP countries. In other words, investment in improving tax administration is much more necessary in LLOW countries to reduce cases of tax evasion by companies.

In addition, like the regression results obtained from the baseline regression models (Table 5), in Table 9, tax payment presents a larger coefficient size than tax time for both income groups. Given that reducing the number of tax payments is relatively easier than cutting the time required to prepare, file, and pay taxes (Djankov et al. 2010), these results present encouraging news for policymakers in the LLOW group, where the problem of tax evasion tends to be more severe.

Table 9. Country heterogeneity analysis results.

Dependent Variables	**Tax Evasion Ratio**		**Tax Evasion Dummy**	
Country Groups	**HUP Countries**	**LLOW Countries**	**HUP Countries**	**LLOW Countries**
Specifications	**(1)**	**(2)**	**(3)**	**(4)**
Log of tax time	0.046 ***	0.080 ***	0.113 ***	0.058 **
	(0.006)	(0.014)	(0.011)	(0.022)
Log of tax payment	0.104 ***	0.564 ***	0.168 ***	0.561 ***
	(0.011)	(0.033)	(0.022)	(0.053)
Log of GDP	−0.314 ***	−0.190 ***	−0 712 ***	−0.180 ***
	(0.024)	(0.029)	(0.046)	(0.046)
Inflation	0.018 ***	0.007 ***	0.026 ***	0.011 ***
	(0.001)	(0.0004)	(0.003)	(0.001)
Unemployment	0.0004	−0.001	0.006 ***	0.001
	(0.001)	(0.002)	(0.002)	(0.003)
Agriculture	0.042 ***	0.012 ***	0.072 ***	0.012 ***
	(0.002)	(0.002)	(0.004)	(0.004)
Tax burden	−0.002 ***	−0.019 ***	−0.006 ***	0.024 ***
	(0.001)	(0.001)	(0.001)	(0.002)
Age	0.035 ***	0.126 ***	0.039 ***	0.135 ***
	(0.002)	(0.006)	(0.004)	(0.009)
Gender	0.041 ***	−0.138	0.076 ***	0.104 ***
	(0.007)	(0.008)	(0.013)	(0.013)
Voice and accountability	−0.053 ***	−0.136 ***	−0.024	−0.116 ***
	(0.017)	(0.021)	(0.032)	(0.034)
Political stability	−0.064 ***	0.061 ***	−0.144 ***	0.157 ***
	(0.011)	(0.014)	(0.020)	(0.022)
Government effectiveness	−0.190 ***	−0.354 ***	−0.478 ***	−0.460 ***
	(0.034)	(0.042)	(0.067)	(0.070)
Regulatory quality	−0.082 ***	−0.068 *	−0.029	−0.017
	(0.022)	(0.037)	(0.041)	(0.058)
Rule of law	0.524 ***	0.864 ***	0.798 ***	1.055 ***
	(0.033)	(0.035)	(0.063)	(0.057)
Control of corruption	−0.247 ***	0.052	−0.393 ***	−0.131 **
	(0.020)	(0.034)	(0.039)	(0.055)
Observations	25,839	20,207	25,839	20,207
Countries	46	37	46	37
Pseudo-R^2	0.063	0.142	0.034	0.070
Industry and year dummies	Yes	Yes	Yes	Yes

Note: The estimation is based on cross-sectional data. The pooled sample period is from 2002 to 2010. The marginal effects (d_y/d_x) of the regressions are presented in all specifications. The marginal effect of a dummy variable is measured as the discrete change in the predicted value of the outcome variable as the value of the dummy changes from zero to one. Heteroskedasticity-robust standard errors are reported in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels, respectively.

5.4.2. Industry Heterogeneity Analysis

After analysing the entire sample, additional sample sorting was conducted by categorising 27 industries, which included over 46,000 companies, into three main industries: raw material extraction (primary), manufacturing (secondary), and the service industry, which supports the transportation, distribution, and sale of goods produced in the secondary industry (tertiary). To perform this categorisation, we relied on the International Standard Industrial Classification of All Economic Activities (ISIC), Rev.4 (United Nations 2008). Consequently, two industries were designated as main industries, including a total of 5455 firms. Additionally, 14 industries were classified as secondary industries, with a total of 24,955 companies. Furthermore, 11 industries were categorised as tertiary industries, encompassing a total of 15,636 organisations. Using the tax evasion indicators for the three industries as the basis, Tobit and Probit regressions were employed to analyse whether the impact of tax complexity on the extent and incidence of corporate tax evasion was

consistent across the various industries. The findings of the investigation on industry heterogeneity are shown in Table 10.

Table 10. Industry heterogeneity analysis results.

Dependent Variables	**Tax Evasion Ratio**			**Tax Evasion Dummy**		
Industry	**Tertiary**	**Secondary**	**Primary**	**Tertiary**	**Secondary**	**Primary**
Specifications	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Log of tax time	0.021 ***	0.053 ***	0.109 ***	0.079 ***	0.049 ***	0.081 ***
	(0.003)	(0.009)	(0.027)	(0.022)	(0.007)	(0.018)
Log of tax payment	0.013 ***	0.094 ***	0.089 ***	0.050 ***	0.065 ***	0.068 ***
	(0.001)	(0.007)	(0.018)	(0.018)	(0.006)	(0.013)
Log of GDP	−0.003	−0.241 ***	−0.382 ***	−0.039	−0.146 ***	−0.231 ***
	(0.017)	(0.011)	(0.028)	(0.028)	(0.009)	(0.020)
Inflation	0.004 ***	0.004 ***	0.005 ***	0.006 ***	0.004 ***	0.004 ***
	(0.0005)	(0.0004)	(0.001)	(0.001)	(0.0003)	(0.001)
Unemployment	0.009 ***	−0.004 ***	−0.007 ***	0.008 ***	−0.003 ***	−0.004 **
	(0.001)	(0.001)	(0.003)	(0.002)	(0.001)	(0.002)
Agriculture	0.008 ***	0.012 ***	0.021 ***	0.020 ***	0.009 ***	0.014 ***
	(0.002)	(0.001)	(0.003)	(0.003)	(0.001)	(0.002)
Tax burden	−0.001 *	−0.004 ***	0.003	−0.004 ***	−0.003 ***	0.002
	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)
Age	0.007 **	−0.057 ***	−0.071 ***	0.023 ***	−0.026 ***	−0.032 ***
	(0.003)	(0.002)	(0.007)	(0.006)	(0.002)	(0.005)
Gender	−0.003	0.073 ***	0.103 ***	−0.015	0.034 ***	0.054 ***
	(0.006)	(0.006)	(0.014)	(0.010)	(0.004)	(0.010)
Voice and accountability	−0.073 ***	0.119 ***	0.135 ***	−0.110 ***	0.099 ***	0.107 ***
	(0.016)	(0.012)	(0.029)	(0.026)	(0.008)	(0.020)
Political stability	−0.037 ***	−0.035 ***	−0.087 ***	−0.065 ***	−0.022 ***	−0.062 ***
	(0.011)	(0.009)	(0.019)	(0.019)	(0.007)	(0.014)
Government effectiveness	−0.106 ***	−0.474 ***	−0.398 ***	−0.119 **	−0.251 ***	−0.208 ***
	(0.032)	(0.025)	(0.058)	(0.057)	(0.020)	(0.045)
Regulatory quality	−0.084 ***	−0.037 **	−0.169 ***	−0.096 **	−0.046 ***	−0.117 ***
	(0.025)	(0.019)	(0.042)	(0.042)	(0.015)	(0.031)
Rule of law	0.409 ***	0.447 ***	0.460 ***	0.604 ***	0.290 ***	0.259 ***
	(0.035)	(0.026)	(0.054)	(0.057)	(0.020)	(0.041)
Control of corruption	−0.396 ***	−0.116 ***	−0.099 **	−0.607 ***	−0.114 ***	−0.080 ***
	(0.023)	(0.021)	(0.050)	(0.041)	(0.016)	(0.036)
Observations	15,636	24,955	5455	15,636	24,955	5455
Countries	70	83	75	70	83	75
Pseudo-R^2	0.108	0.065	0.052	0.049	0.046	0.045
Industry and year dummies	Yes	Yes	Yes	Yes	Yes	Yes

Note: The estimation is based on cross-sectional data. The pooled sample period is from 2002 to 2010. The marginal effects (d_y/d_x) of the regressions are presented in all specifications. The marginal effect of a dummy variable is measured as the discrete change in the predicted value of the outcome variable as the value of the dummy changes from zero to one. Heteroskedasticity-robust standard errors are reported in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels, respectively.

The findings obtained from the analysis in Table 10 indicated that variations in the key independent variable, namely, tax complexity, had a substantial and positive influence on the occurrence of corporate tax evasion across all three industries. This suggested that the findings of the analysis on industry heterogeneity aligned with the overall study conclusions. Consequently, the baseline regression findings of this research indicated that there were no significant differences seen across industries. Nevertheless, it is important to recognise the disparity in the magnitudes of the coefficients, and we intend to provide a logical explanation for this phenomenon. Tax complexity had a greater impact on the primary industry compared with the other two industries. The reason for this might be because primary industries, such as agriculture, mining, and forestry, often have simpler production processes and fewer intermediary stages compared with those of secondary and

tertiary industries. The straightforwardness of operations in the primary industry might result in a heightened need for tax planning tactics to negotiate intricate tax legislation and reduce tax obligations, thereby raising the probability of tax evasion when confronted with high tax complexity.

5.4.3. Spatial Analysis

Almost all cross-country studies of firm tax evasion practices ignore important threats to the internal validity of the estimation strategy. Their analysis assumes statistical independence between countries. However, as previously noted, the adjacent countries compete to produce an efficient tax system to attract mobile tax bases. Meanwhile, the tax evasion ratio in a country is a consequence of such a 'yardstick competition' (e.g., Foucault et al. 2008). More clearly, when governments in neighbouring countries endeavour to streamline their tax systems and expect increased levels of tax compliance, the governments in home countries should do the same as a normal response. This circumstance reflects clear spatial effects in the tax evasion ratio, which, if not accounted for in the model, will bias our parameter estimates (Anselin 1988).

Interestingly, Figure 2 shows that spatial patterns in firm tax evasion ratios are easy to identify. For example, the countries in Western Africa, including Guinea, Guinea-Bissau, Senegal, Mali, and Mauritania, which share common borders, have the highest quantiles of firm tax evasion ratio. The two Baltic states, Estonia and Latvia, and countries with close geographical distances, such as Belarus, Poland, and Germany, have tax evasion ratios in the lowest quantiles. To strengthen this visual argument, we report the results of spatial autocorrelation tests using the global Moran's *I* and Geary's *C*. According to Table 11, the global Moran's *I* value of the average firm tax evasion ratio was greater than zero and significant at the 1% level, while the global Geary's *C* value of the average firm tax evasion ratio was less than one and significant at the 1% level. These results confirmed a significant spatial autocorrelation effect on the tax evasion ratio in all countries involved in this study.

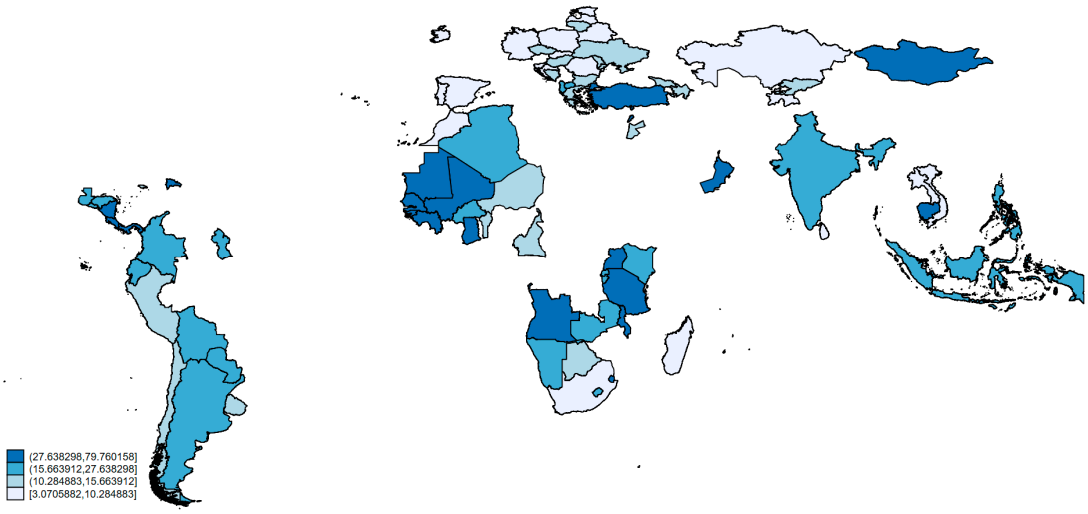

Figure 2. Quantile plot of average tax evasion ratio across sample countries.

Table 11. Global Moran's *I* and Geary's *C* of tax evasion ratio.

Moran's *I*	***I***	**E(*I*)**	**sd(*I*)**	***Z***	***p*-Value**
	0.112	−0.012	0.026	5.112	0.000
Geary's *C*	***C***	**E(*C*)**	**sd(*C*)**	***Z***	***p*-Value**
	0.853	1.000	0.094	−1.570	0.058

To consider the influence of the interdependence effects between different countries on the link between tax complexity and firm tax evasion, we conducted further analysis using the spatial autoregressive (SAR) model for cross-sectional data developed by Kelejian and Prucha (1999), which considers the spatial autocorrelation effects in the dependent variable by introducing a spatial lag term (the tax evasion ratio in neighbouring countries affects the tax evasion ratio in the home countries). Both contiguity and inverse-distance matrices were constructed to run the models. The results are shown in Table 12. First, the Wald test results indicated that the spatial econometric models used in the current analysis were appropriate for estimating the spatial interaction effect on the relationship between tax complexity and firm tax evasion. Second, after tolerating the presence of such effects, our two tax complexity variables still positively affected the firm tax evasion ratio.

Table 12. Spatial analysis results.

Dependent Variable	**Tax Evasion Ratio**	
Weighting Matrix	**Contiguity Matrix**	**Inverse-Distance Matrix**
Specifications	**(1)**	**(2)**
Log of tax time	0.112 *	0.087 *
	(0.059)	(0.052)
Log of tax payment	0.122 **	0.113 **
	(0.061)	(0.048)
Marginal Effect (d_y/d_x)		
Direct Effect		
Log of tax time	0.116 *	0.091 *
	(0.061)	(0.055)
Log of tax payment	0.126 **	0.119 **
	(0.063)	(0.050)
Indirect Effect		
Log of tax time	0.045	0.041
	(0.036)	(0.035)
Log of tax payment	0.049	0.053
	(0.033)	(0.033)
Total Effect		
Log of tax time	0.162 *	0.131
	(0.090)	(0.086)
Log of tax payment	0.175 **	0.172 **
	(0.087)	(0.073)
Observations	83	83
Pseudo-R^2	0.065	0.068
Wald χ^2 test: spatial terms	14.02 ***	12.78 ***

Note: The estimation is based on cross-sectional data. The pooled sample period is from 2002 to 2010. Standard errors are reported in parentheses. All control variables are included, but the estimation results are omitted for simplicity. *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels, respectively.

It should be noted that the coefficients in the spatial econometric models discussed above (pivot coefficients) did not directly serve as the marginal effects of tax complexity on the firm tax evasion ratio. Therefore, direct, indirect, and total effects reflecting changes in the tax complexity measures of a particular country are also reported in Table 12. The direct effect represents the impact of the changes in tax complexity measures on the firm tax evasion ratio in the home countries. The indirect effect is the impact caused by changes in the tax complexity measures of neighbouring countries on the tax evasion ratio in the home countries. The total effect is simply the combination of the direct and indirect effects. We can observe the difference between the direct effect coefficients and the pivot coefficients—also called feedback effects—representing the impact passing through neighbouring countries and back to the countries themselves. These are caused by the unreported coefficients of the spatially lagged tax evasion ratio variable and those of the spatially lagged tax complexity variables.

Generally, we found that the coefficients of the direct effects of tax complexity variables had a similar distribution pattern in significance level to that of the pivot coefficients. Tax time and tax payment are consistently significant at the 10% and 5% levels, respectively, and these results held for both spatial weighting matrices (contiguity and inverse-distance matrices). However, the coefficient magnitudes of the direct effects were broadly larger than the corresponding pivot coefficients, indicating that tax time and tax payment were slightly more responsive to an increase in the home countries' tax evasion than the pivot coefficients shown in all spatial econometric models. For instance, in the contiguity matrix-based regression, the direct effects of tax time and tax payment were 0.116 and 0.126, respectively, and the pivot coefficients were 0.112 and 0.122, respectively. The difference between the direct effects and the pivot coefficients produced feedback effects of 0.0043 and 0.0046 for tax time and tax payment, respectively. The positive feedback effects indicate that over time, the firm tax evasion ratio in the home countries will decrease due to increases in the tax complexity. Gradually, tax authorities will be motivated to manage the improvement of their tax administration efficiency in response to rampant tax evasion; hence, they can compete with neighbouring countries. These results also strengthen our argument regarding the simultaneity bias between tax complexity and tax evasion.

In addition, the coefficients of the indirect effects found in all models were insignificant, even at the 10% level. These results show that tax complexity in neighbouring countries does not play a substantial role in determining tax evasion in home countries, corroborating the exogeneity assumption of our instruments. However, it is worth noting that the positive indirect effects take time to materialise, especially if geographically close countries harmonise and consolidate their tax systems—which may currently be fragmented—to significantly reduce compliance and administrative costs and thus lessen tax evasion opportunities of cross-border operations by firms within the neighbourhood (Mintz 2004; Barrios et al. 2020). These findings corroborate a large body of evidence from Nicodème (2009), Riedel (2018), and van't Riet and Lejour (2018), showing that global firms exploit cross-country differences in corporate income tax rules. Such firms take advantage of existing inconsistencies and loopholes within the international tax network through transfer pricing, debt shifting, and the strategic allocation of intangible assets across tax jurisdictions.

6. Conclusions

This cross-country investigation delved into the intricate dynamics of firm tax evasion and its association with tax complexity, shedding light on a phenomenon that transcends borders and economic strata. While previous research has largely scrutinised tax evasion at the individual level, this study attempted to explore the uncharted territory of corporate entities and unveiled the interconnectedness of tax-related regulatory factors across diverse nations. In doing so, it sought to bridge the gap in the existing literature, offering a holistic view of how tax complexity influences the propensity of firms to engage in tax evasion on a global scale. Drawing from an extensive dataset from over 46,000 firms in 83 countries, our investigation provided compelling evidence that a complex tax system indeed begets increased firm tax evasion. Robustness checks, including endogeneity tests, verified the robustness of the baseline regression results. Furthermore, this study investigated the heterogeneity of these impacts across country income levels and industries. Last, this study also elaborated an analysis that considered spatial dependence in corporate tax evasion ratios. Our main conclusions remained intact with such analyses.

The study's findings yield several policy implications that can guide tax policy and enforcement strategies. First, policymakers should prioritise tax simplification efforts to alleviate the burden of tax complexity. Streamlining tax codes and regulations can enhance compliance and reduce the attractiveness of tax evasion. Second, governments should enhance institutional quality, including governance, rule of law, and regulatory effectiveness, which is pivotal in fostering a climate of tax compliance and regulatory trustworthiness. Effective institutions play a crucial role in deterring tax evasion. Third, in countries with lower per capita GNI, policymakers should adopt tailored strategies to address tax evasion

unique to these settings. Recognising the interplay between tax complexity and the hard-to-tax sectors (e.g., agriculture and informal activities) is imperative. Fourth, given the observed spatial interdependence effects, countries should engage in collaborative initiatives to harmonise tax systems and close cross-border tax evasion loopholes. International cooperation can curtail opportunities for tax evasion. Last, this study underscores the need for responsive tax policies that acknowledge the deleterious impact of tax complexity on firm tax evasion. By simplifying tax systems, fortifying institutions, and embracing international collaboration, nations can embark on a path toward fairer and more effective tax regimes, enhancing fiscal sustainability and revenue collection in an increasingly interconnected global landscape.

While this cross-country investigation provides valuable insights into the association between tax complexity and firm tax evasion, several limitations merit consideration. First, the study relied on data from the WBES and the WBDB databases, which, while robust, may still be subject to measurement errors and limitations inherent in large-scale surveys. Additionally, data availability for some countries may be limited or outdated. Second, the study acknowledges the potential endogeneity of tax complexity as complex tax systems may evolve in response to high levels of tax evasion. Although instrumental variables are employed to mitigate this concern, the challenge of selecting suitable instruments remains. Last, the study encompasses a diverse array of countries, but its findings may not be universally applicable. Cultural, legal, and economic nuances across countries can influence tax evasion behaviours, necessitating caution in generalising results.

Author Contributions: Conceptualization, G.M. and P.B.S.; methodology, G.M.; software, G.M.; validation, G.M., P.B.S. and F.S.; formal analysis, G.M., P.B.S. and I.P.; investigation, G.M.; resources, G.M.; data curation, G.M.; writing—original draft preparation, G.M., P.B.S., F.S., I.P., D.P. and I.K.; writing—review and editing, G.M. and F.S.; visualization, G.M.; supervision, G.M., P.B.S. and F.S.; project administration, I.P.; funding acquisition, P.B.S. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by Universitas Indonesia, NKB-615/UN2.RST/HKP.05.00/2023.

Informed Consent Statement: Not applicable.

Data Availability Statement: The corresponding author will provide the data associated with this work upon reasonable request.

Conflicts of Interest: The authors declare no conflicts of interest.

Appendix A

Table A1. Variable details.

Variable	Definition	Database
Tax evasion ratio	Unreported sales tax.	WBES, the World Bank
Tax evasion dummy	The value is equal to one if the ratio of tax evasion is more than zero; otherwise, it is equal to zero.	WBES, the World Bank
Log of tax time	Log of the duration required for tax preparation and payment.	WBDB, the World Bank
Log of tax payment	Log of the aggregate quantity of taxes paid by firms, including the use of electronic filing methods.	WBDB, the World Bank
Log of GDP	Log of real GDP per capita, which is measured in terms of 2015 USD.	WDI, the World Bank
Inflation	The yearly growth rate of the ratio between the GDP measured in current local currency and the GDP measured in constant local currency.	WDI, the World Bank

Table A1. *Cont.*

Variable	Definition	Database
Unemployment	The proportion of the labour force that is actively seeking employment but currently without a job.	WDI, the World Bank
Agriculture	The contribution of agriculture, forestry, and fisheries to the GDP in terms of value added.	WDI, the World Bank
Tax burden	The tax liability imposed by the governing authorities. A higher value (0–1) implies a heavier tax burden and vice versa.	Index of Economic Freedom, the Heritage Foundation
Age	The percentage of the population in the age range of 15 to 24 who are engaged in economic activities.	Population Estimates and Projections, the World Bank
Gender	The percentage of female labour.	Gender Statistics, the World Bank
Voice and accountability	The perceptions of the public participation level in government selection. A higher value (−2.5–2.5) implies a better institutional quality.	WGI, the World Bank
Political stability	The perceptions on the probability of encountering political instability and politically motivated violence. A higher value (−2.5–2.5) implies a better institutional quality.	WGI, the World Bank
Government effectiveness	The perceptions pertain to several aspects of public services. A higher value (−2.5–2.5) implies a better institutional quality.	WGI, the World Bank
Regulatory quality	The perceptions on the government's capacity to effectively devise and execute well-founded policies and regulations that facilitate and advance the growth of the private sector. A higher value (−2.5–2.5) implies a better institutional quality.	WGI, the World Bank
Rule of law	The perceptions of the degree to which individuals exhibit trust and compliance with societal norms. A higher value (−2.5–2.5) implies a better institutional quality.	WGI, the World Bank
Control of corruption	The perceptions on the degree to which public authority is used for personal benefit. A higher value (−2.5–2.5) implies a better institutional quality.	WGI, the World Bank

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