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THREE ESSAYS ON THE TAX CAPACITY IN THE DIGITAL ERA IN DEVELOPING COUNTRIES : FROM TAX COMPLIANCE TO STATE CAPACITY

TROIS ESSAIS SUR LA CAPACITÉ FISCALE À L'ÈRE DU NUMÉRIQUE DANS LES PAYS EN DÉVELOPPEMENT : DE LA CONFORMITÉ FISCALE À LA CAPACITÉ DE L'ÉTAT

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Executive Summary

The ability of states to sustainably mobilize domestic tax revenues is a fundamental pillar of economic development and political stability. In developing countries, this capacity remains constrained not only by structural factorsnarrow tax bases, high levels of informality, and limited administrative capacitybut also by a persistent deficit in tax legitimacy and trust between the state and taxpayers. Beyond its technical dimension, taxation is therefore an institutional and political relationship that shapes the social contract. However, the literature has paid relatively little attention to how digital transformation reshapes these mechanisms.

This thesis lies at the intersection of public economics, political economy, and behavioral economics. It argues that the digitalization of tax administrations should not be viewed merely as a technical modernization tool, but as an institutional lever capable of transforming the relationship between the state and taxpayers. By simultaneously affecting compliance costs, transparency, and perceptions of legitimacy, digitalization can strengthen tax capacity and, more broadly, state capacity. The central question of this thesis is therefore to what extent digitalization can sustainably enhance tax revenue mobilization, taxpayer compliance, and tax legitimacy in developing countries.

The first essay examines the impact of digitalization on non-resource tax revenues in 111 developing countries over the period 2005-2019. Panel data estimations reveal a positive and statistically significant effect of digitalization on tax revenues. An identification strategy based on exogenous connectivity shocks strengthens the causal interpretation. However, these effects depend critically on institutional quality and administrative capacity, suggesting that technology cannot substitute for credible institutional frameworks.

The second essay analyses the effects of electronic tax services on the compliance of

small and medium-sized enterprises (SMEs) in Burkina Faso, using matched survey and administrative data from 2014 to 2024. The results show that the adoption and effective use of digital tax platforms significantly improve tax compliance, reflected in higher reported and paid amounts. These effects are driven not only by reduced compliance costs, but also by improved perceptions of simplicity, transparency, and fairness, highlighting the importance of institutional and cognitive mechanisms. The findings suggest that digitalization policies should be accompanied by targeted support measures for SMEs.

The third essay explores the behavioral foundations of tax capacity in Africa by examining the role of digital exposure in shaping perceived tax legitimacy. Using Afrobarometer data covering 34 countries in 2022, logit and probit estimations show that regular digital exposure is significantly associated with a stronger recognition of the state's right to tax. This result highlights the role of digital tools in shaping civic and fiscal norms, emphasizing that revenue mobilization relies as much on consent and legitimacy as on enforcement.

Overall, this thesis shows that digitalization can sustainably enhance tax capacity only when embedded within a credible and legitimate institutional framework. It contributes to the literature by providing an integrated analysis of the macroeconomic, microeconomic, and behavioral channels through which digital transformation can strengthen state capacity in developing countries. The findings underscore the importance of complementing digitalization strategies with institutional reforms aimed at improving transparency, fairness, and trust, in order to consolidate the fiscal social contract and support long-term sustainable development.

Keywords : Tax capacity; public finance; digitalization; tax compliance; tax legitimacy; tax morale; institutions; governance; developing countries; Africa.

JEL Classification : C23; D63; H20; H26; H30; O17; O33; O55.

Résumé Exécutif

La capacité des États à mobiliser durablement des ressources fiscales constitue un pilier essentiel du développement économique et de la stabilité politique. Dans les pays en développement, cette capacité demeure limitée non seulement par des contraintes structurelles, étroitesse des assiettes fiscales, poids de l'informalité et faibles capacités administratives, mais aussi par un déficit de légitimité fiscale et de confiance entre l'État et les contribuables. Au-delà de sa dimension technique, la fiscalité renvoie ainsi à une relation institutionnelle et politique qui structure le contrat social. Or, la littérature a encore peu exploré le rôle de la transformation numérique dans la reconfiguration de ces mécanismes.

Cette thèse s'inscrit à l'intersection de l'économie publique, de l'économie politique et de l'économie comportementale. Elle propose d'analyser la digitalisation non comme un simple outil de modernisation administrative, mais comme un levier institutionnel capable de transformer la relation entre l'État et les contribuables. En influençant simultanément les coûts de conformité, la transparence et les perceptions de légitimité, la digitalisation peut renforcer la capacité fiscale et, plus largement, la capacité de l'État. La question centrale est donc de savoir dans quelle mesure la digitalisation contribue à améliorer durablement la mobilisation des recettes fiscales, la conformité des contribuables et la légitimité de l'impôt dans les pays en développement.

Le premier essai examine l'impact de la digitalisation sur les recettes fiscales non extractives dans 111 pays en développement entre 2005 et 2019. Les résultats issus de modèles de panel montrent un effet positif et significatif de la digitalisation sur les recettes fiscales. Une stratégie d'identification fondée sur des chocs exogènes de connectivité renforce l'interprétation causale. Toutefois, ces effets dépendent fortement de la qualité des institutions et des capacités

administratives, indiquant que la technologie ne peut se substituer à des cadres institutionnels solides.

Le deuxième essai analyse l'effet des services fiscaux électroniques sur la conformité des PME au Burkina Faso, à partir de données appariées combinant enquêtes et données administratives (2014-2024). Les résultats montrent que l'utilisation des plateformes numériques de déclaration et de paiement améliore significativement la conformité fiscale. Ces effets s'expliquent à la fois par la réduction des coûts de conformité et par l'amélioration des perceptions de simplicité, de transparence et d'équité. L'étude souligne ainsi l'importance d'accompagner la digitalisation par des politiques de soutien ciblées aux PME.

Le troisième essai explore les déterminants comportementaux de la capacité fiscale en Afrique, en mobilisant les données afrobarometer sur 34 pays en 2022. Les estimations indiquent que l'exposition digitale est associée à une plus grande légitimité perçue de l'impôt. Ce résultat met en évidence le rôle de la digitalisation dans la formation des normes fiscales et du consentement à l'impôt, soulignant que la mobilisation des recettes repose autant sur la légitimité que sur la contrainte.

Dans l'ensemble, la thèse montre que la digitalisation ne renforce durablement la capacité fiscale que si elle s'inscrit dans un cadre institutionnel crédible et légitime. Elle apporte une contribution originale en proposant une approche intégrée des canaux macroéconomiques, microéconomiques et comportementaux. Les résultats suggèrent que les politiques de digitalisation doivent être accompagnées de réformes institutionnelles visant à améliorer la transparence, l'équité et la confiance, afin de consolider le contrat fiscal et soutenir un développement durable.

Mots-clés : Capacité fiscale ; finances publiques, digitalisation ; conformité fiscale ; légitimité de l'impôt ; morale fiscale ; institutions ; gouvernance ; pays en développement ; Afrique.

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Contents

List of Figures

List of Tables

Chapter 1

General Introduction

1.1 Context

Tax revenue mobilization is one of the major challenges facing developing countries at present. In a context marked by growing needs to finance public services, infrastructure, and social policies, the state's ability to mobilize resources effectively determines the sustainability of public finances, budgetary autonomy, and the capacity to support inclusive and sustainable growth. Economic literature highlights that weak domestic resource mobilization limits the capacity of states to provide adequate public goods and reduce their dependence on debt or external aid (Besley and Persson, 2011; Gupta et al., 2017). However, despite several decades of tax reforms inspired by international standards, many developing countries continue to have low tax burdens, narrow tax bases, and high levels of tax noncompliance (Keen et al., 2015).

These difficulties reflect less a problem with the formal design of tax systems than a structural deficit in tax capacity. The capacity of the state, representing its ability to identify taxpayers, measure tax bases, and enforce tax obligations, remains structurally limited in many developing economies (Besley and Persson, 2014). The prevalence of informality, fragmented administrative databases, complex tax procedures, and high compliance costs limit the effectiveness of taxation (Tanzi and Zee, 2000; Keen and Lockwood, 2010). Added to this is a lack of trust between taxpayers and the tax administration, often fueled by perceptions of poor public services, tax inequity, and imperfect governance. Behavioral literature shows that tax compliance depends not only on economic incentives, but also on the perceived legitimacy of the state and trust in public institutions (Luttmer and Singhal, 2014; Alm, 2019). In this context, traditional tax instruments, based mainly on adjusting tax rates and bases, are proving insufficient to improve revenue mobilization in the long term.

Alongside these structural constraints, the last two decades have seen the rapid spread of digital technologies and digital financial services in developing countries. The rise of electronic services, electronic payments, and mobile money has profoundly transformed the way economic agents, particularly households and small and medium-sized enterprises, conduct transactions. By reducing transaction costs, facilitating remote exchanges, and improving the traceability of financial flows, these innovations have contributed to a gradual transformation of economic

behavior and greater integration of certain segments of the economy into more formal channels. The literature shows that these mechanisms promote both the formalization of economic activities and financial inclusion, particularly in contexts where financial and administrative infrastructures are underdeveloped (Aker and Mbiti, 2010; Suri and Jack, 2016; Pazarbasioglu et al., 2020).

In this context, digitalization appears to be a major opportunity to rethink the functioning of tax systems. By facilitating taxpayer formalization, tax reporting and payment, and improving the circulation and use of tax information, digital tools offer new opportunities to strengthen tax compliance and broaden the tax base. The dematerialization of tax procedures reduces compliance costs for taxpayers and improves administrative efficiency, particularly for developing countries (Okunogbe and Pouliquen, 2022; Mascagni et al., 2023). Furthermore, by reducing interactions between taxpayers and tax officials, digitalization can improve tax governance, limit opportunistic practices, and strengthen the legitimacy of the state (Khan et al., 2016). However, the effects of digitalization on the performance of tax systems are not uniform. The adoption of digital tools varies across countries, sectors, company sizes, and taxpayer categories. In addition, digitalization can create new challenges related to digital exclusion, institutional capacity, data protection, and the social acceptability of reforms. The expected gains from digitalization depend heavily on the institutional context, the degree of digital maturity, and how reforms are implemented (Gupta et al., 2017).

In this context, this thesis aims to empirically analyze the mechanisms through which the digitalization of electronic services and tax administrations influences compliance behavior and contributes to improving tax revenue mobilization in developing countries. By combining microeconomic, institutional, and macroeconomic data, it aims to shed light on the role of digital transformation as a key lever for strengthening the state's fiscal capacity and sustainable development financing.

1.2 Theoretical framework

1.2.1 Tax capacity as a fundamental pillar of state capacity

Tax capacity is at the heart of contemporary thinking on state capacity and economic development. It refers to a state's ability to mobilize domestic resources in a regular, predictable, and sustainable manner in order to finance the provision of public goods, ensure redistribution, and guarantee macroeconomic stability. This concept goes far beyond an accounting view of taxation and is part of an institutional and political approach to the state. In political economy, fiscal capacity is inseparable from state-building. North (1981) emphasizes that fiscal extraction capacity is a necessary condition for the emergence of stable institutions, while Tilly et al. (1992) shows historically that taxation has been a central driver of the formation of modern states, structuring relationships of negotiation, representation, and accountability between rulers and ruled. This idea is taken up and formalized by Besley and Persson (2009, 2011), who conceptualize fiscal capacity as a long-term institutional investment that complements the legal and administrative capacities of the state.

In this perspective, tax capacity reflects a set of institutional capacities including taxpayer identification, measurement of tax bases, credibility of enforcement, and management of the state-taxpayer relationship. Baskaran and Bigsten (2013) define tax capacity as the effective extractive capacity of the state, i.e., the gap between an economy's tax potential and the revenue actually collected. This approach is particularly relevant in developing countries, where, despite the existence of significant tax bases, these remain largely underutilized, reflecting a weaker tax capacity as the gap becomes larger.

Studies in Africa highlight that weak fiscal capacity is less the result of deliberate policy choices than of deep-rooted structural constraints. Mkandawire (2010) emphasizes the historical legacy of African states, characterized by tax administrations designed for colonial extraction rather than for generalized and negotiated taxation. DiJohn (2010) highlights the role of the productive structure, noting that the predominance of subsistence agriculture, the importance of the informal sector, and the fragmentation of economic units make the identification and taxation of tax bases particularly costly. In addition, several studies have examined the

relationship between institutional quality and tax capacity. Baskaran and Bigsten (2013) empirically show that an increase in tax capacity is associated with a decrease in corruption and an improvement in democratic governance indicators. This finding is fundamental, as it suggests that fiscal capacity is not only a consequence of institutional development, but also a driver of it. When the state is more dependent on domestic taxation, it is forced to be accountable to citizens and to strengthen the quality of its institutions. This relationship is reinforced by the distinction between tax revenues and rents. Research on the resource curse shows that revenues from natural resources or foreign aid tend to weaken the accountability link between the state and society by reducing the need to negotiate taxes with citizens (Ross, 2001; Baskaran and Bigsten, 2013). Conversely, domestic taxation creates a structuring fiscal link at the heart of the social contract. Therefore, not all public revenues are equal from the point of view of state-building; fiscal capacity based on domestic taxation appears to be a central pillar of state legitimacy.

These constraints explain the high concentration of tax revenues on a limited number of large formal enterprises, while small and medium-sized enterprises and households remain poorly integrated into the tax system (Keen and Mansour, 2010; Mascagni and Santoro, 2021). This configuration not only limits the level of revenue, but also the institutional scope of taxation, by reducing the number of citizens directly involved in the tax relationship.

In this thesis, tax capacity is conceived as a dynamic institutional capacity, resulting from the interaction between the administrative mechanisms of the state, taxpayer compliance behavior, and perceptions of the legitimacy of the tax system. It depends not only on the technical capabilities of the administration, but also on trust, perceived fairness, and the quality of the relationship between the state and its citizens. Compliance behavior directly influences tax revenues, while the legitimacy of the tax system determines voluntary tax compliance. These dimensions interact cumulatively, creating either virtuous circles of fiscal capacity reinforcement or vicious circles of low compliance and institutional underinvestment.

1.2.2 Theories of tax compliance: from deterrence to tax morality

Tax compliance is a key factor in the analysis of tax systems, as it determines the effectiveness of taxation and, consequently, the state's ability to mobilize domestic resources. Thus, understanding taxpayers' choices to comply or not comply with their tax obligations has thus given rise to a rich theoretical literature. This literature has progressively evolved from a strictly deterrence-based conception of compliance toward approaches that integrate behavioral, normative, and institutional dimensions, at the heart of which lies the notion of tax morale.

Early work on tax compliance relied on a deterrence approach developed by Allingham and Sandmo (1972). In this framework, taxpayers are modeled as rational agents who maximize their expected utility by weighing the expected gains from tax evasion against the anticipated costs associated with the probability of audit and the severity of penalties. Compliance is therefore viewed as behavior primarily induced by coercion, and optimal tax policy is based on adjusting enforcement parameters.

This approach was subsequently extended by a large body of public finance literature that sought to analyze more precisely the effects of tax rates, audit probabilities, and penalties on reporting behavior. Yitzhaki (1987) shows that the impact of tax rates on tax evasion depends critically on the structure of penalties, highlighting the role of the institutional framework in shaping incentives. Cowell (1990) emphasizes the complexity of the determinants of tax compliance and the limited predictive power of standard deterrence models. From a synthetic perspective, Slemrod and Yitzhaki (2002) show that the credibility of the tax administration and the perceived risk of audit are key determinants of compliance in enforcement-based approaches, while Slemrod (2019) stresses the central role of tax institutions and the costly nature and diminishing returns of enforcement policies. Taken together, these contributions suggest that, although deterrence is a necessary component of tax compliance, it is insufficient to sustainably explain observed compliance behaviors.

A growing body of empirical evidence has challenged the adequacy of purely deterrence-based explanations. Alm et al. (1992) and Andreoni et al. (1998) show that standard models systematically overpredict tax evasion, even in contexts characterized by weak enforcement, and that modest variations in enforcement parameters fail to account for observed differences

in compliance. Moreover, empirical research suggests that increasing audits and penalties may generate ambiguous or even counterproductive effects by eroding voluntary cooperation and reinforcing avoidance and informality strategies (Frey and Torgler, 2007). These findings have led the literature to question the sufficiency of deterrence as an explanatory foundation for tax compliance and to explore approaches that incorporate psychological, social, and institutional dimensions of tax behavior.

At the core of these alternative approaches lies the concept of tax morale. Tax morale refers to individuals' intrinsic motivation to pay taxes, independently of the immediate risk of sanctions, and reflects the internalization of tax norms and the perception of taxation as a legitimate civic obligation (Torgler, 2007). Luttmer and Singhal (2014) show that tax morale is a major determinant of voluntary tax compliance, shaped by social norms, civic values, perceptions of tax fairness, trust in public institutions, and beliefs regarding the use of tax revenues. For Alm (2019), voluntary compliance grounded in tax morale represents the dominant component of overall tax compliance, with enforcement mechanisms playing only a complementary role. From this perspective, tax compliance is embedded in a broader relationship between the state and taxpayers, often conceptualized as an implicit fiscal contract (Levi, 1988; Moore, 2004). When taxpayers perceive taxation as fair, rules as impartially applied, and public revenues as effectively used, tax morale is strengthened; conversely, perceptions of unfairness, corruption, or poor governance undermine tax morale and foster non-compliance (Fjeldstad and Tungodden, 2003; Prichard, 2015).

Moreover, recent literature has explicitly sought to combine the coercive and normative dimensions of tax compliance. In this regard, Kirchler et al. (2008) distinguish two fundamental determinants: the power of the tax administration, grounded in enforcement mechanisms, and the trust it inspires among taxpayers. Within this framework, tax morale is closely linked to trust and the perceived legitimacy of the state. A strategy exclusively based on deterrence may increase compliance in the short term but risks eroding trust and weakening tax morale in the long run. Conversely, high levels of institutional trust and tax morale can sustain high and durable compliance even in contexts characterized by limited enforcement capacity. Tax compliance thus emerges as the outcome of an institutional balance between coercion and

cooperation, in which state legitimacy and the quality of the fiscal relationship between the state and taxpayers play a decisive role.

1.2.3 Tax digitalization as institutional transformation

The digitalization of tax administrations constitutes a major institutional transformation, as it simultaneously reshapes the state's informational capacities, taxpayers' compliance costs, and the architecture of administrative procedures. Beyond these technical dimensions, it also affects the quality of the fiscal relationship between the state and citizens by influencing perceptions of transparency, fairness, and the legitimacy of taxation. It therefore resembles a capacity-enhancing reform rather than a simple parametric reform affecting tax rates or bases, since it reconfigures the effective rules of the administrative game-taxpayer identification, information processing and circulation, control mechanisms, and service delivery to users. These transformations have potentially significant effects on revenue mobilization and fiscal legitimacy. According to Kochanova et al. (2020), e-government can strengthen public capacity by reducing compliance costs, increasing revenues, and improving administrative efficiency.

Digitalization influences the performance of tax systems by reducing the transaction costs associated with tax compliance. Economic agents make decisions not only based on legal obligations, but also by weighing the monetary, time-related, and cognitive costs involved in complying with those obligations (Williamson, 1985). In many developing countries, compliance costs are particularly high due to procedural complexity, administrative uncertainty, and repeated interactions with tax authorities. The introduction of digital tax services, such as e-filing and e-payment, significantly reduces these frictions by simplifying procedures, limiting physical travel, shortening processing times, and improving access to tax information. The reduction of these costs has substantial effects on tax compliance, especially for small and medium-sized enterprises, whose administrative capacity is limited and for which fixed compliance costs represent a disproportionate burden (Okunogbe and Pouliquen, 2022). Digitalization thus acts as a lever that lowers the entry threshold into formal tax compliance, fostering broader participation in the tax system.

Also, digitalization improves the availability of information and the traceability of tax

transactions. It strengthens the capacity of tax administrations to collect, centralize, and process data in real time, facilitating cross-checks between different internal and external information sources. This improvement in the informational environment enhances the credibility of enforcement, even in the absence of a proportional increase in physical audits. As shown by Kleven et al. (2011), access to more comprehensive and better-integrated data allows tax authorities to target audits more effectively and increases taxpayers' perceived probability of detection. Kochanova et al. (2020) emphasize that these informational gains constitute a central channel through which e-government strengthens fiscal capacity and revenue mobilization. By altering taxpayers' expectations regarding the risk of detection and the coherence of the control system, digitalization directly influences reporting behavior and can reduce incentives for tax evasion.

Finally, digitalization operates on a more institutional and behavioral dimension by shaping perceptions of governance, trust, and procedural fairness. By reducing discretionary interactions between tax officials and taxpayers, digital tax services limit opportunities for corruption, informal negotiation, and arbitrary treatment, thereby contributing to the depersonalization of procedures. This transformation strengthens the transparency, predictability, and impartiality of administrative action, which are central foundations of fiscal legitimacy. Okunogbe and Santoro (2023b) show that the digitalization of tax procedures improves the perceived quality of tax administration and strengthens taxpayers' trust in the tax system. Complementarily, Khan et al. (2016) emphasize that reducing administrative discretion and improving the traceability of fiscal interactions enhances compliance by improving perceptions of fairness and state credibility. Finally, Mascagni et al. (2021) demonstrate that simpler, more transparent, and fairer procedures are associated with higher levels of voluntary compliance, independently of the intensity of enforcement. From this perspective, digitalization constitutes not only a technical enforcement tool but also an instrument of institutional transformation capable of durably strengthening the fiscal relationship between the state and taxpayers.

1.3 Stylized facts

1.3.1 Digitalization of tax administrations

Digitalization refers to the comprehensive integration of information and communication technologies (ICT) into tax procedures, including tax filing, payment, auditing, and data analysis. This digital transition is built on several key pillars, namely the dematerialization of tax procedures, the automation of administrative processes, the interoperability of information systems, and the large-scale processing of data. The benefits of digitalization are manifold. For tax administrations, it enhances efficiency in tax collection, reduces operational costs, facilitates the detection of fraud, and improves information governance. For taxpayers, digitalization improves access to tax services, lowers compliance costs, and reduces face-to-face interactions with tax officials, which are often a source of corruption.

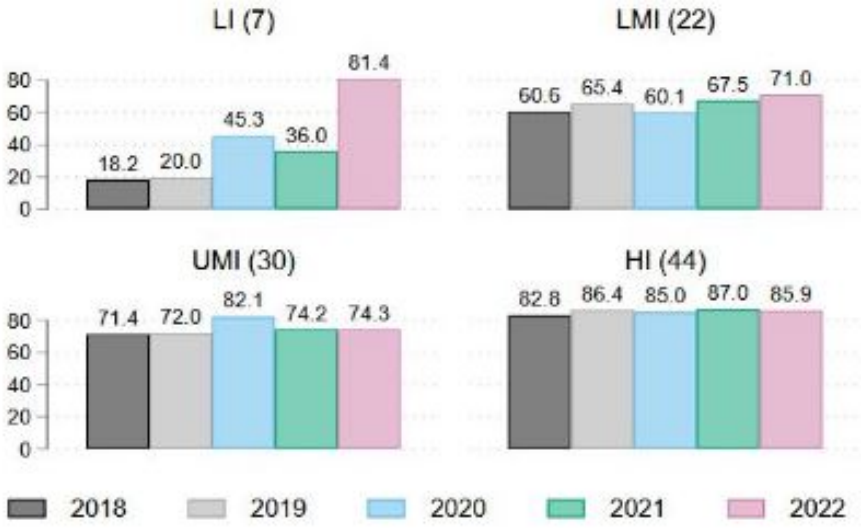
However, this transition is not without challenges. In many developing countries, the modernization of tax administrations faces constraints related to limited technical skills, inadequate infrastructure, low levels of digital literacy, and institutional resistance to change. As a result, digitalization efforts have often initially focused on high-yield taxes, in order to rapidly maximize gains in administrative efficiency and revenue mobilization before progressively extending digital tools to other taxes.

1.3.1.1 Evolution of Corporate Income Tax eFiling

Corporate income tax constitutes a major lever for tax revenue mobilization, particularly in countries where the formal sector is more structured and effectively taxed. According to the OECD (2024) report, revenues from corporate income tax accounted on average for 16% of total tax revenues across 123 countries in 2021, corresponding to 3.2% of GDP. Its contribution is relatively high in Africa (18.7%), Asia-Pacific (18.2%), and Latin America and the Caribbean (15.4%), compared with 10.2% in OECD countries. When expressed as a share of GDP, regional disparities are less pronounced. On average, corporate income tax revenues amount to 3.3% of GDP in OECD countries and Latin America, 3.2% in Asia-Pacific, and 2.7% in Africa. These figures reflect both differences in regional economic performance and variations in the

effectiveness of tax administration.

Figure 1.1: CIT eFiling as % Total



Note: Data from International Survey on Revenue Administration (ISORA) of IMF.

Figure 1.1 shows the evolution of electronic filing of the corporate income tax from 2018 to 2022 across countries by income level. In the seven low-income countries, a sharp increase is observed. In 2018, only 18.2% of declarations were submitted online. The Covid-19 pandemic acted as a catalyst, raising this share to 45.3% in 2020, before reaching 81.4% in 2022. This strong growth reflects an accelerated digital transition in contexts where tax administrations have sought to align with broader digital transformation trends. In the 22 lower-middle-income countries, the adoption of electronic filing platforms follows a more gradual but sustained trajectory. The rate increased from 60.6% in 2018 to 71% in 2022, with an average of 64.9% over the period. These countries benefit from intermediate institutional capacity, allowing for a progressive implementation of digital tools. The 30 upper-middle-income countries also experienced an increase in electronic filing rates under the influence of the pandemic. While the rate stood at 71.4% in 2018, it rose sharply to 82.1% in 2020 before slightly declining to 74.3% in 2022. This pattern suggests that cyclical factors can also influence the use of digital tax services. Finally, in the 44 high-income countries, the use of electronic platforms was already widespread prior to Covid-19. The rate increased from 82.8% in 2018 to 85.9% in 2022, with an average of 85.4%, reflecting a high level of digital maturity. These countries generally benefit from sophisticated infrastructures and widespread access to high-speed internet, which

facilitates the adoption of electronic platforms

1.3.1.2 Evolution of Personal Income Tax eFiling

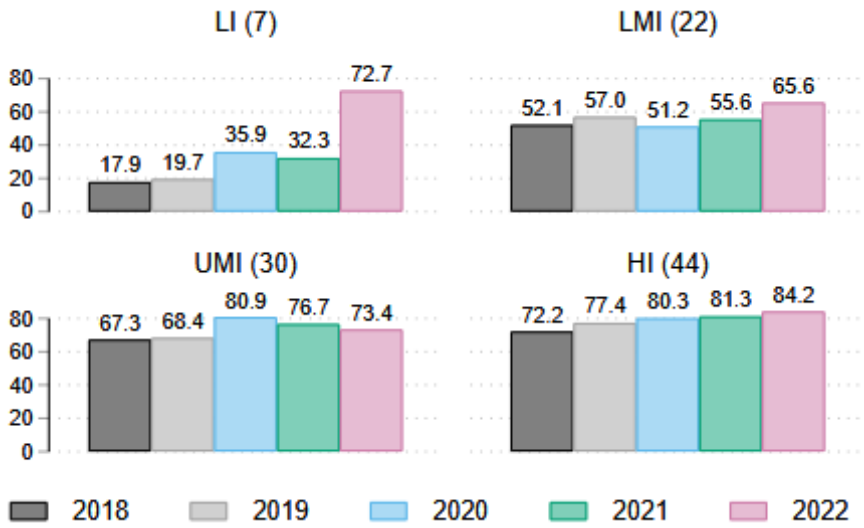
This figure 1.2 traces the evolution of electronic filing of the personal income tax (PIT) between 2018 and 2022 across countries by income level, and extends the patterns observed for corporate income tax and digitalized tax payments. Over the period as a whole, PIT e-filing exhibits contrasting trajectories across income groups. In low-income countries, adoption is very limited at the beginning of the period (17.9 % in 2018), reflecting the prevalence of informality, low levels of financial inclusion, and constraints in access to digital infrastructure. However, adoption accelerates sharply after 2020, reaching 72.7 % in 2022, indicating that the digital reforms implemented during the health crisis were progressively extended to household taxation. Lower-middle-income countries experience a more gradual and steady increase, with the e-filing rate rising from 52.1 % to 65.6 %, reflecting the progressive strengthening of administrative capacity and the growing diffusion of digital tools among formal-sector taxpayers. Upper-middle-income countries display already high levels of adoption prior to the pandemic, with a peak in 2020 (80.9 %) followed by a slight adjustment in 2022 (73.4 %), suggesting a temporary cyclical effect linked to pandemic-related constraints. Finally, in high-income countries, PIT e-filing is largely institutionalized, with a moderate increase from 72.2 % to 84.2 %. This pattern reflects an advanced level of digital maturity, supported by robust infrastructure, strong tax-banking interconnections, and a high degree of household familiarity with online tax services.

1.3.1.3 Digitalization of tax payments

Similar to tax filing, tax payments have also undergone a gradual transformation through the increasing adoption of electronic payment methods. Digital payment instruments such as e-payment, m-payment, and bank transfers are now widely regarded as essential components of the digitalization of tax administrations. They help reduce transaction costs, secure payments, limit the use of cash, and strengthen the traceability of financial flows, thereby contributing to improved tax administration and fiscal management.

Figure 1.3 illustrates the evolution of tax payments across different economies between

Figure 1.2: PIT eFiling as % Total

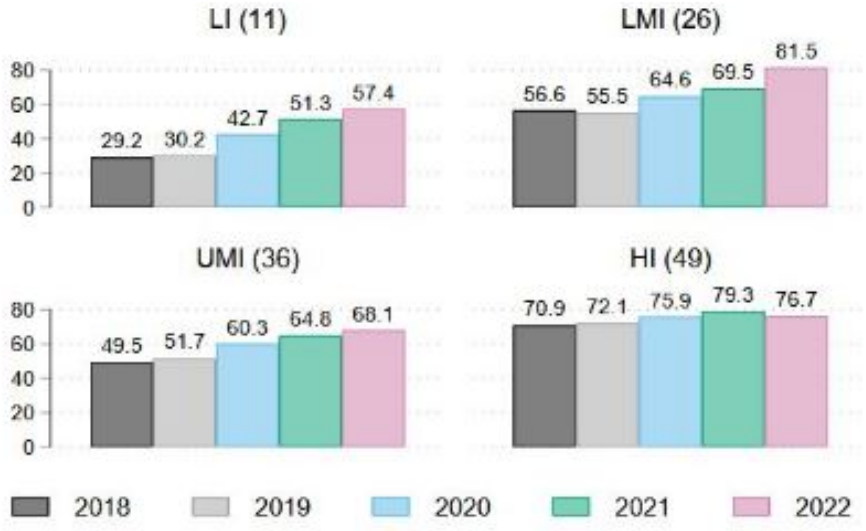


Note: Data from International Survey on Revenue Administration (ISORA) of IMF.

2018 and 2022. In low-income countries, a marked increase in the digitalization of tax payments can be observed. In 2018, only 29% of total tax revenues were paid electronically. A significant acceleration occurred in 2020, when the share reached 42.7%, driven by the operational constraints imposed by the Covid-19 pandemic. By 2022, electronic payments accounted for 57.4% of total tax revenues, reflecting the growing adoption of digital channels and the strengthening of tax administrations' capabilities, often supported by technical assistance programs and international cooperation initiatives focused on digitalization. In lower-middle-income countries, the digitalization of tax payments follows a more structural and sustained trajectory. Electronic payments accounted for 56.5% of total tax revenues in 2018, increasing to 64.6% in 2020 under the influence of the pandemic, before reaching a high level of 81.5% in 2022. This upward trend is mainly driven by the expansion of digital financial services, improvements in digital infrastructure, and a strong political commitment to promoting tax compliance through digital tools.

For upper-middle-income countries, the use of electronic tax payments has increased at a moderate but sustained pace. In 2018, 49.5% of tax revenues were already collected through electronic means. This share rose to 60.3% in 2020, before reaching 68.1% in 2022. This progression reflects a continuous improvement in technological and administrative capacities, as well as a broader adoption of digital payment instruments within the formal sectors of the

Figure 1.3: Tax e-Payment as % of total



Note: Data from International Survey on Revenue Administration (ISORA) of IMF.

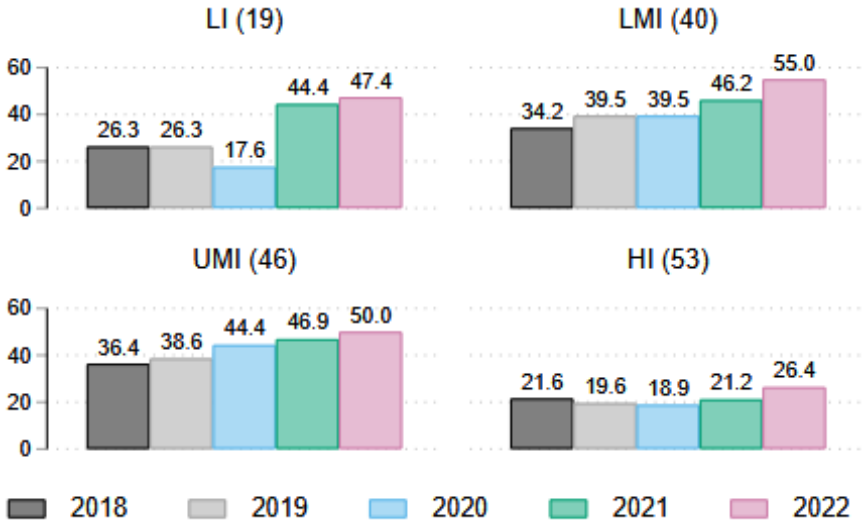
economy. Finally, digital tax payments are widely used in high-income countries, with an average share of around 75% of total tax revenues. This high level reflects the maturity of digital infrastructures, the strong interconnection between tax administrations and banking systems, and a high level of taxpayer compliance.

1.3.1.4 Digitalization of invoicing

This figure 1.4 shows the evolution of the share of countries in which electronic invoicing (e-invoicing) is mandatory for some or all taxpayers between 2018 and 2022, by income level, and complements the previous results on e-Filing and digital tax payments. In low-income countries, the requirement to use e-invoicing remains limited at the beginning of the period (26.3 % in 2018), with a temporary decline in 2020, followed by a marked increase from 2021 onward, reaching 47.4 % in 2022. This pattern suggests that e-invoicing is introduced later, often in a gradual and targeted manner, once basic digital infrastructure and filing platforms have been established. Lower-middle-income countries display a more regular trajectory, with a continuous increase from 34.2 % to 55.0 %, reflecting the progressive diffusion of mandatory e-invoicing as a tool for transaction monitoring and compliance enforcement. In upper-middle-income countries, the increase is also sustained, rising from 36.4 % in 2018 to 50.0 % in 2022, which reflects the strengthening of strategies aimed at combating tax fraud and broadening the tax

base. Finally, in high-income countries, the share of countries requiring e-invoicing remains lower and relatively stable, fluctuating between 20 % and 26 %. This suggests that these economies tend to rely more on targeted obligations or alternative tax control mechanisms, in contexts where overall compliance and digitalization levels are already high.

Figure 1.4: E-invoicing required for some/all TPs

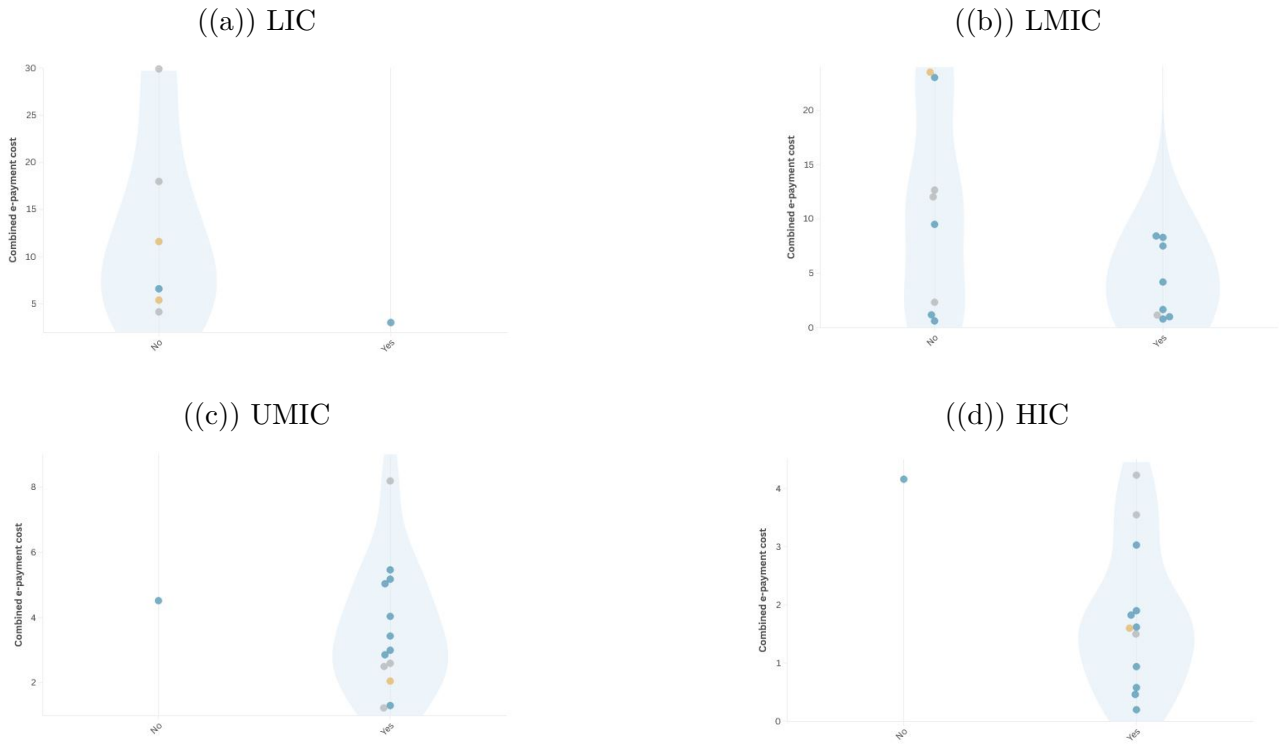


Note: Data from International Survey on Revenue Administration (ISORA) of IMF.

1.3.1.5 Cost of compliance

Figure 1.5 illustrates the costs associated with electronic tax payments across countries by income level. In low-income countries, there is a clear contrast between adopters and non-adopters of e-payment systems. Countries that have not adopted e-payment display highly dispersed and elevated payment costs, reflecting inefficiencies in traditional payment systems, whereas adopters exhibit lower and more homogeneous costs, indicating that digitalization reduces transaction costs even in low-capacity institutional settings (Kochanova et al., 2020). A similar pattern is observed in lower-middle-income countries, where non-adopters face widely dispersed costs, while adopters record lower and more concentrated costs, reflecting growing efficiency in public payment management (Okunogbe and Santoro, 2023b). In upper-middle-income countries, the adoption of e-payment is also associated with lower average costs, with the sole non-adopting country exhibiting higher costs than adopters, confirming the cost-saving effects of digital payments. Finally, in high-income countries, where

Figure 1.5: Cost of general e-payments compared to the uptake of e-paying taxes



Note: B-Ready 2024.

e-payment is almost universal, payment costs are the lowest across all income groups. The only non-adopting country displays substantially higher costs, reinforcing the view that e-payment adoption remains a lever for efficiency gains even in highly developed tax systems (Okunogbe and Santoro, 2023a).

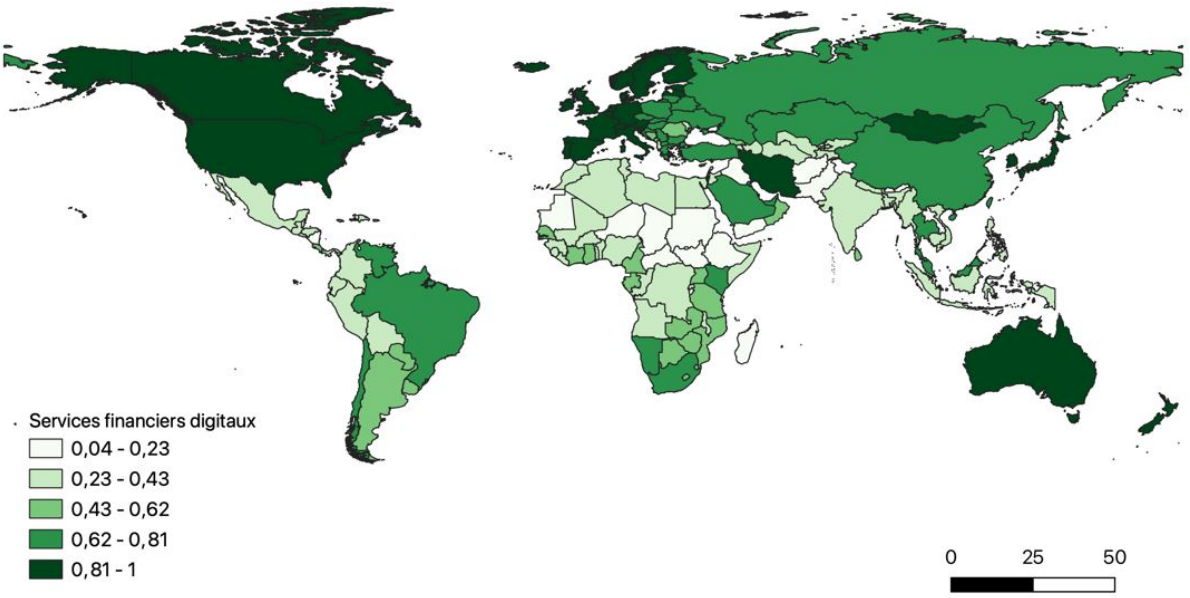
1.3.2 Digital financial services evolution

Digital financial services refer to the full range of financial services that are provided and accessed through digital technologies, such as mobile phones, the internet, and payment cards. They include mobile payments, savings, credit, insurance, and money transfers carried out through digital channels.

Figure 1.6 provides an overview of digital financial services at the global level, drawing on survey data collected in 2024, 2022, 2021, 2017, 2014, and 2011. It illustrates the proportion of individuals who reported using digital means, such as mobile money, a bank card, or a mobile phone, to make payments from an account during the previous 12 months. This measure also includes individuals who used the internet to pay bills, purchase goods online or in stores, or

conduct various financial transactions, such as bill payments, sending or receiving remittances, receiving payments for agricultural products, government transfers, or public-sector wages or pensions, directly from or to a bank account, a similar financial institution, or a mobile money account.

Figure 1.6: Digital financial services evolution



Note: Data from The Global Findex Database.

Significant regional disparities are observed in the use of digital financial services. Although the global average stands at 53.6%, this figure does not accurately reflect the specific realities of each region when income levels are taken into account. Accordingly, the analysis focuses on developing countries, as high-income countries display a substantially higher usage rate of 82.93%. In this regard, the Middle East and North Africa (MENA) region records the lowest usage rate, at 28.6%. This outcome is largely driven by Middle Eastern countries, where the adoption of digital financial services is constrained by insufficient digital infrastructure, persistent political instability, and low levels of financial inclusion. South Asia reports a usage rate of 31.8%, which remains relatively low and reflects a still limited diffusion of financial technologies. Similarly, Sub-Saharan Africa exhibits a usage rate of 37.5%, below the global average. However, this regional average masks substantial internal heterogeneity, with some countries among the lowest globally, such as Burundi (4.3%), the Central African

Republic (9.25%), and South Sudan (6%). These low levels are largely explained by inadequate infrastructure, limited access to formal banking services, and chronic institutional instability. In comparison, Latin America and the Caribbean reach an average usage rate of 40.8%, while East Asia and the Pacific record 48.15%. Although these regions display higher adoption levels than those previously mentioned, they remain below the global average, indicating substantial room for further expansion. Finally, Europe and Central Asia exhibit the highest usage rate among developing regions, at 50.97%, close to the global average, reflecting a more advanced integration of digital financial services within these economies.

1.3.3 Payment methods and determinants of mobile money adoption in specific African countries

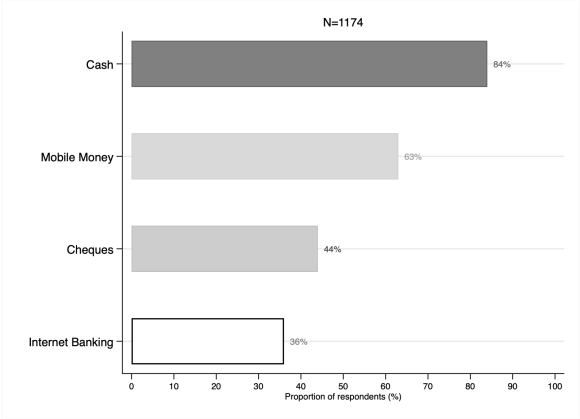
In this section, we analyze the preferences of small and medium-sized enterprises (SMEs) regarding the adoption of different payment methods in Burkina Faso, Ghana, Rwanda, Tanzania, and Uganda. The analysis relies on survey data collected from SMEs in order to better understand the dynamics underlying the adoption of various payment channels in a context of increasing digitalization of financial services, and to identify the economic, institutional, and technological factors that influence the use of digital payments. This approach highlights the role of SMEs' payment choices in the formalization of transactions, the traceability of financial flows, and, more broadly, in strengthening tax capacity in the digital era

- Burkina Faso

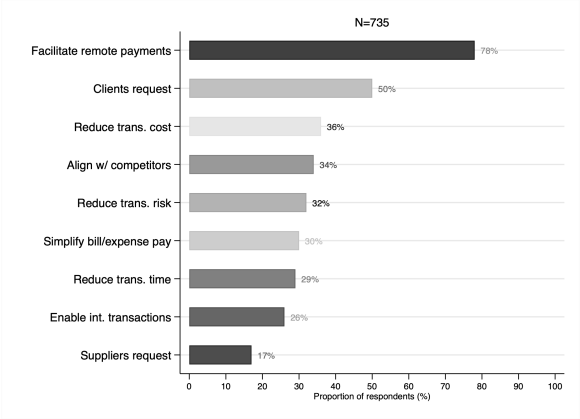
Figure 1.7(a) presents the payment methods and the determinants of mobile money adoption in Burkina Faso. Based on a sample of 1,174 firms, we observe a strong preference for cash payments, with 84% of customers using cash for their commercial transactions. Mobile money is used by 63% of customers, reflecting a notable advance in the adoption of digital financial services. Bank checks and internet banking exhibit adoption rates of 44% and 36%, respectively. These payment methods are less frequently used than cash and mobile money, likely due to low levels of banking penetration.

Figure 1.7: Modes of payment and Mobile payment determinants in Burkina Faso

((a)) Modes of payment



((b)) Reasons of Mobile payment adoption



Note: Author construction by ICTD survey data.

With regard to the reasons for adopting mobile money in Burkina Faso (Figure 1.7(b)), the analysis focuses on a subsample of 735 firms that have adopted mobile money, in order to identify the main determinants of its use. Ease of remote payments emerges as the primary motivation, reported by 78% of respondents. In addition, 50% of firms indicate that adoption was driven directly by customer demand. Furthermore, transaction cost reduction is cited by 36% of firms, while 34% report having adopted mobile money to keep up with competitors. Other motivations include risk reduction in transactions (32%), simplification of payment processes (30%), and time savings in financial operations (29%). Finally, 26% of firms mention the possibility of conducting international transactions, and 17% report adoption in response to supplier demand.

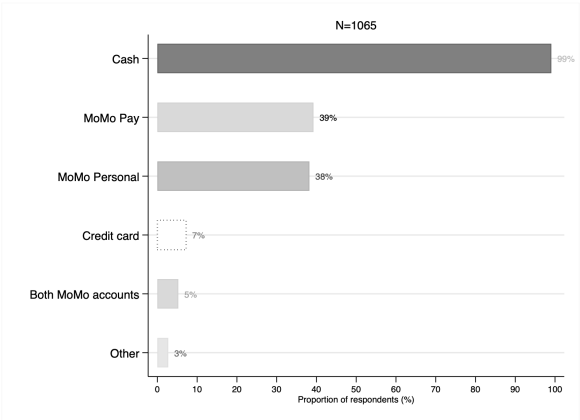
- Ghana

As in Burkina Faso, the vast majority of consumers in Ghana prefer to use cash, while also resorting to other payment methods (Figure 1.8(a)). Based on a sample of 1,065 SMEs surveyed in Ghana, 99% of transactions are conducted in cash. MoMo Pay, an electronic payment solution designed for merchants, is used by 39% of customers, while MoMo Personal, intended for individual use, records an adoption rate of 38%. Credit cards are relatively little used, with an adoption rate of 7%. The simultaneous use of both types of mobile money accounts concerns

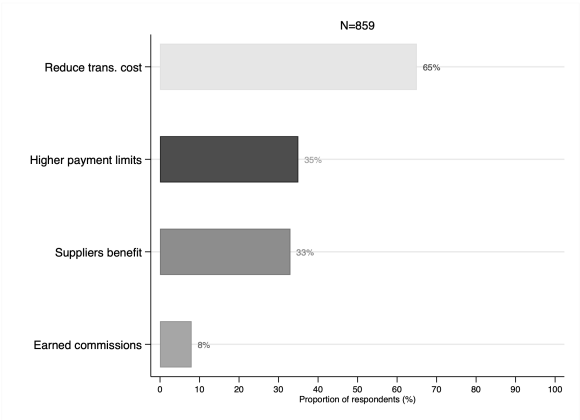
only 5% of customers, while other payment methods such as checks and bank transfers account for 3% of transactions.

Figure 1.8: Modes of payment and Mobile payment determinants in Ghana

((a)) Modes of payment



((b)) Reasons of Mobile payment adoption



Note: Author construction by ICTD survey data.

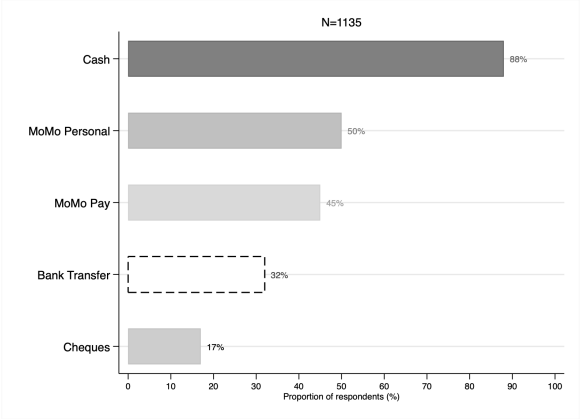
Based on a subsample of 859 firms (Figure 1.8(b)), transaction cost reduction emerges as the main motivation for adopting mobile money, cited by 65% of respondents. This reflects firms' desire to reduce operational expenses. In addition, 35% of firms highlight higher payment limits as a major advantage, facilitating larger transactions. Moreover, 33% of adopting firms report following their suppliers' preferences, illustrating the growing integration of mobile money within supply chains. Finally, 8% of firms mention commissions received as an incentive, although this motivation remains marginal.

- Rwanda

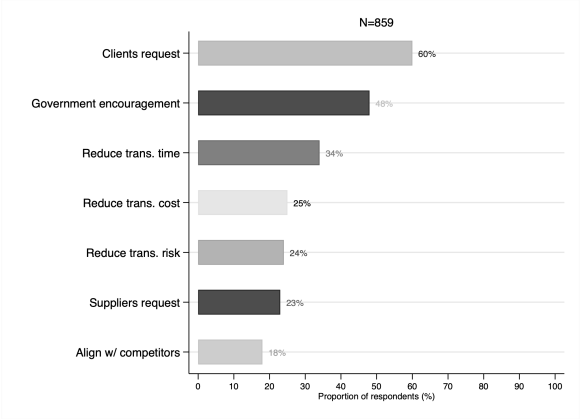
In Rwanda, cash payments remain predominant, with 88% usage among the 1,135 firms surveyed (Figure 1.9(a)). However, electronic payments are gaining ground, led by MoMo Personal, which is used by 50% of firms, followed by MoMo Pay (45%), bank transfers (32%), and checks (17%). These figures indicate a growing use of digital payment instruments, although cash continues to play a dominant role.

Figure 1.9: Modes of payment and Mobile payment determinants in Rwanda

((a)) Modes of payment



((b)) Reasons of Mobile payment adoption



Note: Author construction by ICTD survey data.

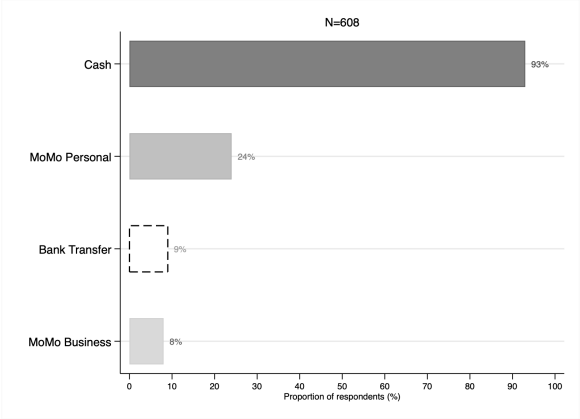
Among the 859 firms in the sample using mobile payments (Figure 1.9(b)), customer demand emerges as the primary motivation for adoption, cited by 60% of respondents. This indicates that the uptake of digital payment methods is strongly driven by consumer preferences. Government incentives represent the second most important motivation, reported by 48% of firms. Benefits associated with mobile payments-such as time savings (34%), reduced transaction costs (25%), and lower transaction risks (24%), also play a significant role in adoption. Finally, supplier pressure (23%) and strategic alignment with competitors' practices (18%) are important factors influencing firms' decisions to adopt mobile payment solutions.

- Tanzania

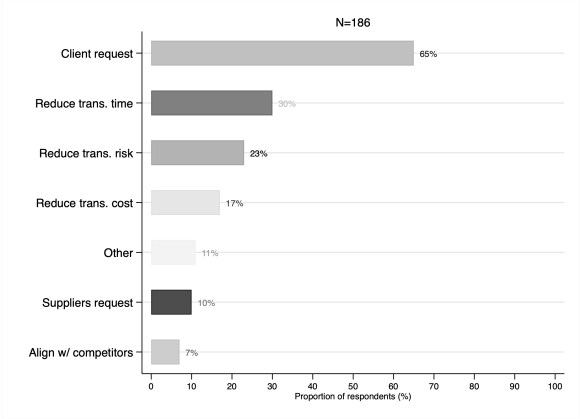
With the smallest sample among the five countries, comprising 608 firms (Figure 1.10(a)), cash payments remain overwhelmingly dominant, with a usage rate of 93%. The use of digital payment solutions remains marginal: only 24% of respondents report using MoMo Personal, 9% use bank transfers, and 8% rely on MoMo Business. These results indicate a low penetration of electronic payment methods among firms in this group, confirming the persistent predominance of cash.

Figure 1.10: Modes of payment and Mobile payment determinants in Tanzania

((a)) Modes of payment



((b)) Reasons of Mobile payment adoption



Note: Author construction by ICTD survey data.

Focusing on a subsample of 186 firms using mobile payments (Figure 1.10(b)), customer demand emerges as the main motivation for adoption, cited by 65% of respondents. This is followed by reductions in transaction time (30%), lower transaction risks (23%), and reduced transaction costs (17%). Other reasons, such as the use of bank transfers or checks, are mentioned by 11% of firms. Supplier pressure (10%) and alignment with competitors' practices (7%) remain secondary factors in the decision to adopt mobile payments.

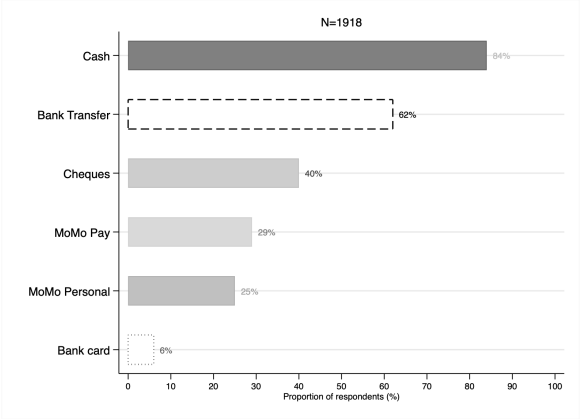
- Uganda

Based on a sample of 1,918 firms, cash payments remain predominant, with a usage rate of 84%, confirming the trend observed in the other countries. However, electronic payment methods are gaining increasing importance, notably through bank transfers, which are used by 62% of firms, followed by checks (40%), MoMo Pay (29%), MoMo Personal (25%), and, to a lesser extent, payment cards (6%). These figures indicate a coexistence between traditional and digital payment methods within firms' transaction practices.

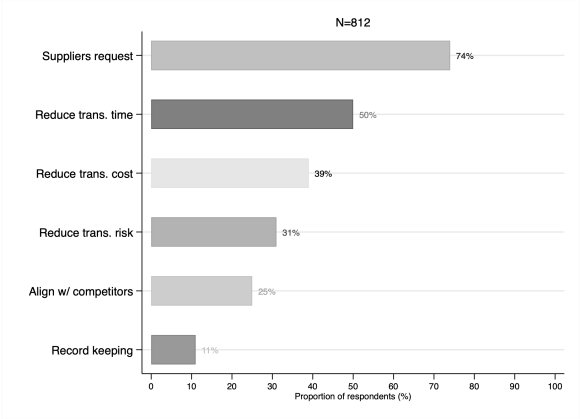
Focusing on a subsample of 812 firms using mobile payments, supplier preference emerges as the main motivation for adoption, reported by 74% of firms. Transaction time reduction constitutes the second most important incentive (50%), followed by lower transaction costs (39%) and reduced transaction risks (31%). Strategic alignment with competitors is mentioned by 25% of firms, while record-keeping and accounting purposes motivate 11% of adopters.

Figure 1.11: Modes of payment and Mobile payment determinants in Uganda

((a)) Modes of payment



((b)) Reasons of Mobile payment adoption



Note: Author construction by ICTD survey data.

1.4 Outline and Contributions

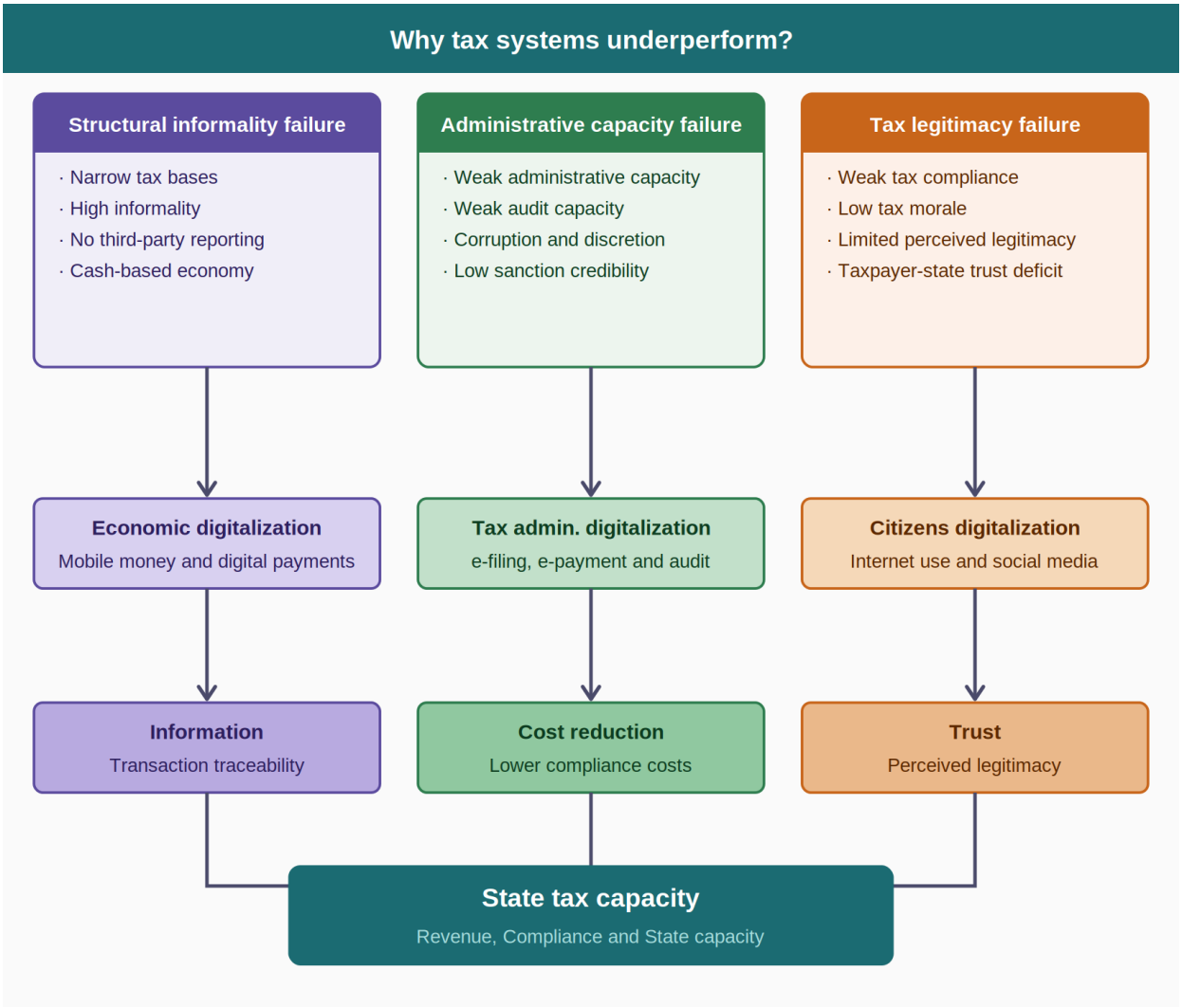
Figure 1.12 maps the three structural constraints underlying the underperformance of tax systems in developing countries, and the three dimensions of digitalization through which this thesis addresses them.

The first constraint, structural informality failure, reflects the persistence of narrow tax bases, cash-based transactions, and the absence of third-party reporting mechanisms. Economic digitalization, through mobile money and digital payments, addresses this constraint by improving the traceability of transactions and generating an information channel that broadens the taxable base. The second constraint, administrative capacity failure, captures the weakness of audit systems, the prevalence of corruption and discretion, and the limited credibility of sanctions. Tax administration digitalization, through e-filing, e-payment, and digital audit tools, responds to this failure by reducing compliance costs and strengthening the enforcement capacity of tax administrations. The third constraint, tax legitimacy failure, reflects low tax morale, limited perceived fairness, and a persistent deficit of trust between taxpayers and the state. Citizens digitalization, through internet use and social media exposure, addresses this constraint by strengthening trust and perceived legitimacy of taxation.

These three dimensions of digitalization, each targeting a specific structural failure through a distinct mechanism, converge toward a single outcome: the strengthening of state tax capacity,

encompassing revenue mobilization, compliance improvement, and broader institutional state capacity. This integrated macro-micro-behavioural framework structures the three essays of this thesis.

Figure 1.12: Digitalization and structural constraints of taxation



Note: Author construction.

1.4.1 How does digitalization improve non-resource tax revenue mobilization? Evidence from developing countries

This essay examines the impact of digitalization on the mobilization of non-resource tax revenues in developing countries from a macroeconomic perspective. It contributes to the literature on fiscal capacity by providing new empirical evidence on the role of the diffusion and effective use of information and communication technologies (ICTs) in strengthening

states' ability to sustainably mobilize domestic tax resources beyond natural-resource rents. The analysis builds on work emphasizing domestic taxation as a cornerstone of development financing and state building, particularly in contexts marked by aid volatility, debt constraints, and widespread informality (Besley and Persson, 2014; Gupta et al., 2017).

Empirically, the essay exploits a panel of 111 developing countries over the period 2005-2019 and relies on fixed-effects panel models to control for country-specific unobserved heterogeneity and common time shocks. Digitalization is measured using a synthetic index combining access to ICTs and their effective use, constructed following Anderson (2008) methodology, which distinguishes technological readiness from actual adoption. To address potential endogeneity, the analysis implements an identification strategy based on exogenous connectivity shocks related to telecommunications infrastructure, namely submarine cable outages and geographical distance. Estimation is conducted using fixed-effects methods, two-stage least squares (2SLS) instrumental variables, and Generalized Method of Moments, ensuring the robustness of the results.

The results indicate that digitalization has a positive and statistically significant effect on non-resource tax revenue mobilization, driven primarily by the effective use of ICTs rather than mere access. The impact is heterogeneous and stronger in countries with lower initial levels of digitalization and higher institutional quality, highlighting complementarities between digital technologies and institutions. Overall, the essay shows that digitalization strengthens fiscal capacity by broadening the tax base, improving information flows, and enhancing tax administration efficiency, reinforcing the view that digital reforms yield durable gains only when embedded in credible institutional frameworks.

1.4.2 Electronic Services and Tax Compliance: Evidence from Medium and Small Businesses in Burkina Faso

Building on the macroeconomic analysis developed in the previous essay, this essay adopts a microeconomic perspective to shed light on the concrete mechanisms through which electronic tax services influence firms' tax compliance behavior. It examines the adoption and impact of digital tax services, specifically registration for and use of e-filing, as well as electronic

tax payment, among small and medium-sized enterprises in Burkina Faso. By focusing on a key segment of the productive and fiscal base, this essay identifies the institutional and behavioral channels through which the digital transformation observed at the macroeconomic level effectively translates into compliance gains and, ultimately, higher tax revenues, in line with recent analyses on the digitalization of tax administrations and compliance (Kochanova et al., 2020; Okunogbe and Santoro, 2023a,b).

The analysis relies on an original matching of administrative tax records covering 23,000 SMEs with a firm-level survey conducted among 1,090 enterprises. This combination of data sources allows the integration of objective information on tax declarations, payments, and their timing with subjective data capturing taxpayers' perceptions, constraints, and attitudes. In a first step, the determinants of adoption of electronic tax services are analyzed using probit models to identify factors associated with the probability of registering on the eSINTAX platform, effectively using e-filing, and relying on electronic payment methods. The results show that adoption is strongly correlated with firms' structural characteristics, such as age, legal status, sector of activity, and the use of electronic invoicing, highlighting the role of organizational capacity, degree of formalization, and familiarity with digital tools. In a second step, the causal impact of digitalization on tax compliance is estimated using a difference-in-differences approach based on the Callaway and SantAnna (2021) estimator, which accounts for staggered adoption of digital services and treatment effect heterogeneity across firms.

The results indicate that digitalization improves tax compliance among SMEs. Registration and filing through the eSINTAX platform increase declared tax liabilities by about 23 percent, while the use of electronic payment methods raises the amount of taxes effectively paid by approximately 1.5 percent compared with traditional, non-digital payment methods. Beyond these direct effects on reported liabilities and payments, digital tax services also contribute to improving the timeliness of tax filing. In particular, registration on the eSINTAX platform and its effective use increase the probability of filing on time by about 40 percent and 67 percent, respectively. These results suggest that digitalization strengthens compliance not only by simplifying administrative procedures but also by influencing taxpayers' perceptions

of the tax system. In particular, digital services tend to improve perceived procedural simplicity, strengthen trust in the tax administration, enhance perceptions of fairness and transparency, and reduce perceived corruption, in line with evidence from other developing countries contexts (Mascagni et al., 2021). Overall, these findings indicate that digitalization is not merely an operational tool for improving compliance but also an institutional lever that connects administrative modernization with the behavioural and attitudinal foundations of fiscal capacity, linking micro-level taxpayer behaviour to broader processes of domestic revenue mobilization.

1.4.3 Digital exposure and perceived tax legitimacy: empirical evidence from African countries

Building on the macroeconomic and microeconomic analyses developed in the previous essays, this third essay examines the behavioral foundations of tax capacity by focusing on the role of digital exposure in shaping tax legitimacy in Africa. While the first two essays show how digitalization improves revenue mobilization and observed legitimacy, this essay concentrates on the attitudes, civic norms, and perceptions that underpin consent to taxation in contexts characterized by limited administrative enforcement capacity. Thus, it aligns with the literature that views taxation as a central component of the fiscal contract between the state and citizens, where compliance depends as much on perceived legitimacy as on formal coercion (Frey and Torgler, 2007; Torgler, 2003, 2011; Luttmer and Singhal, 2014).

The analysis relies on individual-level data from the afrobarometer surveys, covering 34 African countries in 2022. Perceived tax legitimacy is measured through respondents' endorsement of the principle that the state has the right to levy taxes, while digital exposure is captured by regular internet use. Estimation is conducted using logit and probit models, incorporating country fixed effects and a rich set of individual and institutional controls to isolate the association between Internet use and tax attitudes. The analysis is complemented by an examination of several transmission channels, including exposure to social networks and public information, preferences for financing development through domestic resources, and perceptions related to the reliable provision of essential public services, such as electricity.

These channels help identify the mechanisms through which the informational and institutional environment shapes beliefs and norms related to taxation.

The results show that regular Internet use is positively and significantly associated with a stronger recognition of the legitimacy of taxation. This effect operates primarily through institutional and cognitive channels: increased trust in public authorities, more favorable perceptions of how tax revenues are used, a strengthened sense of equity and accountability, and higher democratic satisfaction. These findings underscore that tax mobilization relies as much on voluntary consent as on administrative enforcement capacity, and that digitalization can contribute to strengthening tax capacity by shaping the norms and beliefs that underpin compliance. From this perspective, the essay argues for a broader conception of digitalization policies, viewed not only as tools for administrative efficiency, but also as instruments of governance, transparency, and fiscal communication, to sustainably strengthen tax morale and, more broadly, the fiscal contract in developing countries.

Chapter 2

How does digitalization improve non-resource tax revenues mobilization? Evidence from developing countries

2.1 Introduction

Developing countries rely on multiple sources of development financing, including official development assistance (Minoiu and Reddy, 2010), foreign direct investment (Wang, 2009), debt (Panizza and Presbitero, 2014), and tax revenues (Buss, 2001). However, the first three sources are often subject to instabilities, conditionality, and fragmented policies (Besley and Persson, 2014; Wandaogo, 2022). Domestic tax revenues, by contrast, represent a sustainable and stable source of financing. They play a crucial role in funding health, education, and infrastructure investments (Calderón and Servén, 2014).

Despite this importance, developing countries systematically mobilize less tax revenue than developed ones. A key obstacle is the preponderance of the informal sector (Kpognon, 2022). Informal activities, defined as the production of goods and services deliberately hidden from government authorities (Schneider, 2005), narrow the tax base and limit the potential for domestic revenue mobilization.

Information and Communication Technologies (ICT) have emerged as a promising lever to address these challenges (Brambilla and Tortarolo, 2018; Shokrkhodaei and Salatin, 2018). For individuals, ICT reduces task execution time and facilitates interactions with businesses and administrations. For firms, it improves performance, access to credit, and productivity. For public administrations, it enables the delivery of online services and improves management efficiency. Li et al. (2016) define digitalization as the use of digital technologies to transform existing business processes, creating new channels of interaction between individuals, firms, and governments (Ramaswamy and Ozcan, 2016).

While a large literature has examined the determinants of tax revenue mobilization (Baunsgaard and Keen, 2010; Besley and Persson, 2014; Sen Gupta, 2007), and another strand has studied the effect of ICT on economic outcomes (Niebel, 2018; Stanley et al., 2018), these two bodies of work have largely evolved in parallel. A growing number of studies have started to bridge this gap (Adegboye et al., 2022a; Brun et al., 2020; Gnangnon and Brun, 2018a; Kpognon, 2022; Wandaogo, 2022). Much of this emerging literature focuses on the effect of internet access on tax revenues. Gnangnon and Brun (2018a) show that better internet access

improves government revenue across 164 countries. Gnangnon and Brun (2019) further find a stronger positive effect in low-income countries. Adegboye et al. (2022a) document a positive effect of ICT penetration on revenue in 48 Sub-Saharan African countries. Brun et al. (2020) find that ICT use, but not ICT access, positively affects tax revenues through tax compliance, government efficiency, and corruption control. Shokrkhodaei and Salatin (2018) show that ICT reduces collection costs and improves information available to tax administrations, though it may also facilitate tax evasion. Wandaogo (2022) finds that mobile payment adoption by governments improves tax revenues.

Digitalization improves tax revenue mobilization through three main channels (Gupta et al., 2017). First, it extends the tax base through both intensive and extensive margins (Rogoff, 2017; Allingham and Sandmo, 1972). On the intensive margin, digitalization of accounting and asset information improves knowledge of existing taxpayers. On the extensive margin, it favors the formalization of previously informal enterprises (Kpognon, 2022). Second, it strengthens the efficiency of tax administration by improving revenue collection and control (Gnangnon and Brun, 2018a). Third, it generates new taxable activities, online transactions, digital goods, and electronic payments, that are easier to track and tax.[1]

This paper aims to fill the gap in the literature on the determinants of tax revenues by focusing on the effect of digitalization on non-resource tax revenues in 111 developing countries from 2005 to 2019. It contributes to the literature in three ways. First, it investigates the effect of digitalization on non-resource tax revenues through an empirical analysis of ICT adoption and use by the population, complementing existing approaches (Adegboye et al., 2022a; Gnangnon and Brun, 2018a). Second, it constructs a new composite digitalization index following Anderson (2008), using an inverse-covariance weighted standardized average of ICT access and usage indicators. Unlike PCA, this method weights indicators based on the new information they provide, yielding a comprehensive measure that captures both quantitative and qualitative dimensions of ICT adoption. Third, it introduces a novel instrumental strategy to address endogeneity, extending the approach of Brun et al. (2020). We use

[1]The growing digital economy generates taxable income; online transactions can be taxed; digital goods such as software and online services can be subject to VAT; and electronic payments make it easier to track financial transactions.

the cumulative stock of submarine cable outages and the spatially weighted digitalization of neighboring countries as external instruments. Using these instruments, we isolate the exogenous component of digitalization stemming from connectivity shocks and regional diffusion effects, while minimizing the risks of under-identification and reverse causality. The validity of both instruments is confirmed by the Hansen J-test, and their relevance is established through the Cragg-Donald and Kleibergen-Paap statistics, which exceed the Stock and Yogo (2005) critical values.

Using panel fixed effects, we find that digitalization significantly improves non-resource tax revenue mobilization in developing countries. The effect is driven by ICT usage rather than access, and is stronger in countries with low digitalization levels. Results are robust to alternative estimation strategies and endogeneity corrections.

The remainder of this paper is organized as follows. Section II presents the theoretical framework and transmission channels. Section III describes the digitalization measure. Section IV details the data and estimation strategy. Section V presents the main results, heterogeneity analyses, and robustness checks

2.2 Transmission channels : Theoretical Framework

Digitalization offers significant promise for improving tax revenue mobilization. It enables governments to process more information on taxpayers' economic outcomes, including consumption, labor, land, and capital income (Gupta et al., 2017). In non-digital economies, governments face a fundamental informational constraint: taxpayers may conceal part or all of their income when filing tax returns, and governments cannot easily verify these declarations (Allingham and Sandmo, 1972). Digitalization addresses this problem by providing verification channels that favor tax revenue mobilization (Figure 2.1). Three main channels can be identified.

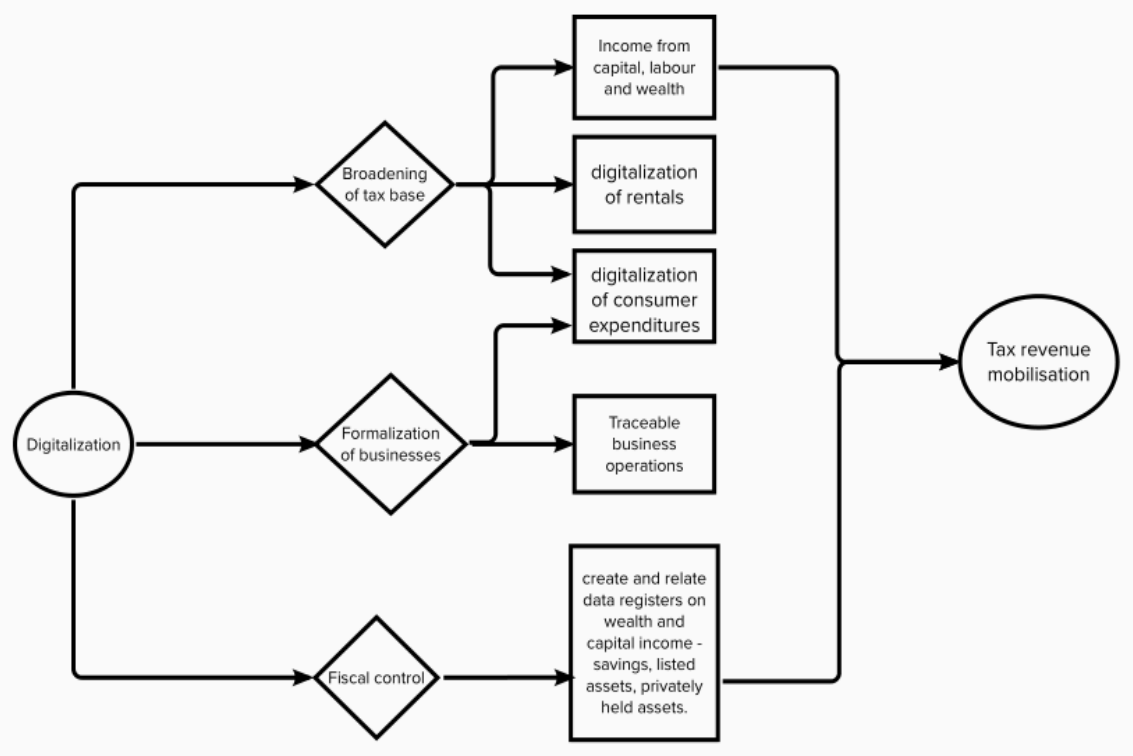
The first channel is the broadening of the tax base through the digitalization of consumer spending. Digital payment methods allow governments to collect detailed information on taxpayers' consumption expenditures (Rogoff, 2017). As commercial transactions become electronic, individual consumption data can be linked to capital income, labor, and wealth

records (Gupta et al., 2017). This enables tax authorities to verify whether reported income is consistent with observed consumption. In addition, digitalization of household expenditures, including rent payments through digital financial services, allows tax administrations to better collect property tax revenues and broaden the overall tax base.

The second channel is the formalization of businesses. When consumption transactions are digitalized, consumers become de facto third-party reporters for sales tax and VAT. Governments can use electronic payment data, from mobile banking or card payments, to estimate the sales of individual businesses and identify those operating informally (Gupta et al., 2017). In developing countries, the informal sector remains a major obstacle to tax revenue mobilization (Kpognon, 2022). Brun et al. (2005) distinguish two groups within this sector: firms that could formalize but choose not to for tax reasons, and firms that are structurally unable to formalize. Digitalization primarily targets the first group, encouraging formalization and thereby expanding the tax base.

The third channel is fiscal control. Digitalization enables the creation and cross-referencing of data registers on wealth and capital income, including savings, listed assets, privately held assets, and home ownership (Gupta et al., 2017). This improves the ability of tax authorities to verify taxpayers' total wealth and conduct more effective in-depth audits. Furthermore, the automation of tax procedures reduces opportunities for fraud and corruption within both firms and tax administrations (Brun et al., 2020). Through digital tax procedures, taxpayers face lower compliance costs, reduced risk of calculation errors, and faster declaration and payment processes, all of which contribute to improved voluntary compliance.

Figure 2.1: Transmission channels of digitalization on tax revenues



Source: Author construction

2.3 Measure of digitalization

Digitalization has gained increasing importance in the literature, prompting efforts to define and measure it through composite indices. In broad terms, digitalization encompasses "telecommunications, broadcasting, internet, and other digital transmission channels through which information is transmitted, stored and delivered" (Guislain and Qiang, 2006). Reis et al. (2018) identify three dimensions of digitalization. The technological dimension refers to the exploitation of new digital technologies such as social networks, mobile technology, and analytical tools. The organizational dimension involves changes in operational processes or the creation of new business models. The social dimension captures the way digitalization influences all aspects of human life.

Several authors offer complementary definitions. For Sebastian et al. (2017), digitalization refers to a comprehensive transformation of the firm, targeting both the speed and scope of its activities. For Verhoef et al. (2021), it describes the changes induced by digital technologies to disrupt value creation within organizations. For Li et al. (2016), it is the

use of digital technologies to modify existing business processes, such as developing online or mobile communication channels that connect customers, businesses, and administrations. Such transformations often require new socio-technical structures that are only possible through digital technologies (Dougherty and Dunne, 2012).

Some authors distinguish digitalization from digitization. Digitization refers to encoding analog information into a digital format so that computers can store, process, and transmit it (Dougherty and Dunne, 2012; Loebbecke and Picot, 2015; Verhoef et al., 2021). It primarily converts internal and external documentation from analog to digital form, without fundamentally changing value-creation activities (Verhoef et al., 2021). Digitalization, by contrast, goes further by transforming the way organizations create value through the integration of digital technologies into their core processes.

In line with this literature and based on data availability across countries and over time, we construct a synthetic digitalization index using two sub-indices. The ICT Access Index includes fixed telephone subscriptions per 100 inhabitants, mobile-cellular telephone subscriptions per 100 inhabitants, the proportion of households with a computer, and access to electricity as a percentage of the population. The ICT Usage Index includes internet users, active mobile broadband subscriptions, fixed broadband subscriptions per 100 inhabitants, and use of online services.

Constructing a composite index raises methodological challenges that, if unaddressed, can lead to misinterpretation or model manipulation. Some authors use principal component analysis (PCA) to aggregate multiple indicators (Calderón and Servén, 2014; Francois and Manchin, 2013). However, PCA is sensitive to missing data, which are present in our panel for some countries and years, leading to potential bias in the evolution of the index over time.

We therefore follow Anderson (2008) and construct a synthetic index using the standardized mean weighted by the inverse of the covariance of the indicators. This generalized least squares (GLS) weighting procedure offers two main advantages. First, it improves efficiency by assigning less weight to highly correlated indicators, and more weight to uncorrelated indicators that carry new information. Second, it uses all available data while assigning lower weights to indicators with missing values, allowing the index to be computed even for observations with incomplete

data.

Using the approach of Anderson (2008), we can calculate the normalized weighted index s of each observation i as follows :

- Identify k relevant indicators for outcome
- Normalize indicators: Disassemble all k indicators by subtracting the average indicator in the reference group
- Construct weights: Generate weights using Σ^{-1}, inverse of the covariance matrix of the standardized indicators.
- Construction of index: In formal terms, weighted average s_i computed using

$$\overline{S_{ij}} = (1'\hat{\sum}_j^{-1} 1)^{-1}(1'\hat{\sum}_j^{-1} \tilde{y}_{ij}) \tag{2.1}$$

where 1 stands for column vector of 1 and $\tilde{y}_{ij}$ stands for column vector of all outcomes for observation i

2.4 Data and methodology

2.4.1 Data

In order to explore the relationship between digitalization and non-resources tax revenue, this paper uses data from 111 developing countries, including 20 low-income, 51 lower-middle-income, and 40 upper-middle-income countries classified by the World Bank from 2005 to 2019. The dependent variable is non-resources tax revenue (% of GDP) from the UNU-WIDER database. Including non-resource and total tax revenue results from resource-related tax revenue depending on commodity prices, which may be more volatile and far from economic forecasts. Also, there is a high degree of homogeneity between non-resource and total tax revenues (Gnangnon and Brun, 2018a)[2].

[2]Refer to Table A1 and A2 for descriptive statistics and Country list

Following the literature on digitalization issues (Brun et al., 2020; Dougherty and Dunne, 2012; Leviäkangas, 2016; Shokrkhodaei and Salatin, 2018), we use a variety of indicators to obtain a comprehensive measure of digitalization. Based on this literature and IUT data, we select these indicators to construct the synthetic index of digitalization which consists of the ICT access index (Fixed telephone subscriptions per 100 inhabitants, Mobile-cellular telephone subscriptions per 100 inhabitants, Proportion of households with a computer and access to electricity as % of population) and the ICT Usage Index (Internet users, active mobile broadband subscriptions, fixed broadband subscriptions per 100 inhabitants and use of online services).

"**Financial globalization**" measures a country's openness to financial flows. Most measures of financial globalization derive from the IMF's Annual Report on Exchange Arrangements and Restrictions (Quinn et al., 2011). It measures the opening of a country's capital account. In order to take into account public policies favorable to capital flows, some authors Gygli et al. (2019) have considered international investment agreements, which cover bilateral investment agreements and treaties with investment provisions. Reforms linked to digitalization encourage financial openness. The services offered by financial systems could improve the performance of the tax administration in collecting tax revenues. Better access to financial services can facilitate the monitoring and collection of taxes from taxpayers (Demirgüç-Kunt and Huizinga, 2001). Indeed, a nation with transparent, developed, and efficient financial institutions such as banks, insurance, and others could provide financial services to businesses and individuals. These financial institutions could, in turn, obtain information on these taxpayers, such as their income and assets, from the tax authorities. This should have a positive and significant impact on non-resources tax revenues.

"**Trade openness**" measures national trade policy liberalization. Trade policy liberalization can positively or negatively affect non-resources tax revenues. Firstly, as trade taxes can easily be collected, especially in developing countries, a positive effect of trade liberalization on non-resources tax revenues can be expected; secondly, as trade liberalization implies at least tariff liberalization, it can be negatively associated with non-resources tax revenues. The effect of trade policy liberalization on non-resources tax revenues ultimately depends on the

sequence of trade liberalization reforms and how these affect domestic and trade non-resources tax revenues. Some recent studies have focused, among other things, on the effect of trade openness on non-resources tax revenues rather than on total tax revenues. For example, Crivelli and Gupta (2014) reported a mixed effect of trade openness on domestic non-resources tax revenue mobilization in resource-rich countries.

"**Population**" represents the growth rate of the total population (in %). It aims to capture the demographic characteristics of a population and corresponds to the number of people legally living on a territory during a year. Bahl (2004) points out that tax systems may be slow in their ability to capture new taxpayers in countries where the population is proliferating. Thus, an increase in population size would decrease the fiscal revenue ratio. A larger population could increase household consumption and, eventually, personal income, resulting in a higher tax collection ratio. As a result, it is not clear what effect this indicator will have on non-resources tax revenues.

"**GDP Per Capita**" is the real per capita income of a country and measures the level of development of a country and its wealth. The more developed a country is, the more efficient the mobilization of tax revenues. An increase in per capita wealth would lead to increased demand for public services and a higher level of sophistication in the quality of institutions and the economy (Crivelli and Gupta, 2014). Therefore, it is reasonable to expect a significant and positive effect on non-resources tax revenues.

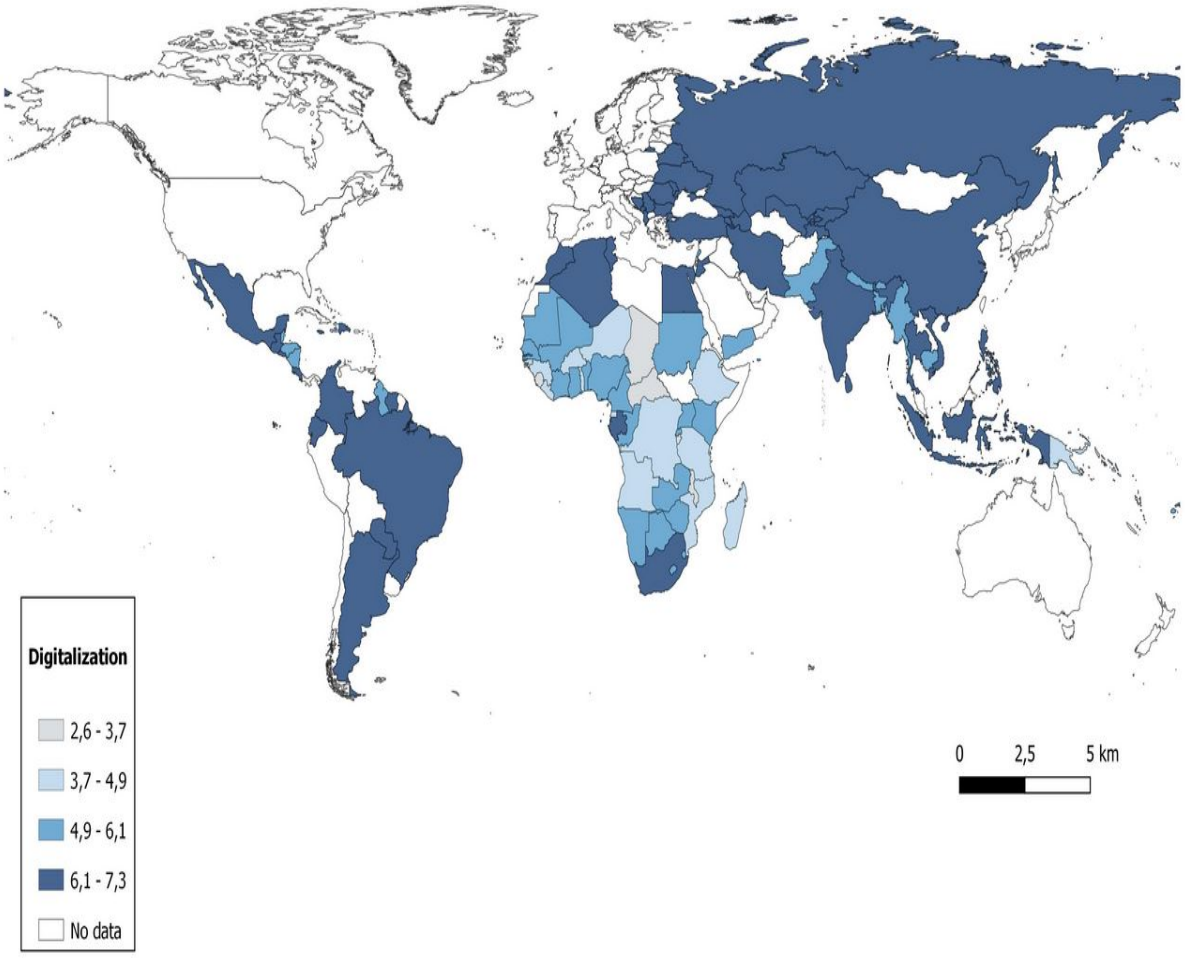
"**Education**" is a measure of the average number of years of schooling for adults (Apeti and Edoh, 2023). Education improves the level of adoption and usage of technology by a population. Indeed, an educated population is more likely to hold better-paid jobs, which can increase their income and thus their tax payments. In addition, an increasingly educated population may be more likely to undertake entrepreneurship and create new businesses, which can lead to economic growth and increased tax revenues. In addition, digitalization-related reforms can contribute to streamlining tax collection processes, thereby reducing opportunities for tax evasion and increasing compliance. Given the above, we expect a positive impact on non-resource-related tax revenues.

2.4.2 Stylized facts

The graph below 2.2 highlights the level of digitalization in all the countries in our sample. It reveals a trend whereby most upper-middle income countries have the highest level of digitalization. Their average digitalization rate exceeds 6.1, putting them ahead of the other countries in the sample. In contrast, low-income countries tend to have a relatively low level of digitalization. These observations suggest a correlation between the level of digitalization and development. In other words, countries that have achieved a higher average income have also managed to adopt and integrate more digital technologies into their economy and society. This may be due to factors such as a solid infrastructure, investment in information and communication technologies and a skilled workforce. Lower-middle income countries, although at a lower level, also made progress in adopting digital technologies, with an average of 5.62. Finally, low-income countries have an average of 4.62, indicating that they still have room for development in terms of digitalization.

Figure 2.3 shows the development of digitalization and its sub-indices, i.e. access to and use of ICTs, over the period studied. The overall trend is positive throughout the period. However, access to ICTs is the most critical indicator in the early years (2005 to 2010). Around five years after the introduction of ICT (2010), a significant increase in use and digitalization was observed. Since 2013, the use of ICT has become more important, as the technology was already in place and adopted by the populations of the countries concerned. These observations underline the importance of access to ICTs as a determining factor in digitalization. Once access to ICT has been established, promoting wider and more intensive use of these technologies is essential to encourage digitalization. However, it is interesting to note that despite a general improvement in digitalization, growth in the ICT access index slowed after 2013, suggesting the need for continued efforts to increase ICT accessibility in the countries studied. On the other hand, the ICT usage index showed a higher average, indicating that people have adopted these technologies and integrated them into their daily activities.

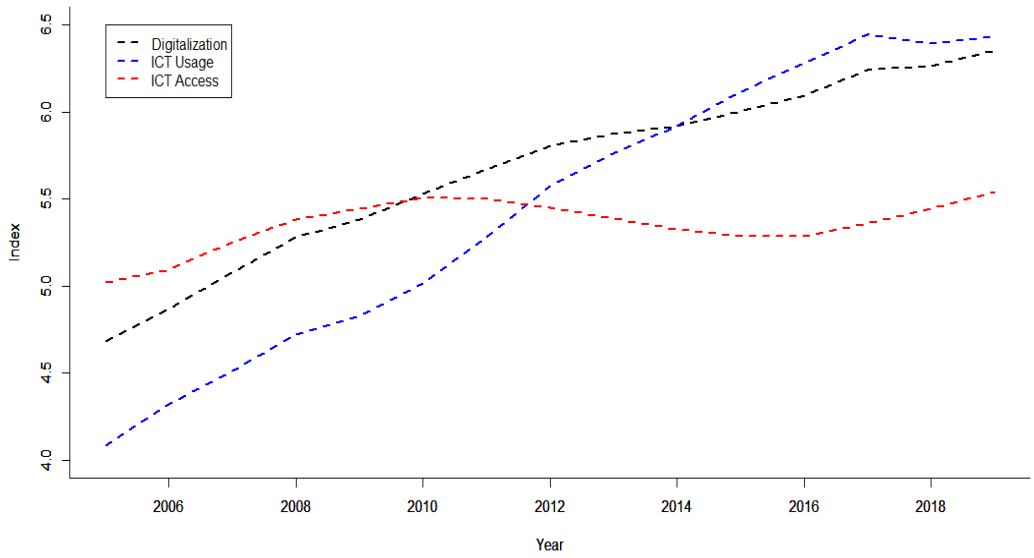
Figure 2.2: level of digitalization in all sampled countries



Source: Author construction of data from ITU.

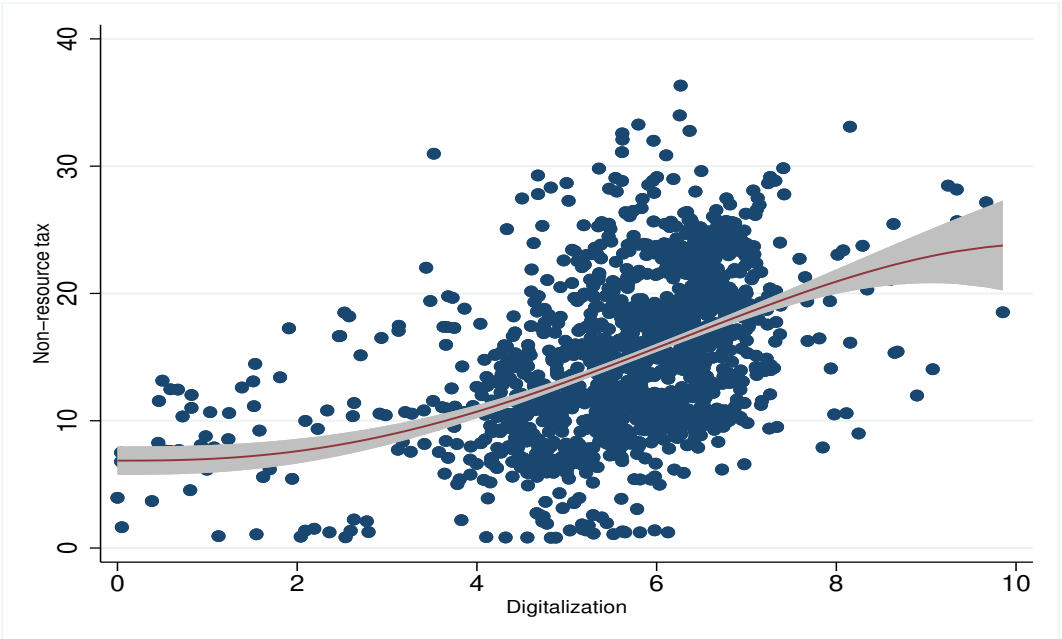
Figure 2.4 presents the data as scatter diagrams showing the relationship between non-resource-related tax revenue and digitalization. There is a positive correlation between these two variables, suggesting a general trend whereby countries with a higher level of digitalization also tend to have higher non-resources tax revenues. However, it is important to stress that correlation does not necessarily confirm a causal relationship. Although digitalization and non-resources tax revenues are correlated, other factors or variables may influence this relationship. As such, examining other factors and variables in depth is essential to understand this complex relationship fully.

Figure 2.3: Trend in average indices of access, ICT usage and digitalization



Source: Author construction of data from ITU.

Figure 2.4: correlation between digitalization and non-resources tax revenues



Source: Author construction of data from ITU and UNU-WIDER.

2.4.3 Identification strategy

Based on the existing literature on resource tax mobilization (Baunsgaard and Keen, 2010; Morrissey et al., 2016; Sen Gupta, 2007) and the nature of the data, we specified our model

with fixed effects to estimate the effect of digitalization on non-resources tax revenues in developing countries. This model refers to a regression model in which the group means is fixed rather than a random effects model in which the group means is a random sample from a given population. This estimation model has two common assumptions regarding the individual-specific effect: the random effects assumption and the fixed effects assumption. The random effects assumption is that individual-specific effects are uncorrelated with the independent variables. The fixed effects hypothesis is that individual-specific effects are correlated with the independent variables. If the fixed-effects hypothesis is true, the fixed-effects estimator is more efficient than the random-effects estimator. However, we use the Hausman (1978) test to discriminate between the fixed and random effects models. We specified our empirical model as follows:

$$NRTAX_{i,t} = \sigma + \beta Dig_{i,t} + \rho X_{i,t} + \alpha_i + \gamma_t + \epsilon_{i,t} \tag{2.2}$$

Where $NRTAX_{i,t}$ represents the non-resources tax revenue for country i in year t; $Dig_{i,t}$, the level of digitalization for country i in year t; $X_{i,t}$, the set of control variables for country i in year t; α_i refers to country fixed effects; γ_t captures the time effect; And $\epsilon_{i,t}$ is the idiosyncratic error term.

2.5 Empirical results

2.5.1 Baseline results

Table 2.1 presents the effect of digitalization on non-resources tax revenues. In column 1, we run a bivariate ordinary least squares regression to estimate the effect of digitalization on non-resources tax revenues. The results show a positive and significant effect of digitalization on non-resource-related tax revenues. From this specification, it should be noted that the model suffers from an omitted variable bias. In this regard, we have performed several estimations by introducing additional explanatory variables that are likely to affect the mobilisation of

non-resources tax revenues based on the literature. The results in column [2], representing the random effects, show the positive and significant effect of digitalization on non-resources tax revenues. However, as each country has specificities that may have an impact on the predictors, we have taken these specificities into account by adding country and time fixed effects. Estimation with the two effects in columns [3] and [4] shows that the effect of digitalization on non-resources tax revenues remains conventionally positive and significant [3]. The results in column [5] show that an average increase in digitalization of one unit leads to an improvement in non-resources tax revenues of 0.329 percentage points.

These results suggest that digitalization is crucial to improving tax revenue collection. Digitalization, which includes the adoption of digital technologies and the use of electronic systems, makes it possible to modernize and optimize tax collection processes. It offers significant benefits in terms of efficiency, accuracy and speed of tax collection. When tax collection systems are digitised, businesses and taxpayers can file returns and make payments faster, more conveniently and more accurately. This reduces the errors, delays and problems associated with traditional paper-based methods. As a result, tax revenues increase. digitalization also enables better traceability and monitoring of tax transactions; electronic systems record data in real time, making it easier to detect irregularities, tax fraud and tax evasion. Tax authorities can use this information to target controls and audits more effectively, which contributes to better mobilization of tax revenues.

For the control variables, results show that the positive impact of financial globalization suggests that a highly developed financial system can help developing countries generate sufficient tax revenues to finance their development (Gnangnon and Brun, 2019). In addition, increased participation in financial globalization can strengthen financial governance and improve transparency and compliance with tax obligations, making it easier to collect taxes. GDP per capita has a positive and significant influence on non-resource-related tax revenues, at 1%. GDP per capita is generally used as a measure of the level of development, and this

[3]In order to obtain the best estimation strategy, we carried out specification tests. Firstly, we performed the Hausman (1978) test, which allowed us to determine the ideal model by comparing the fixed effects model [3] and the random effects model [2]. Secondly, we performed a parametric test for time-fixed effects to determine whether it is necessary to take them into account. The Hausman (1978) test refutes the hypothesis of no correlation between the error term and the explanatory variables in the model with (Prob > chi2 = 0.0000), which is less than 1%.

result is consistent with other studies that have shown that the ability to collect and pay taxes increases with the level of development (Drummond et al., 2012). Indeed, a higher GDP per capita reflects a more prosperous economy and a population with greater purchasing power. This generally translates into an increase in economic transactions, investments and commercial activities, which in turn increases non-resources tax revenues. In addition, countries with higher GDP per capita often have stronger economic and fiscal institutions, more efficient tax administration and greater taxpayer compliance, which facilitates tax collection. Population has no impact on the mobilisation of non-resource-based tax revenues. An increase in trade openness of one unit leads to a decrease in non-resources tax revenues of 0.102 percentage points. Trade liberalisation reforms could explain this result. Indeed, the effect of trade policy liberalisation on non-resources tax revenues ultimately depends on the sequence of trade liberalisation reforms and how these affect domestic and trade non-resources tax revenues. Finally, education has no effect on non-resources tax revenues over time. As the digitalization index is constructed from ICT access and use indices, we have estimated by components of digitalization.

Table 2.1: Impact of digitalization on non-resources tax

	(1)	(2)	(3)	(4)	(5)
Dependent variable: NRTAX					
Digitalization	2.143***	0.420***	0.458***	0.348***	0.329***
	(0.108)	(0.0727)	(0.0736)	(0.109)	(0.109)
Financial globalization		0.0340***	0.0353***	0.0381**	0.0410**
		(0.00860)	(0.00887)	(0.0158)	(0.0163)
GDP per capita		0.0686***	0.0687***	0.0787**	0.0855***
		(0.0138)	(0.0136)	(0.0319)	(0.0307)
Population growth		0.239*	0.461***	0.197	0.450
		(0.130)	(0.135)	(0.216)	(0.286)
Trade Openness		-0.0726***	-0.0884***	-0.0826***	-0.102***
		(0.0178)	(0.0181)	(0.0300)	(0.0301)
Education		1.625***	1.411***	1.203***	0.1079
		(1.691)	(1.915)	(4.182)	(7.717)
Constant	2.863***	5.341***	6.946***	8.016***	14.29***
	(0.629)	(1.256)	(1.265)	(2.569)	(3.875)
Country Fixed Effects	No	No	Yes	No	Yes
Time Fixed Effects	No	No	No	Yes	Yes
Observations	1,498	1,415	1,415	1,415	1,415
R-squared	0.192	0.1469	0.150	0.1755	0.188
Number of Group	112	111	111	111	111

NB: Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

2.5.2 Testing for effect of ICT Access on non-resources tax

Table 2.2 shows the effect of ICT access on non-resources tax revenues as a percentage of GDP. In column [1], we estimate only between digitalization and ICT access by ordinary least squares. The results show that ICT access significantly affects non-resources tax revenue mobilization. As in Model 1, this estimation model also suffers from omitted variable bias. After combining the explanatory variables in line with the literature in column [2], the results indicate significance at the 10% level while considering random effects. In column [5], we find that the impact of ICT access on non-resources tax revenues is not significant.

This observation raises several interesting points. Firstly, it suggests that the mere availability of ICT is insufficient to stimulate the mobilization of non-resources tax revenues. In other words, simply having access to ICT does not guarantee a significant increase in tax revenues. To understand this lack of significant impact, it is essential to recognize that the effective use of ICT plays a crucial role in tax revenue mobilization. The mere existence

of technology does not automatically generate additional tax revenues. ICT must be used appropriately in tax processes, such as tax collection and reporting, to have a positive effect on tax revenues. Thus, our results highlight the importance of combining access to ICT with the effective use of these technologies in the tax context. It highlights the need for policies and strategies that encourage the adoption of ICT in tax practices in order to optimize the mobilization of non-resource-based tax revenues.

Table 2.2: Impact of ICT Access on non-resources tax

	(1)	(2)	(3)	(4)	(5)
Dependent variable: NRTAX					
ICT Access	1.180***	0.103*	0.102*	0.125	0.126
	(0.116)	(0.0591)	(0.0586)	(0.0877)	(0.0881)
Financial globalization		0.0302***	0.0322***	0.0381**	0.0406**
		(0.00867)	(0.00897)	(0.0159)	(0.0163)
GDP per capita		0.0667***	0.0674***	0.0803**	0.0871***
		(0.0140)	(0.0138)	(0.0323)	(0.0312)
Population Growth		0.247*	0.442***	0.180	0.441
		(0.131)	(0.137)	(0.219)	(0.287)
Trade Openness		-0.0729***	-0.0911***	-0.0840***	-0.104***
		(0.0180)	(0.0184)	(0.0306)	(0.0307)
Education		2.097***	2.021***	1.305***	0.1669
		(1.474)	(1.645)	(4.227)	(7.902)
Constant	8.629***	4.768***	5.994***	8.599***	15.04***
	(0.630)	(1.307)	(1.321)	(2.772)	(4.046)
Country Fixed Effects	No	No	Yes	No	Yes
Time Fixed Effects	No	No	No	Yes	Yes
Observations	1,498	1,415	1,415	1,415	1,415
R-squared	0.050	0.1246	0.127	0.1662	0.180
Number of Group	112	111	111	111	111

NB: Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

2.5.3 Testing for effect of ICT Usage on non-resources tax

Table 2.3 presents the results for the second subcomponent of digitalization, the ICT use index. The results obtained from this specification are similar to those in Table [1], except that the coefficients are more significant than those for digitalization. The effect of ICT use on non-resources tax revenues is more significant than that of digitalization because digitalization takes into account the availability of ICT, which minimizes the effect. Including the fixed-effect panel model while adjusting for individual country characteristics and the effect of time [5],

we find that an increase in ICT use of one unit leads to an improvement in non-resources tax revenues of 0.420 percentage points.

This result confirms that the use of information and communication technologies (ICT) influences tax revenue collection in developing countries. Indeed, while the availability of ICT is the foundation of digitalization, it is essential to emphasize that this access must be complemented by effective and efficient use of technology for the benefits of digitalization to be fully realized. Access to ICT, such as Internet connectivity and the availability of computing devices, provides a solid foundation for the digitalization of tax processes. However, these technological resources remain under-exploited in the absence of good ICT use, and their impact on tax revenue mobilization is limited. The use of ICT implies the adoption of digital practices such as electronic filing, the automation of tax processes, the integration of information systems and the establishment of online platforms to facilitate interactions between taxpayers and tax authorities. Efficient implementation of these practices leads to better tax management, faster procedures and lower administrative costs, and therefore better mobilization of tax revenues.

Table 2.3: Impact of ICT Usage on non-resources tax

	(1)	(2)	(3)	(4)	(5)
Dependent variable: NRTAX					
ICT Usage	2.080***	0.520***	0.613***	0.462**	0.420*
	(0.0846)	(0.0698)	(0.0724)	(0.224)	(0.221)
Financial globalization		0.0384***	0.0394***	0.0386**	0.0417**
		(0.00858)	(0.00879)	(0.0154)	(0.0160)
GDP per capita		0.0754***	0.0761***	0.0809**	0.0875***
		(0.0137)	(0.0135)	(0.0317)	(0.0305)
Population growth		0.159	0.399***	0.167	0.414
		(0.129)	(0.134)	(0.214)	(0.283)
Trade Openness		-0.0851***	-0.102***	-0.0901***	-0.109***
		(0.0176)	(0.0178)	(0.0298)	(0.0299)
Education		1.210***	0.7713***	1.162***	0.1283
		(1.894)	(2.198)	(4.244)	(7.521)
Constant	3.755***	7.772***	10.41***	8.426***	14.47***
	(0.456)	(1.289)	(1.329)	(2.379)	(3.674)
Country Fixed Effects	No	No	Yes	No	Yes
Time Fixed Effects	No	No	No	Yes	Yes
Observations	1,498	1,415	1,415	1,415	1,415
R-squared	0.228	0,1651	0.171	0.1793	0.191
Number of Group	112	111	111	111	111

NB : Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

2.6 Sensitivity analysis

First, we test potential heterogeneity in the effect of digitalization on non-resources tax revenues in subsection 6.1, and second; We test the robustness of the main results in subsection 6.2.

2.6.1 Heterogeneity

2.6.1.1 Effect of digitalization on non-resources tax revenues by income level

The sample includes several developing countries with different income levels, so a specific income group is likely the source of digitalization's positive and significant effect. It is essential to explore heterogeneity by income level. To do this, we generated a binary variable for each income level according to the World Bank classification. We assign 1 to low-income countries; otherwise, 0; the income level differs, and so on for the other income levels. Table A4 shows us the effects of digitalization and its components on non-resources tax revenues. We find that the effect of digitalization is positive and significant at all income levels in contrast to the high-income countries. In column [1], the effect of digitalization is positive and significant on non-resources tax revenues for low-income countries at 1%.

Therefore, many initiatives to improve the tax burden in low-income countries have recently been launched, including digitalization as recommended by the World Bank. Digitalization promotes the development of economic activities, which will lead to an increase in per capita income (Sabbagh et al., 2013). Like the baseline model, access to ICT is insignificant, and use has a positive and significant effect. In column [4], the effect of digitalization on lower-middle-income countries is positive and significant at the 10% level.

The effect for these countries is more pronounced compared to low-income countries because they have already started a development process that favors the rapid spread of the effect of digitalization compared to low-income countries. On the other hand, in column [9], we see that the effect is significant and negative for upper-middle-income countries at 5%. This result may be explained by the phenomenon of tax evasion, which is in line with the work of (Shokrkhodaei and Salatin, 2018). It is often noted that the e-commerce sector is relatively developed in these countries. This rapid growth in e-commerce can lead to significant challenges

regarding the traceability of commercial and financial transactions. Electronic transactions can be more complex to monitor and control, which can facilitate fraudulent behavior and tax evasion practices. The digital economy also offers opportunities for individuals and companies to conceal or manipulate financial information, particularly by exploiting the advantages of the dematerialization of transactions and the complexity of the international tax system. The cross-border nature of online activities can also make it difficult to collect and properly tax the income generated by e-commerce. Consequently, a developed e-commerce sector in upper-middle-income countries can pose a major challenge to tax revenue mobilization. Tax administrations face additional obstacles in monitoring and collecting taxes due to the particular characteristics of e-commerce.

2.6.1.2 Effect of digitalization on non-resources tax by level of digitalization

In order to estimate the level of digitalization, we divided the sample into two components: countries with a low level of digitalization and countries with a high level of digitalization. This decomposition was made based on the overall average (5.669113). Countries with low levels of digitalization are those with a level of digitalization below the average, and those with a level above or equal to the average are those with a high level. The results obtained in table A5 provide exciting information on the impact of digitalization on non-resource-related tax revenues. They reveal that this impact is more pronounced in countries with a low level of digitalization, while it is not significant in highly digitized countries.

A closer look at column [1] shows that the effect of digitalization is positive and statistically significant at the 1% confidence level. These results indicate that digitalization can significantly contribute to improving non-resource-related tax revenues, particularly in countries that still have a long way to go in digital development. Access and usage of ICTs have similar effects to those observed in the baseline model, as shown in tables 2.2 and 2.3. However, it is interesting to note that in countries that have already achieved a high level of digitalization, the effect of digitalization on non-resources tax revenues is not significant. This may be because these countries already have advanced digital systems and efficient processes, and further reform would be required to impact their tax revenues significantly. Finally, these results highlight the importance of digitalization in improving non-resource-based tax revenues, particularly in

countries with a low level of digitalization. They also highlight the need for countries that are already digitized to consider further reforms to maintain an upward trajectory in terms of tax revenue mobilization.

2.6.1.3 Effect of digitalization on non-resources tax by institutional quality level

Institutional quality is an essential factor supporting the implementation of digitalization policies in developing countries (Effah and Nuhu, 2017). We assume that digitalization will improve the control of corruption and the role of law extracted from the Worldwide Governance Indicators (WGI). We divide the sample in two for all these indicators based on the average indicator per country for estimation purposes. For control of corruption, we assume that countries with a low level of control of corruption are those whose measure is below the average of the overall sample. For the role of the law, we follow the same logic of corruption control. The results are shown in table A6.

In column [1], the results of our analysis reveal that digitalization has a more pronounced impact on non-resources tax revenues when the level of corruption control improves. Indeed, we find a positive and significant effect at the 5% threshold between digitalization and these tax revenues. However, in column [2], we observe that for countries with a high capacity to control corruption, an increase in digitalization does not affect non-resource-related tax revenues. This result suggests that in these countries, which already have strong anti-corruption mechanisms, improving the level of digitalization does not bring additional gains in terms of tax revenue mobilization. Furthermore, we highlight the crucial role of law in mobilizing non-resource-based tax revenues in developing countries. In column [3], our results show that in countries with low tax rates, digitalization has a positive and significant effect at the 5% threshold on these tax revenues. In contrast, in high-tax countries, as shown in column [4], digitalization's effect is insignificant. These results highlight the importance of considering the quality of institutions in each country, particularly in terms of corruption control and tax legislation, when implementing digitalization policies to improve the mobilization of non-resource-based tax revenues. They also point out that digitalization can be an effective tool in countries facing challenges of corruption control and low tax rates, offering opportunities to enhance tax revenue mobilization.

2.6.1.4 Testing of transmission channels

As pointed out in section 2 on transmission channels, control of corruption, the informal sector, and economic growth are potential channels through which digitalization can positively affect non-resources tax revenue mobilization. In that case, digitalization expects to positively affect the three factors and negatively affect the informal sector. Therefore, this paper explores these three channels using the moderator-mediator method of (Baron and Kenny, 1986). The results of the effect of digitalization by the mediation of these three channels presented in Table A7.

We test the mediator effect of this first channel on digitalization. The regression coefficient in column (1) is significantly positive, which shows that digitalization has improved the mobilization of non-resources tax revenue. The regression coefficient for digitalization in column (2) is 0.0156 and statistically significant, indicating that digitalization has considerably improved the degree of control over corruption. In column (5), the regression coefficient for the control of corruption on the mobilization of non-resources tax revenue is 0.720 and statistically significant, indicating that the improvement in the level of control of corruption has increased the mobilization of tax revenue. In column (8), the variables digitalization and control of corruption are included in the regression model. The regression coefficient for digitalization is 0.386, which is relatively smaller than when the intermediate variable is not included in the model, which proves the existence of the mediating effect of corruption control and indicates that digitalization increases the mobilization of non-resources tax revenue by promoting corruption control. Indeed, the automation of public procedures can reduce the potential for corruption in tax collection processes, as tax collectors have fewer opportunities to engage in bribery or misuse of funds. In addition, tele-procedures and tele-declarations can limit contact between tax collectors and taxpayers, thereby reducing the risk of corruption. Digital tax filing and payment platforms can also provide accessible, easy and fast services to taxpayers, increasing compliance and reducing the potential for tax evasion (Brun et al., 2020).

Another channel through which digitalization can influence the mobilization of non-resources tax revenues is the informal sector. The coefficient for digitalization in column (1) is significantly positive, which shows that digitalization has favoured the mobilization of tax revenues. The regression coefficient for digitalization on the informal sector is -0.422 in column (3) and is

statistically significant, indicating that digitalization has significantly reduced the informal sector. In column (6) shows that the informal sector exerts a negative and statistically significant effect on tax revenue mobilization, with a coefficient of -0.0736, meaning that a larger informal sector is associated with lower tax collection capacity. Column (9) includes both digitalization and the informal sector in the regression model. The regression coefficient for digitalization is 0.385, which is relatively lower than the result when the intermediate variable is not included in the model, proving the existence of the mediating effect of the informal sector and indicating that digitalization favours tax revenue mobilization by reducing the informal sector. The growing use of digital financial services can make it possible to formalise economic activity by offering more traceable and transparent commercial transactions. This can also lead to better access to credit and savings for individuals and small businesses, which can help them become more financially stable and move towards formalisation (Jacolin et al., 2019). Increasing the productivity and profitability of informal businesses can also encourage them to formalise, as they can see the benefits of being a registered business, such as access to more customers, better financing options and legal protections. This can create a more inclusive and sustainable economy, as formalisation can lead to increased tax revenues, improved labour standards and better social protection for workers.

Finally, we test whether digitalization, by promoting economic growth, can lead to greater mobilization of tax revenues. The estimated coefficient of digitalization in column (1) is significantly positive. The estimated coefficient of digitalization on economic growth in column (4) is 0.0306, which is statistically significant, implying that with the increase in digitalization, economic growth has improved significantly. In column (7), the regression coefficient for digitalization on tax revenue mobilization is 3.117, which is statistically significant, indicating that as economic growth increases, tax revenue mobilization improves. Column (10) includes both digitalization and economic growth in the regression model, revealing that the regression coefficient is 0.312, which is lower than the regression coefficient when the intermediate variable is not added in column (1), proving the existence of the mediating effect of economic growth and indicating that digitalization encourages tax revenue mobilization by improving economic growth.

In fact, digitalisation can promote economic activities by offering access to new markets and increasing trade openness, which leads to new economic opportunities. In addition, digitalization can promote financial development and investment, support the development of local businesses and contribute to the development of the industrial sector. These advances can lead to an increase in economic activity, which in turn can mobilise tax revenues. The impact of digitalization on economic growth has been the subject of numerous studies, and the evidence suggests a positive correlation between the two. For example, a study by (Choi and Yi, 2009) found that digitalization significantly affects economic growth. It is also important to note that the benefits of digitalization are not limited to developed countries. Digitalization can also benefit developing countries by improving access to global markets and fostering economic development.

2.6.2 Robustness check

2.6.2.1 Treating reverse causality

This section hypothesizes a possible reverse causality effect between digitalization and non-resources tax revenues. This reverse causality could be explained on the one hand by the fact that digitalization improves non-resources tax revenues. Conversely, better mobilization of non-resources tax revenues will induce the governments of these countries to invest more in digitalization to increase the level of tax revenue collection and the efficiency of the tax administration. Thus, this is a source of reverse causality and endogeneity. Following the example of Datta and Agarwal (2004), we estimate with lag one and two of the digitalization variable to cope with endogeneity.

Table A8 presents results with lags of digitalization on non-resources tax revenues. The effect of digitalization on non-resources tax revenues is positive and significant at the conventional level. The coefficients of the lagged values of digitalization are highly significant, although they have a lower magnitude of the second lag compared to the baseline models. This result supports the argument of Datta and Agarwal (2004) that the positive impact is not only due to a two-way causality. Indeed, this result also shows that the effect of digitalization in a given year can extend over several more years (Wandaogo, 2022).

Furthermore, reverse causality could also arise from some internal and external instruments. Indeed, developing countries, to mobilize tax revenues to finance their development, are led to put in place public policies that contribute to the development of certain economic activities. The development of economic activities will increase tax revenues, enabling the public authorities to provide more and better public services (schools, infrastructure, and health). These policies could lead to a decrease in the level of inequality, poverty, and population size. Therefore, we assume possible endogeneity for almost all our control variables. We make use of the two-stage Generalised Method of Moments (GMM) estimation model Blundell and Bond (1998) while taking into account the proliferation bias of the instruments Roodman (2009) to address this endogeneity issue. We also use connectivity shocks related to telecommunication infrastructure as an external instrument. This instrument reduces concerns about possible omitted variables and reverses causality between digitalization and non-resources tax revenue mobilization.

2.6.2.2 Treatment of endogeneity by instrumental variables method

To estimate the causal effect of digitalization on non-resources tax revenues, we adopt a two-stage instrumental variable (2SLS) approach based on two external instruments : submarine cable outages and the spatially weighted digitalization of neighboring countries.

- **Outages of submarine connectivity cables : cumulative stock of previously recorded failures**

We use connectivity shocks related to telecommunication infrastructures as an external instrument, following the approach of Cariolle and Le Goff (2023). The relevance of this instrument lies in the fact that the deployment of submarine cables faces geological and geographical constraints, generating huge fixed costs (Cariolle, 2021; Cariolle and Le Goff, 2023; Eichengreen et al., 2016). These cables can fail due to several factors, including maritime activities (ship anchors, fishing nets, fish bites, icebergs) or natural causes (earthquakes, abrasion). These failures constitute critical sources of disruption to digital transmission channels (Cariolle, 2021; Pope et al., 2017).

The construction of this instrument deserves careful attention, as it directly determines the

interpretation of our first-stage results. Our instrument is not a contemporaneous measure of cable disruptions. Rather, it is constructed as the cumulative sum of past outages recorded up to the previous period for each country. Formally, for each country i and year t, the variable aggregates all outages historically recorded before period t, with country-years experiencing no outage receiving a value of zero. Two additional restrictions are imposed on the sample of outages: first, we only retain outages that have caused effective internet disruptions; second, outages attributable to government intervention are excluded, so that only natural and accidental failures are considered (maritime activities, natural hazards).

This construction is deliberate and has two important implications. On the one hand, it ensures that our instrument captures the historical stock of resilience experience accumulated by each country in response to past connectivity disruptions, rather than the instantaneous shock of a current outage. On the other hand, it eliminates the risk that transitory economic effects of contemporaneous disruptions such as short-term output losses or trade perturbations constitute a direct channel to tax revenues and threaten the exclusion restriction.

The mechanism underlying the positive sign observed in our first stage is therefore the following: countries that have accumulated more past outages have been compelled to invest in alternative infrastructure, redundant cables, satellite communications, and have developed superior digital resilience expertise. As a result, these countries paradoxically exhibit higher levels of digitalization, which explains the positive coefficient in the first stage. This result is consistent with the findings of Cariolle and Le Goff (2023) and is explicitly documented in our analysis.

The exclusion restriction is satisfied on three grounds. First, natural and accidental cable failures, fish bites, ship anchors, earthquakes, have no direct bearing on a country's fiscal policy. Second, working on the cumulative stock of past outages rather than the contemporaneous shock eliminates the transitory economic effects that could constitute a direct channel to tax revenues. Third, the validity of our instruments is confirmed by the Hansen J-test, whose null hypothesis of instrument validity cannot be rejected at conventional significance levels.

The results of the instrumental variable estimation are reported in Table [2.4]. The 2SLS estimates are shown in column 2. The coefficient on digitalization is positive and statistically

significant at the 1% level, confirming the findings of the baseline specification. The first-stage estimates are reported in column 3. The Kleibergen-Paap rk LM test assesses the null hypothesis of under-identification. This null is rejected (Prob > LM = 0), indicating that the model is properly identified and that the instruments are correlated with the endogenous variable. The Cragg-Donald Wald F and Kleibergen-Paap rk Wald F statistics test for weak instruments. The null hypothesis that the instruments are weak is rejected, as both statistics exceed the Stock and Yogo (2005) critical values. The instruments can therefore be considered sufficiently strong. Finally, the Hansen J-test evaluates instrument validity. The null hypothesis of instrument validity cannot be rejected at conventional significance levels, indicating that the instruments are overall valid and that the identification strategy is coherent.

Table 2.4: Instrumental variable estimation of Digitalization on non-resources tax

	(1)	(2)	(3)
	FE	2SLS	First stage
Dependent variable : NRTAX			
Digitalization	0.329***	0.480***	
	(0.109)	(0.179)	
Financial globalization	0.0410**	-0.0683***	0.00018
	(0.0163)	(0.00962)	(.000902)
GDP Per Capita	0.0855***	-0.0183	0.0101***
	(0.0307)	(0.0400)	(.01374)
Population growth	0.450	-1.138***	-0.02478*
	(0.286)	(0.135)	(.0129)
Trade Openness	-0.102***	0.183***	0.00439**
	(0.0301)	(0.0261)	(0.00187)
Education	1.079	1.459***	0.0604***
	(7.717)	(0.138)	(0.0137)
Submarine cables			**0.0207*** (.0072)**
Geographical distance			**0.13598* (.0716)**
Lagged digitalization			**0.7828*** (0.0327)**
Constant	14.29***	-0.775	0.6468***
	(3.875)	(1.493)	(0.1773)
Observations	1,415	1,326	1,326
R-squared	0.188	0.415	0.5739
Number of CountryID	111	111	111

NB: Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

- **Spatially weighted digitalization of neighboring countries**

Our second instrument is the weighted average of digitalization in neighboring countries, constructed using the longitude and latitude coordinates of each country's capital city to compute bilateral distances in kilometers. This choice is deliberate: using a standard adjacency matrix, which assigns 1 to countries sharing a common border and 0 otherwise, would leave island countries and isolated nations without any neighbors within our sample, as the latter does not include all countries in the world. By relying on coordinates-based distances, every country in our sample of 111 developing countries receives a weighted digitalization measure from its neighbors, thereby guaranteeing full coverage of the instrument.

Algebraically, the weights $w_{i,j}$ of the geographical distance weighting matrix are given as follows:

$$w_{i,j} = \begin{cases} \frac{1/d_{ij}}{\Sigma_j 1/d_{ij}}, & \text{for } i \neq j \\ 0, & \text{for i = j} \end{cases} \tag{2.3}$$

where $d_{i,j}$ represents the geographic distance (in kilometers) between the capitals of countries i and j, computed from their respective longitude and latitude coordinates.

Based on this matrix, the spatial instrumental variable is calculated as the weighted average of digitalization in neighboring countries:

$$IV\_Dig = \sum_j w_{i,j} \times Dig \tag{2.4}$$

This formulation captures the regional diffusion of digitalization and provides an exogenous source of variation that is independent of each country's internal economic dynamics. The rationale for this instrument draws on the law of geography: geographically close countries are more relevant competitors and partners, as productive capital is highly mobile between them due to lower transport and information costs (Lee and Gordon, 2005), consistently with Tobler (1970).

In the first stage of the two-stage least squares (2SLS) estimation, digitalization ($Dig_{i,t}$) is

regressed on its spatially weighted counterpart (IV_Dig_i) as well as on a set of control variables ($X_{i,t}$), according to the following equation:

$$Dig_{i,t} = \sigma + \beta IV\_Dig_i + \rho X_{i,t} + \alpha_i + \gamma_t + \epsilon_{i,t} \tag{2.5}$$

In the second stage, the instrumented variable of Digitalization ($\widehat{Dig}_{i,t}$) obtained from the first equation is used to estimate its causal impact on Non-resources tax revenue ($NRTAX_{i,t}$):

$$NRTAX_{i,t} = \sigma + \beta \widehat{Dig}_{i,t} + \rho X_{i,t} + \alpha_i + \gamma_t + \epsilon_{i,t} \tag{2.6}$$

We acknowledge that the spatially weighted digitalization of neighbors may be correlated with deep determinants of development colonial infrastructure, market access, regional integration that could threaten the exclusion restriction. We address this concern through three complementary elements. First, our model includes both country fixed effects and time fixed effects, which absorb all time-invariant deep determinants colonial history, geography, resource endowments that could be correlated with geographic distance between neighbors. What remains in the instrument after this double control is the **temporal variation** of neighbors' digitalization, which is exogenous to each country's internal fiscal dynamics. Second, the inclusion of macroeconomic control variables GDP per capita, trade openness, financial globalization, education captures the direct economic channels through which geographic proximity could influence tax revenues independently of digitalization. Third, the validity of both instruments jointly is confirmed by the Hansen J-test, which is precisely designed to detect violations of the exclusion restriction.

The analysis results [2.4] show that close geographical proximity significantly influences the level of digitalization, consistent with a diffusion or imitation effect whereby countries close to each other tend to adopt similar digital practices through resource sharing, inter-administrative cooperation, and exposure to regional innovations. This neighbor effect is reflected in a significant improvement in the mobilization of non-resource tax revenues, suggesting that administrations benefiting from the digital influence of their neighbors are better able to strengthen their tax collection capacity.

2.6.2.3 Treatment of endogeneity by system GMM

non-resources tax revenue mobilization tends to be persistent, as the country's tax revenue mobilization level may depend on revenues in the previous year. If this does not consider, the estimates may suffer from a severe problem of relevant explanatory variables. In line with the dynamic model literature, we have considered the one-period lagged value of the dependent variable as an explanatory variable to address the potential dynamic problem of non-resources tax revenue mobilization. Therefore, our model is written as follows:

$$NRTAX_{i,t} = \sigma + \delta NRTAX_{i,t-1} + \beta Dig_{i,t} + \rho X_{i,t} + \alpha_i + \gamma_t + \epsilon_{i,t} \tag{2.7}$$

Results of GMM estimation are presented in Table A8. The p-values of the AR test [1], [2], and Hansen test confirm the validity of the results, as the p-values are higher than all conventional levels. Also, the high and significant coefficient of the lagged dependent variable validates the relevance of the GMM system model. It confirms that the efficiency of non-resources tax revenue mobilization is persistent. This means that previous years can explain the non-resources tax revenue mobilization level. The effect of digitalization and its components are similar to those of the conventional level column [1]. The results of the digitalization components, such as access to ICT and use of ICT, are similar to the baseline results.

2.6.2.4 Testing for additional controls on baseline specification

We add additional controls in the baseline specification to consider other variables that may affect non-resources tax revenues and digitalization. These additional controls are agriculture, resource rents, imports, exports, inflation, Foreign Direct Investment, control of corruption, and the rule of law. The results are presented in Table A10.

In column two, we control for the effect of agricultural sector value added on non-resources tax revenue. Agriculture is a significant employment sector in developing countries and is complex to tax. Several studies on government revenue tend to show a negative impact of this variable on government revenue (Baunsgaard and Keen, 2010;Gnangnon and Brun, 2018a; Khattry and Rao, 2002). Even when considering agricultural value-added, digitalization still positively affects non-resources tax revenues. In column [3], we include resource rents

as a percentage of GDP. The exploitation of natural resources plays an essential role at the macroeconomic level. Indeed, some work has shown that natural resources can reduce governments' incentives to collect taxes (Martinez-Vazquez, 2001). Our results are similar to these previous studies, which found a non-significant effect on non-resources tax revenues. In columns [4] and [5], we include control of corruption and the role of the law. Indeed, lowering corruption levels and tightening taxation allows a state to mobilize tax revenues better. By controlling these two institutional variables, digitalization positively affects non-resources tax revenues. By including Foreign Direct Investment in the regression [6], we find digitalization's positive and significant effect on non-resources tax revenues. Indeed, digitalization contributes to shaping the behavior of society in order to promote an enabling social, economic, and political environment that is the source of attraction for new domestic and foreign investments. An increase in FDI leads to an improvement in tax revenues. In the last columns [7] and [8], we control imports and exports as a percentage of GDP to ensure that our results are not sensitive to these two variables. We find that not only are these two variables significantly different from zero with expected effects (Morrissey et al. (2016)), but that digitalization does not impact non-resources tax revenues when we include both.

We include the inflation variable in the column to ensure that our results are robust to the Olivera-Tanzi effect [9]. According to their theory, an economic situation involving a period of high inflation in a country leads to a decrease in the volume of tax collection and a slow deterioration of the actual tax revenue collected by the government of that country (Combes and Ouedraogo, 2016). We do not find an Olivera-Tanzi effect, while digitalization remains an essential driver of non-resources tax revenue mobilization. Overall, our result is robust to many additional control variables. Second, digitalization affects non-resources tax revenue mobilization in developing countries by increasing the tax base and the incentive to comply with taxes.

2.7 Conclusion

In a context where digitalization is impacting all aspects of people's lives, this paper examines whether, by promoting ICT, developing countries would be able to mobilize more non-resources tax revenues. The study considers data on 111 countries, including 20 low-income, 51 lower-middle-income, and 40 upper-middle-income countries classified by the World Bank over 15 years, from 2005 to 2019. The empirical results rely on the fixed effects method with supporting instrumentalization to correct for endogeneity. The results provide strong evidence that improving a developing country's digitalization improves its non-resources tax revenues. This effect is more significant for lower-middle-income countries than low- and upper-middle-income countries. When weighing the digitalization index overall, the effect is minimized by considering the access index. Also, it remains relevant when testing the sensitivity to several levels, including the level of digitalization, macroeconomic and institutional.

The findings of this study highlight how developing countries can harness digital transformation to improve their tax collection. However, to maximise the benefits of digitalization, it is crucial to establish a regulatory and institutional framework that is conducive to the adoption and integration of ICTs across all economic sectors. This framework must be flexible enough to adapt to rapid changes in digital technologies, while ensuring fair competition between market players. Public policies must encourage private investment in digital infrastructures while ensuring that these services remain accessible and affordable for the entire population.

In addition, universal access to the Internet, particularly broadband, must become a priority. Governments must draw up national strategies for the development of broadband, including incentives to stimulate investment in rural and underserved areas. These strategies must also include efficient management and allocation of radio spectrum to support the expansion of mobile broadband networks. Expanding broadband access is essential not only for digital inclusion, but also to support key economic sectors such as education, health and financial services. It is also imperative that governments invest in the development of human capital, with a particular focus on education and continuing training in digital skills. The development

of appropriate educational programmes from an early age is crucial to prepare future generations for full integration into the digital economy. At the same time, vocational training and retraining programmes for workers in traditional sectors are needed to help them adapt to technological change. In addition, it is essential to support universities and research centres in their efforts to strengthen local ICT research and development capabilities.

Cybersecurity must also be seen as a central pillar of any digital policy. Governments must develop and implement robust security frameworks to protect critical infrastructures, personal data and financial systems from cyber threats. A national cybersecurity strategy, including awareness-raising, training and the development of advanced technical capabilities, is essential to ensure the resilience of the digital ecosystem.

Finally, strengthening institutional capacity to manage and oversee the digital transition is essential. This involves modernising public administrations by digitising government services, improving administrative efficiency and making processes more transparent. The institutions responsible for regulating the digital sectors must be equipped with the technical skills and resources needed to carry out their mission effectively. The success of the digital transformation will largely depend on the political will of leaders. Governments must not only make a firm commitment to promoting digitalization through coherent public policies, but also show leadership by investing in strategic digital initiatives and supporting innovation. Ongoing evaluation of the policies and programmes implemented is essential to adjust strategies in line with the results achieved and emerging challenges. These recommendations aim to establish a solid basis for an economic policy that not only facilitates the digital transition, but also maximises its impact on tax revenue mobilisation and overall economic development.

Appendix A

Table A1: Summary statistics

Variable	Obs	Mean	Std. dev.	Min	Max
Fixed telephone lines	1,649	8.992869	9.847882	0	48.10332
Mobile telephone subscriptions	1,659	75.72749	42.40172	.2629218	207.7518
Households with computer	1,421	20.6057	19.46805	.1	80.52794
Households with Internet access	1,426	19.83342	21.65846	0	90.34098
Households with electricity	1,677	69.13922	31.89979	1.300314	100
Internet users	1,518	22.60357	20.6055	.0652389	82.78915
Fixed broadband Internet	1,540	3250768	2.40e+07	0	4.49e+08
Mobile broadband subscription	1,451	1.36e+07	7.66e+07	0	1.39e+09
Online services index	1,692	.3230032	.2085906	0	.9514
Index Access	1,680	5.351356	1.227288	0	10
Index Usage	1,680	5.44562	1.445369	0	10
Digitalization	1,680	5.669113	5.669113	0	10
Non-resource tax revenue	1,510	14.88105	6.262941	.8051321	36.33237
Foreign Direct Investment	1,681	4.534471	6.391559	-11.19897	103.3374
GDP per capita growth	1,685	2.424793	4.198464	-36.55692	33.03049
Import	1,551	43.74571	21.00898	.5882712	191.4582
Export	1,551	32.79351	18.12722	.6111681	158.3742
Population Growth	1,695	1.644724	1.215609	-1.745365	6.559122
Natural resources	1,682	7.834842	10.00347	.0009353	81.94996
Inflation	1,613	6.454806	8.895501	-8.97474	255.305
Agriculture	1,660	16.06124	11.50228	.8926961	66.03273
Rule of Law	1,695	-.5321568	.5707901	-1.852296	1.079298
Control of Corruption	1,695	-.5318135	.5700835	-1.815811	1.640953
Financial globalization	1,695	47.55384	15.63502	12.16022	81.6432
Trade openess	1,605	56.27855	7.240929	21.4	77
Education	1,694	.543951	.1510336	.143	.862
Cables break	1,695	.139233	.3462917	0	1
School enrollment	1,319	104.7376	15.69383	43.61315	149.9568

Table A2: List of countries and income levels

Country	Income level	Country	Income level
Albania	Upper-Middle Income	Lebanon	Upper-Middle Income
Algeria	Lower-Middle Income	Lesotho	Lower-Middle Income
Angola	Lower-Middle Income	Liberia	Low Income
Azerbaijan	Upper-Middle Income	Madagascar	Low Income
Argentina	Upper-Middle Income	Malawi	Low Income
Bangladesh	Lower-Middle Income	Maldives	Upper-Middle Income
Armenia	Upper-Middle Income	Mali	Low Income
Bhutan	Lower-Middle Income	Mauritania	Lower-Middle Income
Bosnia and Herzegovina	Upper-Middle Income	Mauritius	Upper-Middle Income
Botswana	Upper-Middle Income	Mexico	Upper-Middle Income
Brazil	Upper-Middle Income	Moldova	Upper-Middle Income
Belize	Lower-Middle Income	Montenegro	Upper-Middle Income
Solomon Islands	Lower-Middle Income	Morocco	Lower-Middle Income
Bulgaria	Upper-Middle Income	Mozambique	Low Income
Myanmar	Lower-Middle Income	Namibia	Upper-Middle Income
Burundi	Low Income	Nepal	Lower-Middle Income
Belarus	Upper-Middle Income	Vanuatu	Lower-Middle Income
Cambodia	Lower-Middle Income	Nicaragua	Lower-Middle Income
Cameroon	Lower-Middle Income	Niger	Low Income
Cape Verde	Lower-Middle Income	Nigeria	Lower-Middle Income
Central African Republic	Low Income	Micronesia	Lower-Middle Income
Sri Lanka	Lower-Middle Income	Pakistan	Lower-Middle Income
Chad	Low Income	Papua New Guinea	Lower-Middle Income
China	Upper-Middle Income	Paraguay	Upper-Middle Income
Colombia	Upper-Middle Income	Philippines	Lower-Middle Income
Comoros	Lower-Middle Income	Guinea-Bissau	Low Income
Congo (Rep. of the)	Lower-Middle Income	Timor-Leste	Lower-Middle Income
Democratic Republic of the Congo	Low Income	Romania	Upper-Middle Income
Costa Rica	Upper-Middle Income	Rwanda	Low Income
Benin	Lower-Middle Income	Saint Vincent and the Grenadines	Upper-Middle Income
Dominica	Upper-Middle Income	Sao Tome and Principe	Lower-Middle Income
Dominican Rep.	Upper-Middle Income	Senegal	Lower-Middle Income
Ecuador	Upper-Middle Income	Sierra Leone	Low Income
El Salvador	Lower-Middle Income	Viet Nam	Lower-Middle Income
Equatorial Guinea	Upper-Middle Income	South Africa	Upper-Middle Income
Ethiopia	Low Income	Zimbabwe	Lower-Middle Income
Fiji	Upper-Middle Income	Sudan	Low Income
Djibouti	Lower-Middle Income	Suriname	Upper-Middle Income
Gabon	Upper-Middle Income	Swaziland	Lower-Middle Income
Georgia	Upper-Middle Income	Tajikistan	Lower-Middle Income
Gambia	Low Income	Thailand	Upper-Middle Income
Ghana	Lower-Middle Income	Togo	Low Income
Kiribati	Lower-Middle Income	Tonga	Upper-Middle Income
Guatemala	Upper-Middle Income	Tunisia	Lower-Middle Income
Guinea	Low Income	Turkey	Upper-Middle Income
Guyana	Upper-Middle Income	Uganda	Low Income
Haiti	Lower-Middle Income	Ukraine	Lower-Middle Income
Honduras	Lower-Middle Income	Russian Federation	Upper-Middle Income
India	Lower-Middle Income	Egypt	Lower-Middle Income
Indonesia	Lower-Middle Income	Tanzania	Lower-Middle Income
Iran (Islamic Republic of)	Lower-Middle Income	Burkina Faso	Low Income
Cote d'Ivoire	Lower-Middle Income	Uzbekistan	Lower-Middle Income
Jamaica	Upper-Middle Income	Samoa	Lower-Middle Income
Kazakhstan	Upper-Middle Income	Yemen	Low Income
Jordan	Upper-Middle Income	Serbia	Upper-Middle Income
Kenya	Lower-Middle Income	Zambia	Lower-Middle Income
Kyrgyzstan	Lower-Middle Income		

Table A3: Variable description

Variables	Description	Source
Fix_Tes	It represents all telephone lines, Internet telephony subscriptions, fixed wireless local loop subscriptions, integrated services digital network channel equivalents and fixed payphones.	ITU
Mob_Sub	It refers to public mobile telephone subscriptions providing access to public switched telephone network using cellular technology. It includes all mobile-cellular subscriptions that offer voice communication.	
Pro_Hou	This is defined as households with a computer that is ready for use by all members of that household at any time. It includes everything from desktops to laptops to tablets.	
Pro_House	Internet is a worldwide public computer network. Access can be via a fixed or mobile network. Household with internet access involves internet being available to all members of household at all times.	
Elect	Proportion of households with electricity	
Int_Use	It refers to people using internet from any location and for any purpose. Use can be via a computer, tablet, mobile phone, game machine, digital TV.	
Act_Mob	This represents all mobile broadband subscriptions for data and voice, and mobile broadband subscriptions for data only, public internet.	
Fixe_Bro	It refers to fixed subscriptions providing high-speed access to public Internet at data rates equal to or greater than 256 kbit/s.	
Onlines	Online Services Index assesses availability and quality of online government service delivery.	UN E-Government Survey
Index_Ac	This index encompasses factors that promote access to ICT. It takes into account availability and access to telecommunications infrastructure.	Autor construction
Index_Use	It measures real usage of ICTs by main segments of society.	
Dig	It covers both access and usage of ICT	
nrtax_ex_sc	This is defined as the proportion of a country's total non-resource tax revenue in relation to its GDP. It is measured as follows: Total tax revenue excluding subsidies and social security (% GDP) minus resource-related tax revenue (% GDP)	ICTD Dataset
FDIO	Foreign direct investment, net inflows (% of GDP)	WDI
GDPPPG	GDP per capita growth (annual %)	
Import	Imports of goods and services (% of GDP)	
Export	Exports of goods and services (% of GDP)	
PopG	Population growth (annual %)	
Agriculture	Share of agricultural value added, in % of GDP	
Natural Resources	Total natural resources rents (% of GDP)	
Inflation	Inflation, consumer prices (annual %)	
School	School enrollment, primary (% gross) [SE.PRM.ENRR]	
Education	It is measured by average years of schooling for adults aged 25 and over and expected years of schooling for school-age children.	Global datalab
rle	Perception of the extent to which agents trust and abide by the rules of society, and in particular the quality of contract enforcement, property rights, police and courts, and the likelihood of crime and violence.	WGI
cce	The perception of extent to which public power is wielded for private gain, including both small and large forms of corruption, as well as the 'capture' of the state by elites and private interests. private interests	
KOFFiGIdj	KOF Financial Globalisation Index, de jure	KOF database
Trade Openness	Trade freedom score refers to trade policy of domestic economy. It measures aggregate absence of tariff and non-tariff barriers that affect imports and exports of goods and services and thus trade freedom.	Heritage Foundation
Cables break	Technical breakdowns related to submarine cables. Several factors can cause these breakdowns, including maritime activities (ship anchors, fishing nets, fish bites, icebergs), man (sabotage, drilling) or natural causes (earthquakes, abrasion).	Cariolle and Le Goff (2023)

Table A4: Testing for effect of digitalization and its components on non-resources tax by income

	Low income			Lower Middle Income			Upper Middle Income		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dependent variable: NRTAX									
Digitalization	0.363***			0.443*			-0.354		
	(0.121)			(0.230)			(0.219)		
ICT Access		0.118			0.223			0.0323	
		(0.103)			(0.219)			(0.207)	
ICT Usage			0.459**			0.296			-0.503**
			(0.228)			(0.223)			(0.219)
Financial globalization	0.0398**	0.0409**	0.0379**	0.0434***	0.0404**	0.0444***	0.0416***	0.0407**	0.0427***
	(0.0163)	(0.0162)	(0.0161)	(0.0164)	(0.0162)	(0.0168)	(0.0158)	(0.0162)	(0.0155)
GDP per capita	0.0856***	0.0875***	0.0871***	0.0856***	0.0884***	0.0853***	0.0866***	0.0886***	0.0827***
	(0.0317)	(0.0313)	(0.0318)	(0.0301)	(0.0312)	(0.0296)	(0.0315)	(0.0311)	(0.0313)
Population growth	0.441	0.425	0.452	0.405	0.424	0.400	0.397	0.427	0.427
	(0.290)	(0.286)	(0.291)	(0.276)	(0.285)	(0.275)	(0.283)	(0.288)	(0.276)
Trade Openness	-0.104***	-0.107***	-0.104***	-0.108***	-0.107***	-0.109***	-0.111***	-0.107***	-0.104***
	(0.0300)	(0.0304)	(0.0294)	(0.0304)	(0.0301)	(0.0305)	(0.0299)	(0.0299)	(0.0303)
Education	0.1305	0.1659	0.2089	0.0921	0.1810	0.1055	0.1461	0.2065	0.1335
	(7.861)	(7.927)	(7.705)	(7.638)	(7.914)	(7.615)	(7.874)	(7.973)	(7.694)
Constant	15.76***	15.77***	15.45***	15.28***	15.29***	15.67***	16.95***	15.60***	16.83***
	(3.870)	(3.944)	(3.752)	(3.883)	(4.015)	(3.836)	(4.042)	(4.111)	(3.887)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,415	1,415	1,415	1,415	1,415	1,415	1,415	1,415	1,415
R-squared	0.186	0.178	0.191	0.185	0.179	0.183	0.180	0.177	0.187
Number of Group	111	111	111	111	111	111	111	111	111

NB : Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A5: Testing for effet of digitalization on non-resources tax by level of digitalization

	Low digitalization			High digitalization		
	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable: NRTAX						
Digitalization	0.436***			-0.107		
	(0.122)			(0.205)		
ICT Access		0.155			0.0686	
		(0.112)			(0.163)	
ICT Usage			0.476**			-0.198
			(0.200)			(0.187)
Financial globalization	0.0381**	0.0406**	0.0359**	0.0400**	0.0407**	0.0382**
	(0.0158)	(0.0163)	(0.0147)	(0.0162)	(0.0162)	(0.0160)
GDP per capita	0.0871***	0.0878***	0.0886***	0.0892***	0.0882***	0.0891***
	(0.0309)	(0.0313)	(0.0307)	(0.0309)	(0.0309)	(0.0312)
Population growth	0.435	0.424	0.442	0.417	0.432	0.435
	(0.284)	(0.285)	(0.280)	(0.283)	(0.288)	(0.286)
Trade Openness	-0.0971***	-0.104***	-0.100***	-0.107***	-0.107***	-0.103***
	(0.0303)	(0.0309)	(0.0297)	(0.0304)	(0.0300)	(0.0309)
Education	0.1207	0.1671	0.1720	0.2133	0.1987	0.2249
	(7.779)	(7.916)	(7.641)	(7.926)	(7.922)	(8.001)
Constant	15.05***	15.45***	15.11***	16.03***	15.47***	16.06***
	(3.828)	(3.982)	(3.692)	(4.042)	(4.048)	(3.980)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,415	1,415	1,415	1,415	1,415	1,415
R-squared	0.194	0.180	0.199	0.177	0.177	0.179
Number of Group	111	111	111	111	111	111

NB: Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A6: Testing the transmission channels of digitisation through quality institutions

	Control of corruption		Rule of Law	
	(1)	(2)	(3)	(4)
Dependent variable: NRTAX				
Digitalization	0.151**	-0.0999	0.0774**	-0.0265
	(0.0673)	(0.0685)	(0.0366)	(0.0381)
Financial globalization	0.0419***	0.0414**	0.0420**	0.0411**
	(0.0160)	(0.0161)	(0.0161)	(0.0161)
GDP per capita	0.0877***	0.0890***	0.0882***	0.0887***
	(0.0305)	(0.0309)	(0.0310)	(0.0311)
Population growth	0.455	0.436	0.437	0.425
	(0.289)	(0.286)	(0.287)	(0.286)
Trade Openness	-0.0930***	-0.0995***	-0.102***	-0.106***
	(0.0274)	(0.0278)	(0.0298)	(0.0300)
Education	0.1462	0.1940	0.1927	0.2068
	(7.931)	(7.972)	(7.875)	(7.935)
Constant	14.72***	15.49***	15.19***	15.66***
	(3.713)	(3.853)	(3.930)	(3.950)
Country Fixed Effects	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes
Observations	1,415	1,415	1,415	1,415
R-squared	0.190	0.182	0.181	0.177
Number of Group	111	111	111	111

NB : Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A7: The mediator effects of control of corruption, informal sector, and GDP

	(1) NRTAX	(2) Control of corruption	(3) Informal sector	(4) GDP	(5) NRTAX	(6) NRTAX	(7) NRTAX	(8) NRTAX	(9) NRTAX	(10) NRTAX
Digitalization	0.388***	0.0156**	-0.422***	0.0306***				0.386***	0.385***	0.312***
	(0.0768)	(0.00668)	(0.0997)	(0.00501)				(0.0776)	(0.0770)	(0.0799)
Control of corruption					0.720*			0.700*		
					(0.416)			(0.416)		
Informal sector						-0.0736***			-0.0645***	
						(0.0165)			(0.0160)	
GDP							3.117***			2.591***
							(0.727)			(0.753)
Constant	15.40***	-0.722***	49.56***	22.61***	18.13***	21.11***	-53.40***	15.86***	18.44***	-43.24**
	(0.515)	(0.0526)	(0.773)	(0.0333)	(0.405)	(0.830)	(16.57)	(0.620)	(0.908)	(17.07)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control variables	No	No	No	No	No	No	No	No	No	No
Observations	1,498	1,680	1,620	1,657	1,498	1,449	1,475	1,498	1,449	1,475
R-squared	0.923	0.918	0.985	0.998	0.922	0.929	0.925	0.924	0.930	0.926

NB : Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A8: Effect of digitalization and level of digitalization on non-resource tax with lags

	Full Sample			Low level of digitalization			High level of digitalization		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dependent variable: NRTAX									
Digitalization	0.329***			0.436***			-0.107		
	(0.109)			(0.122)			(0.205)		
Digitalization (t-1)		0.337***			0.402***			-0.139	
		(0.106)			(0.111)			(0.263)	
Digitalization (t-2)			0.245**			0.270**			-0.0754
			(0.114)			(0.108)			(0.315)
Financial Globalization	0.0410**	0.0400**	0.0401**	0.0381**	0.0382**	0.0394**	0.0400**	0.0400**	0.0412**
	(0.0163)	(0.0172)	(0.0164)	(0.0158)	(0.0168)	(0.0163)	(0.0162)	(0.0170)	(0.0165)
GDP per capita	0.0855***	0.0866***	0.0847***	0.0871***	0.0879***	0.0854***	0.0892***	0.0878***	0.0837***
	(0.0307)	(0.0328)	(0.0322)	(0.0309)	(0.0328)	(0.0321)	(0.0309)	(0.0326)	(0.0319)
Population growth	0.450	0.510	0.517	0.435	0.499	0.512	0.417	0.480	0.501
	(0.286)	(0.323)	(0.326)	(0.284)	(0.316)	(0.322)	(0.283)	(0.315)	(0.323)
Trade Openness	-0.102***	-0.113***	-0.123***	-0.0971***	-0.111***	-0.122***	-0.107***	-0.118***	-0.125***
	(0.0301)	(0.0296)	(0.0280)	(0.0303)	(0.0300)	(0.0284)	(0.0304)	(0.0300)	(0.0287)
Education	0.1079	-0.0558	-0.2035	0.1207	0.0990	-0.1359	0.2133	0.1121	-0.0882
	(7.717)	(7.287)	(6.913)	(7.779)	(7.360)	(6.968)	(7.926)	(7.469)	(7.041)
Constant	14.29***	16.02***	18.04***	15.05***	16.69***	18.48***	16.03***	17.53***	18.98***
	(3.875)	(3.694)	(3.780)	(3.828)	(3.688)	(3.771)	(4.042)	(3.886)	(3.888)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,415	1,326	1,236	1,415	1,326	1,236	1,415	1,326	1,236
R-squared	0.188	0.180	0.176	0.194	0.184	0.177	0.177	0.169	0.170
Number of Group	111	111	111	111	111	111	111	111	111

NB : Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A9: Two-Step system GMM estimation

	(1)	(2)	(3)
Dependent variable: NRTAX			
Non-resource tax (t-1)	0.740***	0.766***	0.781***
	(0.0666)	(0.0612)	(0.0613)
Digitalization	0.348**		
	(0.155)		
Access ICT		0.108	
		(0.0877)	
Usage ICT			0.340*
			(0.184)
Access*Usage ICT			
Financial globalization	-0.124***	-0.112***	-0.0874**
	(0.0410)	(0.0424)	(0.0357)
GDP Per Capita	0.0534***	0.0580***	0.0672***
	(0.0186)	(0.0185)	(0.0180)
Population Growth	-0.288*	-0.275*	-0.270*
	(0.153)	(0.156)	(0.150)
Trade Openness	-0.0174	-0.00608	0.0153
	(0.0426)	(0.0410)	(0.0349)
Education	7.447***	7.648**	4.280**
	(2.822)	(2.947)	(2.143)
Constant	4.977**	4.765*	2.530
	(2.480)	(2.565)	(2.016)
Time Fixed fixed	Yes	Yes	Yes
Observations	1,319	1,319	1,319
Number of CountryID	111	111	111
Number of instruments	44	44	44
AR1(p-value)	0.000	0.000	0.000
AR2(p-value)	0.608	0.644	0.676
Hansen	0.284	0.255	0.121

NB: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A10: Testing for additional controls on baseline specification

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dependent variable: NRTAX									
Digitalization	0.329***	0.300***	0.301***	0.296**	0.308***	0.264**	0.229*	0.259**	0.240**
	(0.109)	(0.107)	(0.111)	(0.113)	(0.110)	(0.116)	(0.117)	(0.120)	(0.119)
Financial Globalization	0.0410**	0.0389***	0.0378***	0.0357**	0.0376**	0.0248	0.0257	0.0108	
	(0.0163)	(0.0147)	(0.0141)	(0.0147)	(0.0146)	(0.0171)	(0.0168)	(0.0148)	
GDP Per Capita	0.0855***	0.0871***	0.0939***	0.0915***	0.0923***	0.0785**	0.0832**	0.0467**	0.0401*
	(0.0307)	(0.0290)	(0.0293)	(0.0306)	(0.0302)	(0.0356)	(0.0346)	(0.0222)	(0.0229)
Population Growth	0.450	0.401	0.427	0.412	0.438	0.389	0.397	0.333	0.179
	(0.286)	(0.268)	(0.271)	(0.267)	(0.279)	(0.316)	(0.332)	(0.330)	(0.269)
Trade Openness	-0.102***	-0.114***	-0.110***	-0.119***	-0.107***				
	(0.0301)	(0.0304)	(0.0304)	(0.0284)	(0.0267)				
Education	0.1079	0.1581	0.1311	0.0991	0.1108	0.0580	0.1106	O.2172	0.2049
	(7.717)	(7.631)	(7.565)	(7.459)	(7.498)	(6.955)	(6.698)	(6.753)	(6.489)
Agriculture		-0.112**	-0.119**	-0.116**	-0.123***	-0.138**	-0.135**	-0.0820**	-0.0697*
		(0.0438)	(0.0458)	(0.0460)	(0.0461)	(0.0562)	(0.0550)	(0.0369)	(0.0359)
Natural Resources			-0.0422	-0.0416	-0.0476	-0.0546*	-0.0149	0.00146	0.00993
			(0.0306)	(0.0308)	(0.0299)	(0.0309)	(0.0368)	(0.0322)	(0.0270)
Corruption Control				0.656	1.188*	0.642	0.610	0.838	0.320
				(0.653)	(0.644)	(0.912)	(0.968)	(0.964)	(0.735)
Rule of Laws					-1.396*	-1.120	-1.057	-1.060	-0.602
					(0.712)	(0.814)	(0.848)	(0.916)	(0.795)
FDI						0.0464**	0.0698***	0.0840***	0.0835***
						(0.0226)	(0.0257)	(0.0255)	(0.0188)
Import							-0.0510**	-0.0492**	-0.0548***
							(0.0242)	(0.0240)	(0.0197)
Export								-0.0190	-0.0235
								(0.0184)	(0.0188)
Inflation									0.0541**
									(0.0223)
Constant	14.29***	16.91***	17.37***	18.50***	17.27***	10.68***	10.94***	9.660***	10.34***
	(3.875)	(3.591)	(3.578)	(3.447)	(3.492)	(3.362)	(3.304)	(3.250)	(3.096)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,415	1,393	1,387	1,387	1,387	1,334	1,334	1,271	1,260
R-squared	0.188	0.206	0.211	0.214	0.221	0.221	0.236	0.225	0.259
Number of Group	111	110	110	110	110	106	106	103	103

NB: Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Chapter 3

Electronic Services and Tax Compliance: Evidence from Medium and Small Businesses in Burkina Faso

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3.1 Introduction

The digital revolution has radically transformed the financial services landscape globally, a transformation that has significantly accelerated on the African continent (Arewa and Santoro, 2022). The rapid emergence of ICT has remarkably shaped the economic landscape in Burkina Faso, the country under study, as in other developing countries around the world. Digitalization allowed African tax administrations to introduce electronic services for tax purposes in recent years (Okunogbe and Santoro, 2023b). Following this path, the government of Burkina Faso took an important step in April 2018 by launching a digital platform for tax filing and payments. This initiative is part of a broader drive to modernise and digitise tax processes and demonstrates the commitment of the government and tax authority to leveraging the benefits of digitalization.

Electronic services are now emerging as a key lever to overcome the traditional challenges associated with tax collection. They facilitate more efficient and transparent management of tax revenues by simplifying procedures. The introduction of digital platforms is revolutionising various administrative tasks, such as tax collection, verification, and the processing of tax information. This automation reduces potential human errors and speeds up overall processing, thereby improving the efficiency of tax administration (Apeti and Edoh, 2023; Okunogbe and Santoro, 2023b). In addition, the digital transformation of tax reduces compliance costs for taxpayers while strengthening the capacity of tax administrations to monitor and promote compliance (Okunogbe and Pouliquen, 2022). By simplifying tax procedures, digitalization reduces the administrative burden on taxpayers. It allows them to save time and resources previously spent on filling out tedious paper forms (Kochanova et al., 2020). In addition, e-services provide taxpayers with easy access to tax information, reducing the costs associated with physical travel to tax offices and facilitating access to the resources needed to better understand tax obligations. The usefulness of electronic services is crucial in the promotion of taxpayers' tax compliance. As procedures become simpler, taxpayers have a natural incentive to fulfil their tax obligations more easily, thus contributing to an overall improvement in the financial health of the tax system (Santoro et al., 2023; Hakizimana and Santoro, 2023).

The study of Burkina Faso's context in terms of the adoption of electronic tax services is particularly pertinent, considering the important initiatives implemented to promote the use of these services. The introduction of the electronic tax filing and payment platform, eSINTAX, in 2018 represents a significant step forward in the modernisation of tax procedures in Burkina Faso. The government's reform to make the use of this technology mandatory for businesses, especially large and medium businesses, from 2022 underscores its commitment to the transition to electronic tax processes. From the launch of the platform to 2024, eSINTAX registered 22,540 adherents, with 847,053 electronic filings and 97,365 online payments since inception in 2018 to early 2023. While adoption is high among medium and large firms, smaller businesses still face constraints such as limited connectivity, digital literacy, and technical support, which continue to shape the effectiveness of digital reforms (Conley and Udry, 2010; Kochanova et al., 2020; Santoro et al., 2024).

However, despite the increased accessibility of online procedures, many tax administrations still fail to provide technical assistance to many taxpayers. This situation can be explained by a lack of resources, insufficient training of administrative staff, or inadequate technological infrastructure to fully support these online services. Against this background, we seek to answer the following questions in the context of Burkina Faso: (i) what are the determinants of the adoption of tax electronic services?, (ii) How does the adoption of these services influence taxpayer compliance behaviour? (iii) Through which changes in taxpayers' perceptions does digitalization shape compliance behaviour?.

To conduct our analysis, we opt for a methodology that combines different data sources. This includes the use of administrative data provided by the DGI, as well as survey data from a sample of 1,090 small and medium-sized enterprises. The administrative data provides a solid quantitative basis for examining general trends in adoption and usage of e-filing, and e-payments. It allows us to assess the impact of eSINTAX adoption in terms of actual compliance behaviours. In addition, the survey data gives us a detailed, more granular insight into taxpayers' motivations, practical barriers, and experiences in using tax services. By interviewing this sample directly, we gather contextualised information on the perceptions, preferences, and concerns of potential and actual users of e-services. We distinguish in our

analysis between taxpayers who have adopted the eSINTAX, those who actively use it to file tax returns, and those who pay taxes digitally.

We present three sets of findings. First, a set of findings related to the descriptive mapping of eSINTAX adoption shows that such a platform is massively adopted, mainly because of the time and effort savings it offers in the tax filing and payment process (Mascagni et al., 2019). In addition, easier access to tax documents, such as proof of tax status, real-time monitoring of tax records and reduced opportunities for corruption are also motivating factors. However, despite this uptake, effective use of eSINTAX is hampered by barriers such as the inability to use the platform effectively and connectivity issues, highlighting the importance of know-how and infrastructure (Shaikh and Karjaluoto, 2015; Conley and Udry, 2010). In a more robust regression framework, we elucidate the determinants driving the adoption of tax e-services. A coherent narrative emerges across the three indicators of technology utilisation employed in our study of registration for eSINTAX, active use for e-filing, and the digital payment of taxes. Variables such as possessing SARL legal status[1], the deployment of electronic sales machines, elevated levels of tax knowledge, engagement in the trade sector, prior audit experiences, the presence of a dedicated accounting department, and the longevity of business operations exhibit a significant positive correlation with all three indicators.

Second, we document the impacts of digitalization on compliance behaviour using a difference-in-differences design following Callaway and SantAnna (2021). Registration on the platform and the use of e-filing significantly increase declared tax liabilities, by approximately 25% to 35%, depending on the specification. Beyond revenue effects, e-filing also improves compliance behaviour in terms of timeliness. Specifically, filing through eSINTAX increases the probability of filing on time by about 6.7 percentage points in the preferred specification, corresponding to an improvement of roughly 17% relative to the never-treated baseline of 38.3%.

Third, to better understand the compliance effects documented above, we explore the

[1]The Société à Responsabilité Limitée (SARL) is the most common form of commercial company in Burkina Faso. It is established by one or more partners who are only liable for the company's debts up to the amount of their capital contributions. The SARL is managed by one or more individuals, who may or may not be partners, as specified in the articles of association or decided collectively by the partners. Besides SARLs, there are approximately seven other types of legal statuses available.

mechanisms through which digital tax services influence taxpayer behaviour, focusing on shifts in attitudes and perceptions. Our analysis indicates that registering for or using the platform does not substantially alter practical perceptions of navigating the tax system. However, the adoption of digital payment methods for tax remittance significantly enhances perceptions of the ease of filing and post-adjustment compliance, highlighting how technology can reduce transaction costs and facilitate timely and accurate reporting.

Beyond procedural improvements, digitalization also affects broader perceptions of the tax system. Across the three indicators of technology use, electronic services contribute to higher perceived fairness, lower perceived corruption, stronger trust in the DGI, and increased recognition of the legitimacy of audits. These attitudinal shifts help explain why taxpayers who adopt digital services exhibit higher compliance: positive perceptions of the administration and its processes can reinforce the willingness to meet tax obligations.

At the same time, we observe mixed results regarding satisfaction with public services. Surveyed taxpayers often benefit from quality services, yet their overall perceptions of taxes remain largely negative. This apparent contradiction underscores the complexity of the link between service quality and tax attitudes, suggesting that while digitalization can improve procedural fairness and trust, it may not fully offset entrenched negative sentiments toward tax obligations.

Existing studies highlight significant disparities in the adoption of tax e-services across developing countries. Early models, such as the Technology Acceptance Model (Davis, 1989), emphasize perceived usefulness and ease of use as key drivers of technology uptake. Subsequent research identifies additional determinants, including education, gender, income, age, and familiarity with technology, alongside barriers such as limited information or awareness, high transaction costs, and digital skills gaps (Santoro et al., 2023; Efobi et al., 2019; Anane et al., 2022; Borg and Smith, 2018; Zins and Weill, 2016). Moreover, certain groups, such as women, less educated taxpayers, and less sophisticated businesses, have lower awareness of online services. Taxpayer awareness is also significantly correlated with interactions with the tax administration Santoro et al. (2023). A complementary literature examines the compliance effects of digitalization. Recently, an IMF study (Nose and Mengistu, 2023) found that the

incorporation of digital technologies could potentially boost tax collection, but that the benefits vary depending on the type of services introduced. Another case study from Eswatini (Santoro et al., 2024), assessing the mandate of adopting e-filing during the pandemic, shows the positive impacts of e-filing on timeliness and accuracy of reporting. Similar positive results have been produced for a different technology, electronic fiscal devices or e-invoicing, in Rwanda (Hakizimana and Santoro, 2023), Ethiopia (Mascagni et al., 2021) and Peru (Bellon et al., 2022).

This study contributes to these strands of literature in different ways. It fills a major gap by focusing on Francophone Africa, a region largely overlooked in research on digitalisation and tax compliance. Most existing studies on this topic have focused on English-speaking countries (Yimam et al., 2024; Hakizimana and Santoro, 2023; Arewa and Santoro, 2022; Anane et al., 2022). Second, we combine survey and administrative data to provide a more comprehensive understanding of technology adoption and its behavioural mechanisms, an approach rarely implemented in the literature. Third, we distinguish between adoption and actual usage of e-filing, showing that registration on the eSINTAX platform does not necessarily translate into effective utilisation. We therefore add further nuances in the understanding of taxpayers' experience with technology, while most of the studies are not able to disentangle the aspect of adoption from usage, due to data limitations.

Lastly, our empirical findings, derived from in-depth analyses of tax administration data and surveys, provide valuable guidance to policymakers and tax administrations on how to improve digital services to optimize tax revenue mobilization. This primary data, collected on the ground, plays a crucial role in formulating targeted policy reforms, ensuring an evidence-based approach, and meeting the needs of stakeholders such as policymakers and taxpayers. It also highlights the importance of tax administrations putting in place measures to improve taxpayer behaviour, such as effective communication channels, ongoing training programmes, awareness-raising initiatives in the form of games, and regular reminders of tax module updates. This evidence is particularly relevant as African governments have recently implemented public policies aimed at making digital fiscal processes mandatory (Santoro et al., 2024), often accompanied by awareness-raising campaigns and training initiatives (Okunogbe

and Santoro, 2023a).

Beyond its empirical contribution, the study offers practical insights for policymakers seeking to leverage technology for revenue mobilisation. Our results highlight the need for effective communication and training programmes to encourage adoption, continuous improvements in system reliability and user support, and measures to enhance transparency in tax administration. Ensuring that digital systems are accessible, secure, and trusted by taxpayers is critical for consolidating the compliance gains from digitalisation.

The paper is structured as follows. We start with a description of the context in Burkina Faso in section 2, followed by a detailed description of the research design in section 3. Section 4 presents the results on adoption factors and impacts on tax perceptions and behaviour. Section 5 concludes the paper.

3.2 Context and conceptual framework

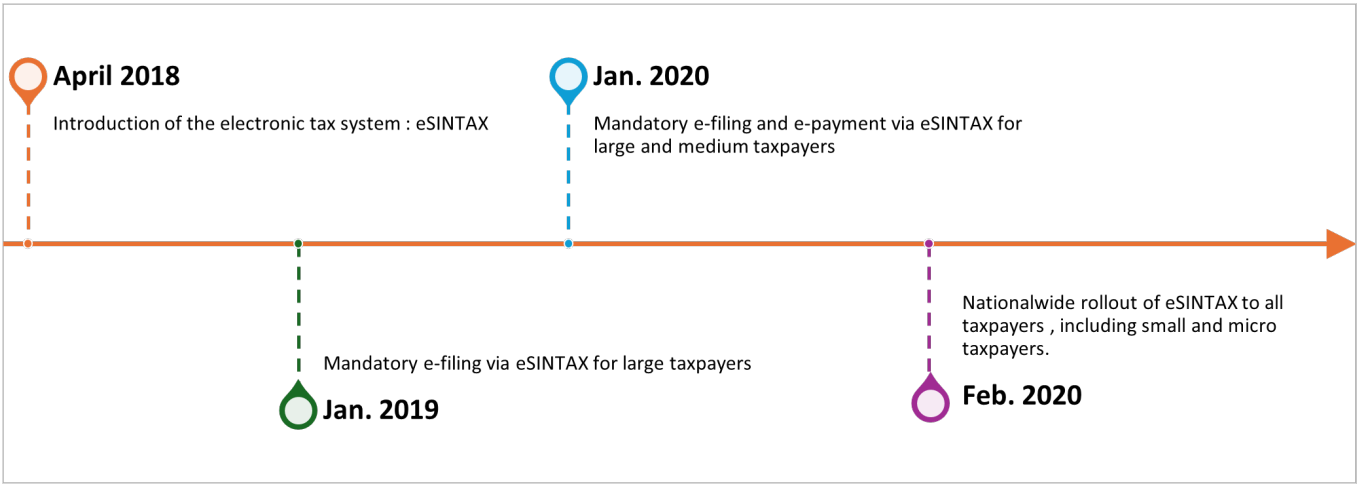
3.2.1 Institutional context: the eSINTAX reform

Burkina Faso collects about 18.8 per cent of GDP in taxes, one of the highest ratios in the West African Economic and Monetary Union in 2024 (World Bank). Yet revenue remains heavily concentrated among large firms, while small and medium-sized enterprises (SMEs) contribute little to overall receipts. The informal sector, comprising the vast majority of businesses, adds less than one per cent of domestic tax revenue. Strengthening compliance among SMEs has therefore become a central priority for the tax administration's modernisation and revenue-broadening agenda.

Over the last decade, the Burkinabe government has invested heavily in technology to modernise its systems and offer digital services to citizens. The DGI has been part of this dynamic, implementing a range of tax e-services. Launched in April 2018, the eSINTAX platform became the centerpiece of this reform. It was designed to enable taxpayers to register, file, and pay taxes online, thereby reducing compliance costs and administrative bottlenecks. The platform's rollout followed a multi-phased approach. As of 1 January 2019, large enterprises were required to submit their tax returns online, an obligation that was extended to tax

payments starting on 1 January 2020. With regard to medium-sized enterprises, the obligation to file returns online was imposed as of 1 January 2020. The DGI subsequently extended the use of the eSINTAX platform to all taxpayers subject to the real tax regime, thereby including small enterprises, as of 1 February 2020. However, as we also document in this study, this extension to small enterprises was not implemented with strict enforcement, as those that continued to file their returns at the tax office counters were still allowed to do so. Lastly, there is no legal obligation requiring micro-enterprises to use eSINTAX. They therefore use the platform more out of necessity than as a result of a regulatory requirement (see graph 3.1).

Figure 3.1: Timeline of Digital Reforms in Burkina Faso Tax System



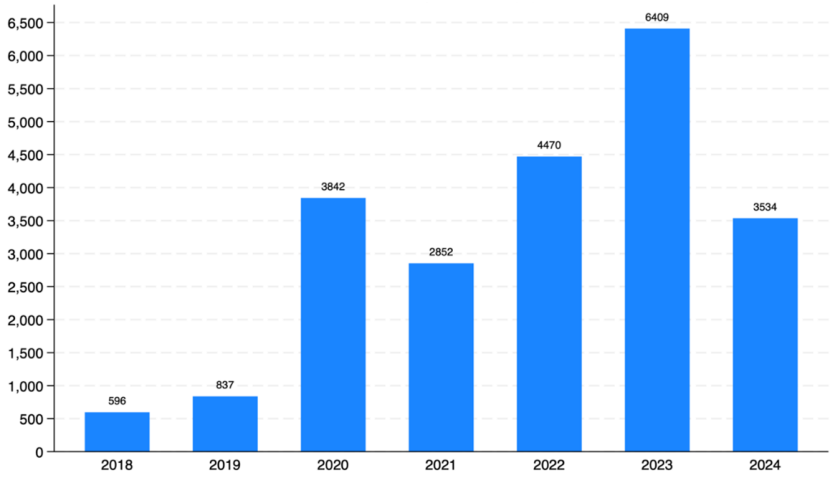
Source: Authors' own elaborations on qualitative information from official reports and interviews with DGI.

Functionalities were gradually expanded from e-filing and e-payment modules through banks and mobile money, to automated generation of withholding certificates and online access to taxpayer accounts. Importantly for our study, eSINTAX clearly indicates all tax obligations for a given taxpayer, including the declaration period and filing/payment deadline, although automatic notification of deadlines is not in place. The platform also includes a messaging system that allows taxpayers to contact the tax administration directly; however, this feature remains very little used.

To support the rollout of eSINTAX, the DGI implemented a multichannel communication strategy, including radio and television programmes, the installation of billboards along major roads in Ouagadougou and Bobo-Dioulasso, and the broadcasting of awareness videos in tax office waiting areas, all aimed at familiarising taxpayers with digital services. Within each

tax office, staff from assessment services units can assist taxpayers in meeting their needs in navigating eSINTAX. Moreover, focal points are designated in each office and serve as key contacts for any questions related to eSINTAX. This momentum was further reinforced by the Covid-19 pandemic, which accelerated the shift toward online services through government incentives and additional awareness campaigns. From the launch of the platform to 2024, eSINTAX registered 22,540 adherents, with the registration trend depicted in 3.2, for a total of 847,053 eSINTAX filings via eSINTAX.

Figure 3.2: eSINTAX registrations over time



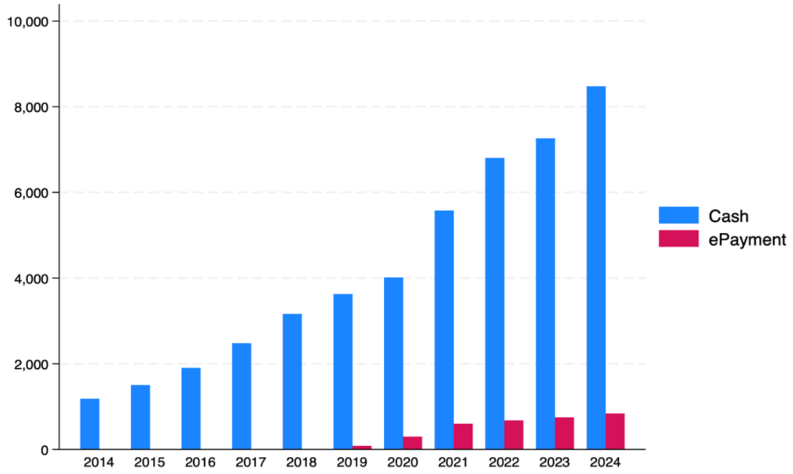
Source: Authors' own elaborations on data derived from tax administration data on business registration.

For what concerns actual payment of taxes, digital options have also been introduced to gradually reduce cash prevalence. For instance, e-payment and mpayment are described as digital payments integrated into eSINTAX to allow taxpayers to pay online via their bank account or mobile money. Beyond digital, DGI-Cash is an experimental payment method that requires payment in person at a bank counter after online submission, based on out outsourcing agreement between DGI and UBA bank[2]. Historically manual practices such as payment by cash or credit advice still take place at the tax counter. Figure 3.3 below describes the distribution of cash vs. digital payments of CIT in the past 11 years , showing how e-payments are still a minority of the total. Figure A3, derived from survey data, confirms that digital payments are still not widely used, with just a third of our sample opting for cashless options,

[2]The experiment also aimed to assess the capacity of eSINTAX to synchronise in real time with an external banking system, enabling the immediate generation of electronic receipts. The objective was notably to determine whether this mechanism could ease the workload of DGI counters, reduce queues, secure cash payments, and facilitate payment for small non-banked enterprises.

while at least two-thirds prefer cash-based payments. Such share is higher than the nation, wide distribution in figure 3.3 as the survey sample, extracted from the capital and economic hubs of the country, likely overrepresents more IT-savvy, urban taxpayers.

Figure 3.3: Tax payments over time



Source: Authors' own elaborations on data derived from tax administration data on tax payments.

After the survey implementation, in late 2023, DGI introduced e-CME[3] , a simplified mobile, money payment system for micro, enterprises with annual turnover below CFA 5 million (US $8300), while slightly larger firms, up to CFA 15 million (US $25000), remain declarative through eSINTAX. This extension marked an important step toward inclusive digital taxation, ensuring that even the smallest taxpayers can meet obligations electronically and, when necessary, pay in instalments.

These reforms demonstrate an attempt to digitalise the entire taxpayer journey, from registration to payment, while balancing administrative control with user accessibility. They provide a rich setting to examine how such digital innovations influence not only compliance outcomes but also taxpayers' perceptions of fairness and trust in the administration.

[3]eCME (Contribution des Micro Entreprises au forfait) is the digital payment device for micro-businesses with annual turnover less than CFA francs 5,000,000 (US$8,276). The main options available on the platform are: payment of taxes via mobile money, consultation of unpaid eCME, storage of RUMAP and IFU, and cancellation of RUMAP and IFU.

3.2.2 Conceptual framework: mechanisms linking e-services and compliance

The effects of e-tax services on compliance can be understood through insights from the Technology Acceptance Model (Davis, 1989) and the behavioural-compliance literature. Digital systems alter taxpayer behaviour when they are perceived as useful, easy to use, and trustworthy. They influence both the cost and the psychological payoff of compliance by simplifying procedures, reducing discretionary interactions, and signaling greater administrative transparency. Three interrelated mechanisms are expected to transmit these effects.

- Transaction-cost reduction: e-services lower the time and monetary costs of compliance by automating filing and payment processes. When taxpayers can fulfil obligations online without queuing at tax offices, the opportunity cost of compliance falls, encouraging regular and timely reporting.

- Information and interaction effects: digitalization enhances data traceability and real-time information exchange between taxpayers and the administration. By increasing the perceived probability of detection, e-services strengthen deterrence while also enabling quicker feedback and error correction. This improved informational environment can raise declared liabilities and payments even in the absence of direct enforcement.

- Trust and fairness perceptions: beyond efficiency, digital reforms reshape attitudes toward the tax system. Transparent procedures and automated validation reduce opportunities for corruption and arbitrary treatment, enhancing perceptions of fairness and institutional legitimacy. When taxpayers believe the system is impartial and their payments are properly recorded, voluntary compliance tends to rise.

These three channels, cost reduction, information transparency, and trust, form the theoretical basis for the studys second research question, which explores how digitalisation influences compliance through changes in taxpayer perceptions

3.3 Data and methodology

3.3.1 Data

Empirically, and drawing on recent literature (Santoro, 2021; Mascagni et al., 2021), we test the theoretical assumptions and expectations from section 2 by adopting a mixed-method approach. We originally combine, by leveraring taxpayer identification number, two complementary data sources: administrative records that capture behavioural responses (declared and paid taxes) and survey data that capture attitudinal responses (perceptions of fairness, corruption, and trust).

3.3.1.1 Tax administration data

Thanks to the collaboration with the DGI, we had access to the taxpayer registry. The registry contains a wealth of data, including key taxpayer elements information such as the year of registration, the tax regime to which each taxpayer is subject (whether normal or simplified), telephone contact details, geographical location, and details of the sector of activity. Our analysis covers all active small and medium businesses operating in Burkina Faso that are registered for corporation income tax (CIT). The main reason for choosing CIT is its central importance in the tax system and its significant impact on government revenue. Large firms are not part of this study, as for them adoption has been mandatory for many years[4]. Microenterprises are excluded too, as they are required to use a simplified e-services and regimes (section 2). Hence, we target a more homogeneous population of income taxpayers, while preserving variation in size, legal status and sectors of activity.

The data on CIT returns and payments provides a detailed view of the tax behaviour of taxpayers. It covers the period from 2014 to 2024. CIT returns include the turnover declared by taxpayers for each tax year, the filing date, the filing deadline, active taxpayers' status and the method of declaration, including via eSINTAX. Payment data includes the amounts of tax paid, tax year, payment date payment deadline, active taxpayers' status and the method of payment, including eSINTAX.

[4]A large firm is a business with a turnover which excluding tax is equal to or greater than CFA francs 1 billion. Microenterprise is a business with a turnover less than CFA francs 15,000,000.

In addition, the information available in the eSINTAX register allowed us to access more specific data, such as tin registration year, eSINTAX registration year, sector of activity, location and active taxpayer's status. We identified about 68,000 SMEs in the tax authority historical database, covering about 23,000 actives and 45,000 inactive taxpayers. However, to ensure the quality and relevance of our sample, we excluded inactive tax payers, including those who stopped operating and those who never filed a tax return, to avoid potential bias arising from intensive registration campaigns targeting such units (Mascagni et al., 2022). Despite these exclusions, the sample remains regionally representative and statistically reliable. Finally, we focus on the 3 safe and dynamic economic regions (Centre, Hauts-bassins and Centre-ouest). The final sample includes 11,314 SMEs that filed or paid taxes at least once from 2014 to 2024, enabling relevant and meaningful analyses of the adoption and use of digital financial services.

3.3.1.2 Survey data

The survey data provide a more granular and detailed picture of taxpayers' characteristics, attitudes and experiences. Combining such information with the evidence on compliance responses from administrative data helped disentangling the key mechanisms that could explain the main results on behaviours.

Sampling was carried out using a stratified random method, with strata being tax regime, economic sector, location and whether the business was registered and using eSINTAX. All such information relevant for the sampling was extracted directly from the eSINTAX registry and other key administrative dataset, as shared by DGI. Crucially, this enabled us to connect each surveyed business to their tax records - via an anonymised taxpayer identification number. Exclusion criteria were mostly geographical, as we restricted data collection in the capital Ouagadougou and other economic hubs (Bobo-Dioulasso and Koudougou), as fieldwork was not possible in rural and more remote areas due to security concerns. While not strictly nationally representative, such sampling strategy allowed us to achieve a sample which is representative of the fiscal and economic nature of the businesses in the urban/economic hubs.

Appendix Table A2 reports the summary statistics of the sample. We successfully interviewed approximately 1,090 taxpayers registered for corporate income tax, divided into the two main tax regimes: 61 per cent with the simplified regime (RSI) and 39 per cent with

the real regime (RN)[5]. The business sectors covered include 47 per cent services, 33 per cent commerce, and 20 per cent handicrafts. Despite being incorporate businesses, about 72% are legally established companies, while about 30% consist of individual enterprises of solo traders. The sample also represents 12 per cent women, 41 per cent taxpayers with higher education (university training level), and 50 per cent Muslims. The survey process commenced on 4 July 2023 and concluded on 14 August 2023, with an average interview duration of 46 minutes.

The survey modules were designed to cover all relevant aspects of the taxpayers' tax experience. Detailed demographic data of the main person responsible was collected, as well as the specific characteristics of each business. A key aspect of the survey was an in-depth exploration of experiences with the tax system. It included questions on the reasons for adopting and using the electronic tax platform, to gather detailed information on the factors influencing taxpayers' use of this technology. Finally, the module on the perception of tax discipline collected subjective data on taxpayers' morale and attitudes toward paying their taxes[6].

Additionally, we conducted in-depth interviews with key players in the Burkina Faso business environment. This crucial phase of our methodology involved in-depth dialogues with key figures from the DGI, the Chambre de Commerce et de l'Industrie, the Maison de l'Entreprise, and Orange Burkina. During these discussions, we carefully addressed key issues related to the adoption and use of digital services in the context of doing business in Burkina Faso. The conclusions of these interviews provide a better understanding of the context and enable the results of the study to be interpreted.

3.3.1.3 Patterns of tax e-service adoption

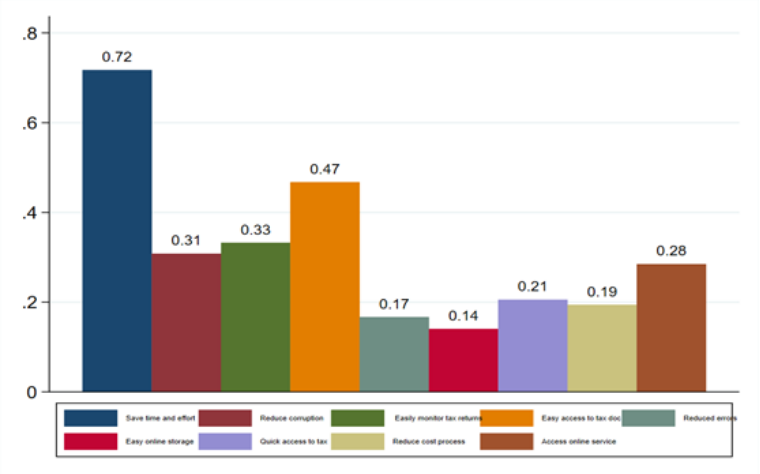
The field survey of 1,090 enterprises allows us to capture the reasons of eSINTAX adoption. Figure 3.4 shows the main reasons for adopting the electronic tax platform. Saving time and effort is the dominant factor, leading 72 per cent of taxpayers to use the platform for the

[5]RN: régime du réel normal d'imposition (real regime): individuals or legal entities whose annual turnover excluding tax is equal to or greater than CFA francs 50 million are subject to the normal real profit tax regime. RSI: régime du réel simplifié d'imposition (simplified regime): individuals or legal entities whose annual turnover excluding tax is equal to or greater than CFA francs 15 million and less than CFA francs 50 million are subject to the simplified real profit tax regime.

[6]For more information on the survey data, please see the Table A1.

electronic submission of tax returns and payments. Easy access to tax documents, especially tax status certificates, is the second most important reason, with a rate of 47 per cent. Real-time monitoring of tax files is also an important factor, influencing 33 per cent of taxpayers. Other reasons include reducing opportunities for corruption (31 per cent), quick access to tax updates (21 per cent), reducing the cost of processing tax documents (19 per cent), and access to 24/7 online services (28 per cent). On the other hand, the reduction of errors when filing tax returns and the ability to store tax documents online are mentioned at lower rates, at 17 per cent and 14 per cent respectively. These results highlight the range of functional and operational benefits that motivate taxpayers to adopt the electronic tax platform.

Figure 3.4: Reasons for eSINTAX registration



Note: data derived from survey data

In our sample of 1,090 taxpayers surveyed, 762 (70 per cent) have adopted the platform, while 328 (30 per cent) have not, as shown in Figure A1. The nuance, however, is that adoption does not always translate into active use. Some taxpayers seem to have adopted eSINTAX without necessarily using it. Of the adopters, only 630 taxpayers actively use the platform to file and pay their taxes online, representing 82 per cent of the adopters. This result highlights the complexity of taxpayers' behaviour regarding tax technologies. Figure A2 provides a more detailed explanation of the reasons why taxpayers who have registered for eSINTAX are not using the platform. It is mainly the difficulties of use and connection problems that demotivate the use of the platform.

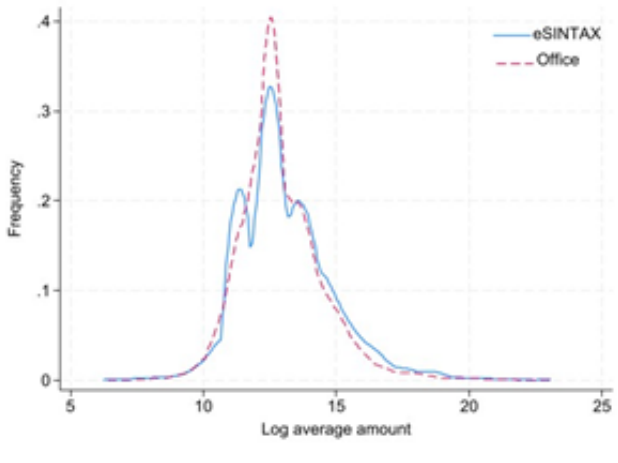
From 2018 to 2024, the amounts of tax declared according to the method of declaration show

a clear similarity between declarations made at the office and those made via the electronic platform, as illustrated in Figure 3.5(a). However, a distinct trend emerges as in-office personal returns remain the preferred option for small amounts declared. This may be explained by the familiarity and perceived security that taxpayers associate with face-to-face interaction with tax agents for smaller amounts.

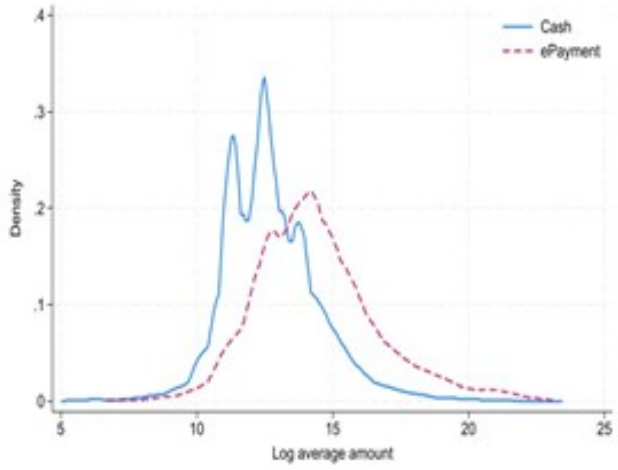
On the other hand, the use of the electronic platform has increased significantly for transactions involving larger amounts. This development suggests that taxpayers are increasingly confident in using technology to manage larger amounts. Several factors contribute to this increased confidence. Firstly, awareness of the benefits of the electronic platform, such as convenience, speed of transactions, and reduced human error, has increased because of awareness campaigns and administrative reforms. Secondly, the positive experience of early adopters has probably reassured other taxpayers about the reliability and security of the platform. The increase in the use of the electronic platform for higher tax amounts also reflects a gradual adaptation of taxpayers to digital technologies, often encouraged by government initiatives to modernise tax services.

Figure 3.5: Average amounts of tax declared and paid (2018 to 2024)

((a)) E-filing vs manual filing



((b)) Digital vs cash



Source: Authors' elaborations on data derived from the administration

Figure 3.5(b) compares the amounts of taxes actually paid by payment method and highlights a clear distinction between digital and cash payments. Digital payments are associated with substantially higher tax amounts than cash payments, suggesting that taxpayers are more

likely to rely on electronic channels for larger transactions. This pattern may reflect the greater traceability and security offered by digital payments, as well as the fact that more formalised firms with better access to financial services are more inclined to use these options. Overall, the results indicate that the digitalization of tax payments plays a particularly important role for settling higher tax liabilities.

3.3.2 Estimation strategy

As a first exercise, we analyse the factors that explain taxpayers' adoption of tax e-filing and e-payment services. Our approach is encapsulated in the following probit equation, which forms the framework of our methodology:

$$Y_i = f(\beta' Individ_i; \gamma' Business_i; \lambda' DFS_i; \delta' Taxs_i; \mu_i; \epsilon_i) \tag{3.1}$$

where we consider Y_i as the dependent variable, which is a binary variable indicating the adoption of tax e-service. This adoption is firstly defined by the registration to eSINTAX. We then distinguish between the general use of the eSINTAX platform and the different payment methods associated with this platform, highlighting the differences in the adoption factors (table A3).

In terms of explanatory factors, we divide these into four different categories. In each eSINTAX step, we use the same set of covariates. First, we consider a set of individual characteristics of the primary taxpayer. Second, we consider a set of characteristics related to the firm. Thirdly, we analyse a set of characteristics specific to tax-related electronic services. Fourth, we consider a set of tax-related factors (table A4). The associated probit coefficients, denoted β', γ', λ', and δ', indicate the relative importance of each factor in the adoption process. μ_i is the vector of district fixed effects included to account for regional specificities, and standard errors are clustered at the district level. ϵ_i is the error term. In addition, we run a few regressions in which we distinguish between the two tax regimes (RN and RSI) to assess whether adoption factors differ across fiscal systems.

Impact on tax behaviour : In order to address our research question on the impact of tax e-services adoption on compliance behaviour, we assess the effect of each step of

eSINTAX (adoption, filing and payment) on the tax declared and tax paid, as derived from tax administrative data in 2014-2024. Thus, we identify three different treatment indicators: eSINTAX adoption, eSINTAX filing and tax e-payment, and two outcomes: tax declared and tax paid.

We adopt a difference-in-differences (DiD) method with staggered treatment adoption and heterogenous dynamic effects, as proposed by Callaway and SantAnna (2021). This method best exploits the panel nature of our administrative data on filings and payments, also allowing for different outcome trends after adoption. This method is also best suited for staggered treatment adoption, as for eSINTAX users who register for the technology at different points in time[7]. In addition, we restrict our study to taxpayers for whom at least one filing period before and after the first period of eSINTAX usage can be observed in the administrative data.

This approach is proven to be more robust as it does not suffer from the common pitfalls with two-way fixed effects, namely the 'negative weight problem' with linear regressions, highlighted by De Chaisemartin and dHaultfoeuille (2020) and Sun and Abraham (2021). We apply the average treatment effect of units who are members of a specific group g at a particular period t, that is they started using eSINTAX at the same time - conditional on pre-treatment covariates X as follows: :

$$\mathrm{ATT}(g,t) \equiv \mathbb{E}[Y_t(g) - Y_t(0) \mid X,\ G_g = 1] \tag{3.2}$$

Where G_g is a binary variable that is equal to one if a unit is first treated in period g. Here, there are three different treatments in separate regressions: eSINTAX adoption, eSINTAX filing, and e-tax payment. Y_t represents the amount of CIT declared and paid in each reporting period t. X represents a set of covariates, such as an Ouagadougou-specific binary variable taking the value of 1 for firms located in the capital and 0 otherwise, a dummy variable taking the value of 1 for firms operating in the trade sector and 0 if not, and another dummy variable taking the value of 1 if filing/payments before the deadline and 0 otherwise. Then, we measure the overall effect of policy intervention by aggregating the average treatment effect for all groups across all

[7]In this approach, when one unit is treated, it remains treated in the next periods - that is, the treatment status is absorbing. This is the case with our datasets, as e-services users keep using them after the first period of adoption

periods. In other words, we aggregate the results by averaging the year-by-year effect in a single series of estimations relative to the ATT for the event study. We calculate the average effect of treated ATT for event times e relative to the year of treatment $g(e = tg)$. In equation 4, we use the suggested group-dependent weights $w(g,t)$ following Callaway and Sant'Anna (2021).

$$\text{ATT} = \sum_{g \in G} w(g,t) \ * \text{ATT}(g,t) \tag{3.3}$$

Mechanisms : As a way to explore potential mechanisms behind the behavioural effect, we produced correlational evidence using survey data. We carried out a linear regression using the OLS model, connecting survey-based tax attitudes and e-services adoption, as follows:

$$Y_i = f(\beta' DFS; \gamma' Controls) \tag{3.4}$$

where Yi represents two groups of variables concerning tax perceptions. We distinguish more practical tax perceptions from more general and broad ones. The practical tax perceptions are defined by three specific indicators, i.e. variables representing respectively ease of contact with the tax authorities, ease of tax filing/payment, and ease of tax recovery. For the more general tax perceptions, there are eight indicators. These are a set of soft motivations to comply that are related to conditional tax morality (Prichard, 2022) such as the fairness of the tax amount, paying taxes to benefit from better public services, satisfaction with public services, transparent use of tax revenues, the presumption of betting, and a set of perceptions related to deterrence and trust in the tax authority, namely being selected for an audit, trust in the DGI and perceptions about if corruption can or cannot make doing business easier[8].

3.4 Results

3.4.1 Determinants of electronic services Adoption

We now explore the main factors affecting the adoption of e-services, considering the registration on the eSINTAX platform (adoption), actual filing through eSINTAX (usage), and digital payment of taxes (e-payment). We present the coefficient plots in Figure 3.4(a) , 3.4(b), and

[8]For more information on the survey data, please see the Table A2.

3.4(c) for the three outcomes, respectively, from the tables (A5; A6; A7).

From Table 3.1, which summarises the previous graphs, it emerges that factors like using electronic sales machines, having higher tax knowledge, operating in the trade sector, having been audited, having a dedicated accounting department, and operating in older businesses are all significantly positively correlated with eSINTAX registration, actual filing and digital payments registration, actual filing, and digital payments. All these factors point to a pattern in which more established, IT-ready, and sophisticated businesses are more likely to adopt technology. This pattern has been established in other contexts as well, as in Rwanda and Eswatini (Santoro, 2021; Santoro et al., 2023).

For instance, the SARL legal status of firms is more likely to characterise larger businesses in the trading sector. These more complex entities tend to have more rigorous accounting systems, and a higher familiarity with the tax system and hence with the different aspects of digitalization. Consistently, very small businesses (fewer than five employees) are much less likely to adopt eSINTAX, even though this dimension does not matter for digital payments. Relatedly, being in the trade sector is also a key factor in all regressions. Considering that most trading companies are also active in foreign trade, they might be familiar with digital procedures to respect tax obligations (say, at customs), or with cashless payments. Relatedly, using electronic billing machines directly correlates with technology adoption, indicating positive spillovers across digital services. It is also true that EBM users might be more aware of the benefits of digital services and perceive higher scrutiny from the tax administration.

Furthermore, the relevance of tax knowledge can be explained as more knowledgeable firms might be more aware of the regulatory background and requirements, on top of knowing more about the benefits from digitalization. This dimension also nicely resonates with the role played by the account department factor. Firms with an accounting department might benefit from accountants with high tax knowledge and IT readiness. Unsurprisingly, this translates into higher technology adoption. Interestingly, technology adoption correlates strongly with having received an audit, indicating that audited firms are more likely to respect regulations around eSINTAX adoption, probably due to a strong perception of being on the tax agency's radar.

Table 3.1: Determinants of adoption of tax e-services

	Registration	E-filing	E-payment
Tax knowledge index	+	+	+
Legal Status: SARL	+	+	+
Trade sector	+	+	+
Account department	+	+	+
Older businesses	+	+	+
Tax audit	+	+	+
Sales electronic machine	+	+	+
Mobile Money Customers	-	-	-
Female	+	+	
Access internet for business	+	+	
Interaction with DGI	+	-	
CEO experience	+	-	
Online trading	-	+	
Less than 5 employees	-	-	
Mobile Money Knowledge		+	+
Higher education		-	+
CEO religion: Islam	-		
Bank transaction time		-	
Bank account		-	
Older taxpayers			+

Source: Authors own elaboration based on survey data.

Lastly, older businesses are more likely to make use of technology. These firms might be more familiar with the tax system and have witnessed the rise in technology in government services, adapting to it. Also, arguably these businesses have had more interaction with the tax administration and hence have been more exposed to the new digital advancements in the tax system. This finding might also simply suggest that it takes time to fully adopt technology, and more recently established firms are only slowly adapting to it.

Among the factors affecting eSINTAX registration and usage without affecting digital payments, it is worth mentioning the role of internet access. The eSINTAX platform requires a stable internet connection for registration and usage. Those firms without connections fail then to adopt technology and are left out of the platform. Another important factor to discuss is the gender dimension. The results show that female respondents are more likely to adopt eSINTAX and use it for filing taxes. This could be related to the fact that women are more likely to respect tax obligations (Stockard et al., 1988) hence they would abide more with the 2018 law concerning eSINTAX adoption. It could also simply mean that female taxpayers

prefer the digital platform as it enables remote compliance, avoiding in-person interactions with tax officials.

As a last key factor to consider, having a higher knowledge of mobile money positively correlates with using cashless payments. This finding is consistent with recent research around digital merchant payments in Ghana (Abounabhan et al., 2024) and Rwanda (Bernad et al., 2023), where knowledge of mobile money is a direct enabling factor for merchants' digital payments with their customers. This happens also for person-to-government payments in Burkina Faso, where taxpayers who know more about mobile money prefer cashless means of tax payments.

However, contrary to expectations, certain factors influence the adoption and usage of eSINTAX in unexpected ways. Businesses whose customers use mobile money, those involved in e-commerce, those with a bank account, and those with fewer than five employees show the opposite trends to those expected. Businesses using mobile money, despite their familiarity with digital transactions, may be reluctant to adopt new technologies that are perceived as complex or not in line with their current practices. E-commerce businesses, while accustomed to using digital tools, may have integrated and proven processes that make it difficult to integrate new systems. In addition, businesses with bank accounts, while having access to modern financial infrastructures, may have concerns about the security and confidentiality of data processed by the platform. Finally, small businesses, which often have limited resources and a heavy administrative burden, may find new technologies costly and difficult to meet their immediate needs. These factors highlight the complexity of the barriers to the adoption of tax technology and underline the need for more nuanced approaches to address these specific challenges.

3.4.2 Impacts on tax compliance behavior

We first assess the effect of eSINTAX registration and eSINTAX filing on the tax-declared amount. Second, we measure the effect of digital payment adoption on the amount of tax paid. For each analysis, we deploy the difference-in-difference with staggered treatment and dynamic trends following (Callaway and SantAnna, 2021). Table 3.2 (Figure A5) highlights the result of eSINTAX adoption (panel a) and usage (panel b) on the amount of tax declared.

Column (1) presents results without controls while column (2) produces more precise results by adding controls. First off, the simple eSINTAX registration has a positive and significant effect on the tax-declared amount, by about 0.237 log points, highly statistically significant. The magnitude of the estimate corresponds to an increase of approximately 26.7% relative to the average log tax declared by not yet treated firms, consistent across specifications. Similar results are found for the actual usage of the platform, that is filing through eSINTAX (panel b). E-filing produces an increase in the tax liability declared by 0.168 log points, smaller than the estimate from registration, which amounts to an 18.3% increase in relative terms.

Table 3.2: Impacts of eSINTAX registration and filing on tax declared

	(1) Log tax declared	(2) Log tax declared
(a) Registration		
eSINTAX registration	0.297***	0.237***
	(6.74)	(4.77)
N	17,966	14,790
Controls	No	Yes
Never-treated average log-tax declared	13.061	
(b) Usage		
eSINTAX filing	0.223***	0.168***
	(4.70)	(3.28)
N	18,591	15,417
Controls	No	Yes
Never-treated average log-tax declared	12.781	

Note: t-statistics in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.
Source: Authors own elaboration based on administration data.

Second, our analysis focuses on the effect of tax e-payments on the amount of tax paid. Table 3.3 (Figure A7) shows a positive, albeit not significant when controls are added, effect on tax paid. The positive effect, albeit modest and not consistent across specifications, indicates that taxpayers who adopt digital payment may tend to pay higher amounts of tax.

Table 3.3: Impacts of digital payments on tax paid

	(1) Log tax paid	(2) Log tax paid
eSINTAX payment	0.130**	0.096
	(2.02)	(1.18)
N	24,207	18,249
Controls	No	Yes
Never-treated average log-tax paid	12.972	

Note: t-statistics in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.
Source: Authors own elaboration based on administration data.

Lastly, we consider additional indicators for tax compliance behaviour, namely timeliness in respecting filing and payment deadlines. Table 3.4 below reports the Callaway and Sant'Anna estimates for a regression measuring impacts of e-filing on timeliness of returns, proxied by a 0-1 dummy for filing on time. Despite the mixed evidence from survey data, this more robust analysis indicates a highly statistically significant impact of e-filing on filing on time, an increase of 6.7 p.p., when controls are added (column 2), which represents an increase of about 17% of the control group mean. Such increase is quite sizeable and more economically meaningful than the negligible increases in tax declared (Table 3.2)[9]. On top of helping taxpayers respect deadlines, e-filing also spares them from often-severe and regressive penalties for filing late.

Table 3.4: Impact of eSINTAX filing on filing on time

	(1) Filing on time	(2) Filing on time
eSINTAX filing	0.075***	0.067***
	(4.55)	(3.48)
N	27,279	23,229
Controls	No	Yes
Never-treated average filing on time	0.383	

Note: t-statistics in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.
Source: Authors own elaboration based on administration data.

[9]The same positive evidence is not found when looking at digital payments and paying on line (Appendix Table A8).

3.4.3 Mechanisms

In this section, we leverage survey data to disentangle the key mechanisms that could explain the main results on behaviour, based on the theoretical framework developed in section 2. We focus on survey respondents' tax perceptions, considering two sets of indicators. The first set refers to practical perceptions around navigating the tax system, connecting to the theoretical assumptions on transaction-cost reduction, while the second consists of broader soft perceptions and opinions around the tax system, more tied to our theoretical formulations around information/interaction, trust and fairness (section 2).

Table 3.5 column (1) analyses the effect of technology on an outcome indicating the ease of contacting the tax revenue authority. Column (2) assesses the same effect on the perceived ease to file tax returns and the last column shows how technology can act on the opinion concerning the ease of tax adjustments. Results on practical perceptions are quite mixed, especially in light of a significant improvements in filing on time (3.4), which hint at taxpayers better knowing how to navigate the tax system. In panel a, we find no tangible correlation between registering for eSINTAX and any of the practical perceptions. These results remain insignificant for panel b which shows the correlation between actually using the platform for filing and the practical perceptions. In panel c, where we evaluate the effect of digital payments, there is a positive and statistically significant relation concerning the outcomes "easy to file" (11 p.p.) and "easy adjustment" (17 p.p.). Relevantly, on the "easy adjustment" side, the positive and significant effects can be explained by the fact that the platform indicates the amount the firm must pay after the tax adjustment. This facilitates taxpayers' experience with the system at the time of paying, improving corresponding perceptions, even if the feature showing amounts due after adjustments comes with the e-filing platform itself, and not the digital channels of payments. We do not find any improvements on the ease to contact the tax agency, which is an aspect DGI can work more to strengthen the accessibility and user experience of its digital solutions.

The second aspect of tax compliance is the effect of eSINTAX on soft tax perception, highlighted in Table 3.6. Here, we build indicators like peer pressure or social norms (column 1), agreeing with a statement of tax reciprocity (column 2), perceived fairness or high tax equity (column 3), perception of corruption in the tax system (column 4), high satisfaction with the

Table 3.5: Correlates of technology adoption and practical tax perceptions

	(1) Easy contact DGI	(2) Easy to file	(3) Easy adjustment
(a) eSINTAX registration			
esintax registered	-0.03	0.08	0.06
	(0.02)	(0.03)	(0.03)
District FE	Yes	Yes	Yes
Controls	Yes	Yes	Yes
R-sq.	0.09	0.20	0.28
Observations	975	1046	1005
(b) eSINTAX filing			
eSINTAX filing	0.01	0.02	0.05
	(0.01)	(0.02)	(0.04)
District FE	Yes	Yes	Yes
Controls	Yes	Yes	Yes
R-sq.	0.10	0.17	0.25
Observations	846	909	874
(c) eSINTAX payment			
Digital payments	-0.00	0.11*	0.17**
	(0.02)	(0.03)	(0.03)
District FE	Yes	Yes	Yes
Controls	Yes	Yes	Yes
R-sq.	0.09	0.20	0.29
Observations	982	1054	1012

Standard errors in parentheses

Outcome is More practical perceptions

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

provision of public services (column 5), perceived transparency in how tax revenues are used (column 6), trust in tax administration (column 7) and acknowledgement of the DGI's right to audit or control taxpayers (column 8). We explore correlations for our three main indicators of tax e-services adoption.

Results in the first panel a reveal no effect of registering for eSINTAX on peer pressure, reciprocity, fairness, transparency, and right to audit. However, positive correlations are found between registering on the platform and perceiving no corruption in the system, feeling more satisfied with public services, and sensing higher trust towards the tax administration. This positive evidence hints at improvements in the perceived transparency of the tax system overall,

thanks to the access to the platform. Users believe the system is now more predictable, less prone to corruption or bribery, and more trustworthy. Even if marginally significant, we find a positive effect on satisfaction with public services, probably as taxpayers see the e-filing platform as a public service offered to them. Broader tax perceptions around social norms, reciprocity, fairness, and enforcement remain untouched, as these probably need a stronger intervention or policy change to be shaped.

Panel b indicates that actual usage correlates with a highly significant improvement in perceived fairness, and a less significant one in fiscal reciprocity, as well as with a negative change in satisfaction with public services. The positive variation is encouraging in the sense that using the platform to comply might be increasing the perceived equity in the amounts declared, now more transparent and predictable than a historically manual, paper-based, practice, which in turn stresses the role of tax remitted to fund public services. As for the deleterious effect on public service satisfaction, it is a surprising effect that is somehow in contrast to evidence in the case of panel a. This could be explained by the fact that actual users of eSINTAX, compared to those that merely registered, are declaring taxes to the DGI - while they now see value in those taxes to fund growth, they are still dissatisfied with the quality and provision of those public services their taxes are meant to fund.

In panel c, assessing the effect of tax digital payments, we find a positive and significant improvement on the perceived absence of corruption, public service satisfaction, tax revenue transparency, and the DGI's right to audit variables. The strong reduction of perceived corruption can be explained by the fact that, for users of digital payments solutions, cash-based payments, which are more prone to negotiation or bribe-extortion, are abandoned. Limiting physical interactions between taxpayers and tax collectors seems to reduce the possibility of collusion and corruption. When it comes to the enhanced endorsement of the DGI's right to audit taxpayers, this could be explained by taxpayers who pay digitally believing that corruption or evasion should be curbed. Given the higher transparency of digital payments, users would think that is the right of the DGI to prosecute non-compliant taxpayers, probably those paying in cash, with a higher chance of collusion. We also document a weakly significant, positive effect on public service satisfaction, which is somewhat in contrast with the negative

impact of eSINTAX filing described above, and thus needs further research to fully understand its underlying mechanisms.

Table 3.6: Correlates of technology adoption and broader tax perceptions

	(1) Peer pressure	(2) Statement closest	(3) Fairness	(4) No corruption	(5) Service satisfacty	(6) Revenue satisfacty	(7) Trust	(8) Right to audit
(a) eSINTAX registration								
eSINTAX regist	-0.01	0.07	0.03	0.07**	0.14*	-0.01	0.10**	0.06
	(0.01)	(0.08)	(0.06)	(0.01)	(0.04)	(0.03)	(0.02)	(0.04)
District FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-sq.	0.26	0.27	0.26	0.19	0.13	0.13	0.19	0.18
Observations	1045	1079	1030	1052	1076	974	1054	1020
(b) eSINTAX filing								
eSINTAX filing	-0.05	0.05*	0.15***	-0.02	-0.09**	-0.01	-0.01	-0.02
	(0.03)	(0.02)	(0.01)	(0.03)	(0.02)	(0.03)	(0.02)	(0.03)
District FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-sq.	0.24	0.32	0.29	0.17	0.16	0.13	0.21	0.17
Observations	906	934	890	913	932	849	912	885
(c) eSINTAX payments								
Digital payments	-0.02	0.05	0.01	0.09***	0.12*	0.01**	-0.02	0.06**
	(0.01)	(0.04)	(0.01)	(0.00)	(0.03)	(0.00)	(0.01)	(0.01)
District FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-sq.	0.26	0.27	0.26	0.19	0.14	0.13	0.18	0.18
Observations	1055	1089	1038	1062	1086	982	1063	1030

Standard errors in parentheses
Outcome is Tax morale perceptions
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

In sum, it is true that tax e-services contribute to raise only little extra revenue from users. However, beyond mere revenue considerations, a range of mechanisms are in place. First, technology help users to file on-time, in line with our transaction cost formulation. This finding is very similar to that of e-filing solutions in Eswatini (Santoro et al., 2023). Second, users feature considerably better perceptions and opinions of the tax system, especially around fairness, (lack of) corruption and trust, thus confirming our theoretical expectations. Such evidence corroborates similarly positive results of e-filing in Tajikistan (Okunogbe and Pouliquen, 2022).

3.5 Conclusions and policy recommendations

This paper examines the adoption and effects of electronic tax services, registration on the eSINTAX platform, e-filing, and digital tax payments, among small and medium-sized enterprises in Burkina Faso. Drawing on a unique combination of administrative tax records and original survey data, it provides new evidence from a Francophone African context on how digitalization shapes tax compliance behaviour and taxpayer perceptions.

Three main findings emerge. First, the adoption of electronic tax services is strongly patterned by firm characteristics associated with formality, administrative capacity, and prior exposure to the tax system. Older firms, those with a formal legal status, accounting capacity, prior audit experience, and familiarity with electronic billing technologies are consistently more likely to register for, use, and pay taxes through eSINTAX. These results suggest that digital uptake is not random, but closely linked to existing compliance capacity and engagement with the tax administration. At the same time, the descriptive nature of these associations call for caution in interpreting individual determinants as distinct drivers of adoption.

Second, the paper documents statistically significant effects of digital tax services on compliance outcomes, though these effects are economically modest. Registration on the platform and actual e-filing are associated with higher declared tax liabilities, while digital tax payments are associated with higher amounts paid, although the latter effect weakens once controls are introduced. More robust and economically meaningful effects are observed on timeliness: e-filing substantially increases the probability of filing on time, reducing exposure to penalties and easing administrative processing. Taken together, these findings suggest that the primary compliance gains from digitalization among SMEs lie less in expanding the tax base or sharply increasing revenue, and more in improving the regularity, accuracy, and predictability of compliance.

Third, the analysis of taxpayer perceptions provides suggestive evidence on the mechanisms through which digitalization may influence behaviour. While registration and e-filing show limited associations with practical perceptions of navigating the tax system, digital tax payments are positively associated with perceived ease of filing and post-adjustment compliance.

More broadly, adoption and use of digital services are correlated with improved perceptions of transparency, reduced corruption, and higher trust in the tax administration. These results are consistent with theoretical expectations that digitalization can reduce discretionary interactions and increase institutional legitimacy. However, because these relationships are identified using cross-sectional survey data, they should be interpreted as correlational rather than causal.

Overall, the findings highlight that digital tax reforms can yield meaningful benefits even when their immediate revenue impact is limited. By improving filing timeliness, reducing opportunities for corruption, and strengthening trust in the tax administration, electronic tax services can contribute to gradual and sustainable improvements in tax compliance, particularly among smaller firms. The policy implications of these findings are several. First, efforts to expand the uptake of digital tax services should prioritise targeted support for firms with lower administrative and digital capacity, including tailored communication, practical training, and hands-on assistance. Second, continued investment in reliable digital infrastructure and user-friendly system design is essential to ensure that digitalization effectively reduces compliance costs rather than shifting them onto taxpayers. Third, complementary measures, such as greater transparency around tax procedures and the use of revenues, may help reinforce the trust-enhancing effects of digital reforms. Finally, digitalization should be viewed as part of a broader strategy of tax administration modernisation, where improvements in service delivery, enforcement, and taxpayer engagement jointly shape compliance outcomes over time.

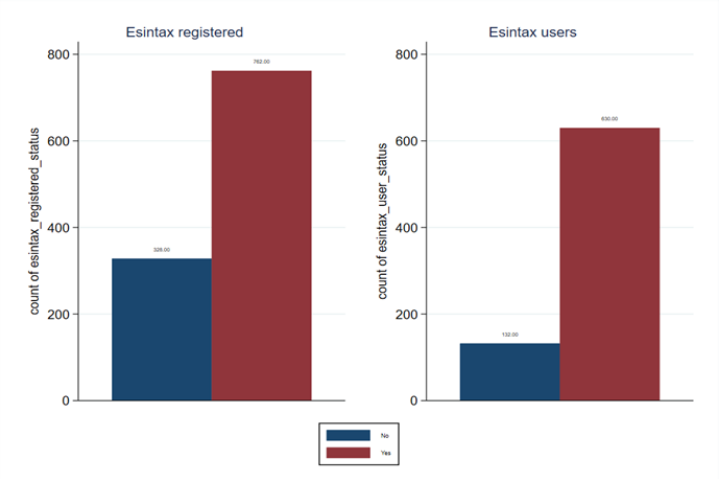
Appendix B

Table A1: Description of the interview questions and modality of responses

Category	Variable	Survey question	Possible response	Variable coding
Demographic (individual)	Female	What is the gender of the company's 1st manager?	Female 1 Male 0	0.Male; 1.Female
	Age median	how old is the manager?	Open answer 18+	1. if age > age meian; 0. if not
	Higher education	What is the highest level of education completed by the principal?	Lower secondary school (post primary) 04, Secondary school (lycée, BEP or CAP, BAC) 05, Post-secondary qualification (vocational training school) 06, University education (BTS, DUT, licence, Master, Doctorat) 07, Literacy (in national languages) 08	1. if 6. University education and 0. Otherwise
	Religion	What is the religious affiliation of the person in charge?	01. Atheism 02. Christianity 03. Islam 0 4. Animism 05. Other (please specify)	1. if 3.Islam and 0. Otherwise
	High Experience	How many years of professional experience does the 1st manager have in his field?	01. Between 1 and 5 years 02. Between 6 and 15 years 03. More than 15 years	1. if 3.More than 15 years and 0. Otherwise
Business characteristics	Less than 5 employees	How many permanent employees and temporary workers does your company employ in total?	01. Less than 5 02. 5 - 19 03. 20 - 49 04. 50 - 99 05. 100+	1. if 1.Less than 5 and 0. Otherwise
	Industry (trade)	What is the activity sector?	1.Trade, 2. Industry 3. Services	1. if 1.Trade and 0. Otherwise
	Account department	Does the company have an accounts department?	01. Yes 02. No	1. Yes; 0. No
	Online trading	Does the company sell its products or services online?	01. Yes 02. No	1. Yes; 0. No
	Bank account	Does this establishment have a bank account?	01. Yes 02. No	1. Yes; 0. No
	Legal status	What is the current legal status of the company?	Open anwer	1. if SARL; 0. if not
	Internet	Does the company have access to the Internet via mobile or optical fibre?	01. Yes 02. No	1. Yes; 0. No
Digital Financial Services	Mobile Money for customer	Which of these payment methods do your customers accept?	01 Cash 02.Mobile money (Orange money and/or Moov money) 03.Credit cards 04.Bank transfer/Internet Banking 05.Cheques	1. if 2.Mobile money and 0. if not
	Electronic Sale Machine	When you make a sale, do you use an electronic machine at the point of sale	01. Yes 02. No	1. Yes; 0. No
	Bank transaction time median	How much time do you need to spend queuing at a bank to complete a transaction?	Open answers in hours	1. if Bank transaction time > Bank transaction time median; 0. if not

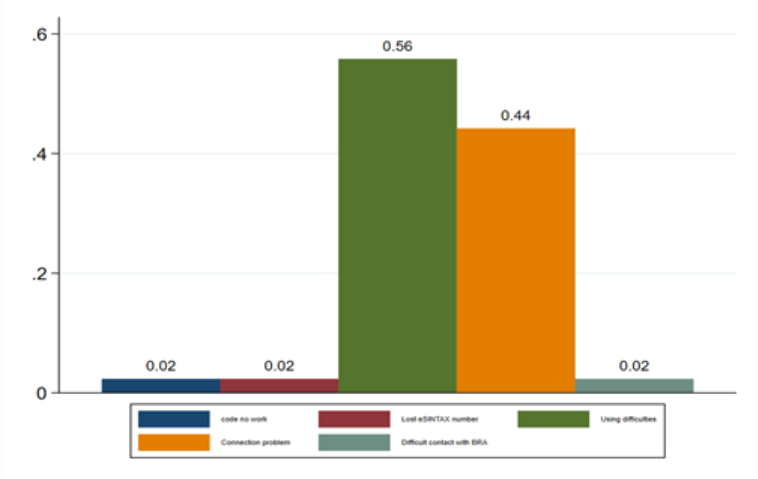
Category	Variable	Survey question	Possible response	Variable coding
Tax	Tax knowledge index	Who is responsible for managing your company's tax obligations?	02. Friends/family members 03. An internal accountant 04. An external accountant 05. The owner 06. Business partner/external partner 07. Secretary 08. Tax official 09. Casual employee 11. Other [please specify]	
		What is the rate of corporation tax in Burkina Faso?	Open answer	
	Tax audit	During the last 5 years, has your company ever been subject to a tax audit by the DGI?	01. Yes 02. No	1. Yes; 0. No
	Interaction with tax authority	How often did you use the DGI for services other than returns and payments in 2022?	Open answer	1. Yes; 0. No
	Easy contact DGI	More generally, how easy or difficult is it to contact the DGI for help, assistance or information?	01. Very easy 02. Easy 03. Difficult 04. Very difficult	1. if 1. or 2. and 0. if not
	Easy declaring	What is the level of difficulty related to the declaration/payment of taxes that may hinder the operation of this business?	01.No difficulty 02.Moderate 03. Major 04. Severe	1. if 1. or 2. and 0. if not
	Easy adjustment	What is the level of difficulty following an adjustment by the tax authorities that could hinder the operation of this business?	01. No difficulty 02. Moderate 03. Major 04. Severe	1. if 1. or 2. and 0. if not
	Peer pressure	Please tell me whether you totally agree, somewhat agree, somewhat disagree or totally disagree with the following statement: If my neighbours don't pay tax, it's only fair that I don't pay tax either.	01. Totally disagree 02. Somewhat disagree 03. Somewhat agree 04. Totally agree	1. if 3. or 4. and 0. if not
	Statement closest	Which of the following statements is closest to your point of view? Choose statement 1 or statement 2:	1. Taxpayers must pay their taxes to the government in order to benefit from better public services. 2. Taxpayers can refuse to pay their taxes if they do not receive adequate public services.	1. if 1. and 0. if not
	Fairness	To what extent do you think the amount of all official taxes you have to pay is fair?	01. Very unfair 02. Unfair 03. Fair 04. Very fair	1. if 3. or 4. and 0. if not
	No corruption	How many difficulties do you encounter in your work related to corruption?	01. No difficulties 02.Moderate 03.Major 04.Severe	1. if 1. or 2. and 0. if not
	Service satisfacty	On a scale of 1 to 5, how satisfied are you with the delivery of public services?	01 - totally dissatisfied 02 - dissatisfied 03 - neither satisfied nor dissatisfied 04 - satisfied 05 - totally satisfied	1. if 4. or 5. and 0. if not
	Revenue satisfacty	In your experience, is it easy to find out how the government uses the revenue from citizens' taxes?	01. Very easy 02. Easy 03. Difficult 04. Very difficult	1. if 3.Islam and 0. if not
	Trust	To what extent do you trust the DGI to act in the interests of ordinary taxpayers?	01. A great deal of confidence 02. Some confidence 03. Not very confident 04. No confidence at all	1. if 1. or 2. and 0. if not
	Right to audit	Is selecting a company for an audit a bad thing?	01. Yes 02. No	1. Yes; 0. No

Figure A1: eSINTAX status, sample population



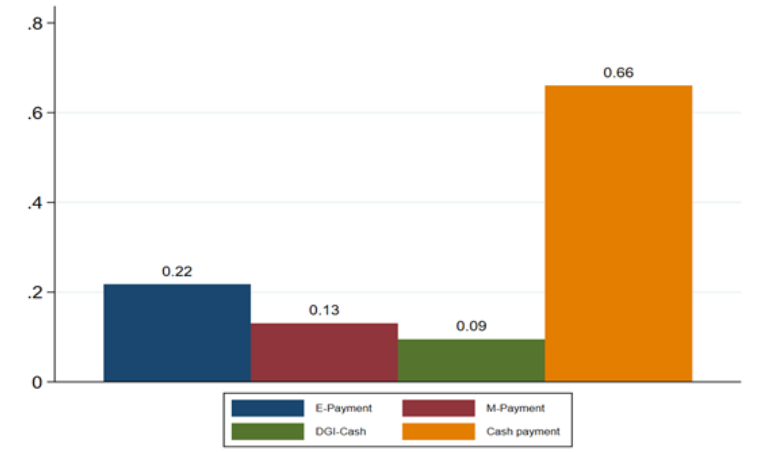
Note: data derived from survey data

Figure A2: Reasons for not using eSINTAX



Note: data derived from survey data

Figure A3: Tax payment mode



Note: data derived from survey data

Table A2: Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
E-filing and e-payment adoption					
eSINTAX registered	1,090	0.699	0.459	0	1
eSINTAX user	1,090	0.578	0.494	0	1
Tax e-payment	1,090	0.095	0.294	0	1
Demographics					
Female	1,090	0.122	0.327	0	1
High education	1,090	0.415	0.493	0	1
High experience (more than 5 years)	1,090	0.728	0.445	0	1
CEO religion Christian	1,090	0.486	0.500	0	1
CEO age	1,090	45.3	8.4	21	75
Business features					
Less than 5 employees	1,090	0.355	0.479	0	1
Internet for business	1,090	0.749	0.434	0	1
Bank account for business	1,090	0.917	0.275	0	1
Trade online	1,090	0.252	0.433	0	1
Trade sector	1,090	0.339	0.473	0	1
Accounts	1,090	0.833	0.373	0	1
SARL legal status	1,090	0.622	0.485	0	1
Time bank median	1,090	0.215	0.411	0	1
Mobile money knowledge	1,090	0.559	0.497	0	1
Uses electronic fiscal device	1,090	0.082	0.274	0	1
Uses digital payments with customers	1,090	0.619	0.486	0	1
Tax profile					
RSI tax regime	1,090	0.612	0.487	0	1
Tax knowledge index	1,090	0.621	0.486	0	1
Interacted with DGI	1,090	0.389	0.488	0	1
Tax audited	1,090	0.277	0.448	0	1
Practical perceptions					
Easy contact DGI	982	0.759	0.428	0	1
Easy declaring	1,054	0.484	0.500	0	1
Easy adjustment	1,012	0.488	0.500	0	1
Soft tax perceptions					
Peer pressure	1,055	0.223	0.416	0	1
Must always pay taxes	1,089	0.792	0.406	0	1
Fairness	1,038	0.646	0.478	0	1
No corruption	1,062	0.492	0.500	0	1
Service satisfactory	1,086	0.245	0.430	0	1
Revenue satisfactory	982	0.495	0.500	0	1
Trust	1,063	0.693	0.461	0	1
Right to audit	1,030	0.099	0.299	0	1

Table A3: Interest variables description

Variables	Definition
eSINTAX registration	Represents membership of the digital platform for online tax obligations.
eSINTAX filing	Represents the use of the digital platform for filing tax returns. eSINTAX filing requires registering first for eSINTAX.
Tax e-payment	Represents tax payments via eSINTAX. This step requires filing taxes first on eSINTAX.

Source: Authors' own descriptions of interest variables.

Table A4: Factors explaining DFS adoption

Category	Variable
Demographic (individual)	Female
	Age median
	Higher education
	Religion
	High experience
Business characteristics	Number of employees
	Industry (trade)
	Account department
	Online trading
	Bank account
	Legal status
	Internet
Digital financial services	Mobile money for customer
	Electronic sale machine
	Bank transaction time median
Tax characteristics	Tax knowledge index
	TIN registration year median
	Tax audit
	Interaction with tax authority

Source: Authors' own descriptions of survey modules.

Table A5: Determinants of e-Tax registration Probit

	(1) Demographics	(2) Business	(3) DFS	(4) All	(5) All+
Female	0.00			0.02	0.04**
	(0.03)			(0.02)	(0.02)
Higher education	0.04***			-0.02	0.01
	(0.01)			(0.02)	(0.02)
CEO experience	0.14***			0.08***	0.05***
	(0.01)			(0.01)	(0.01)
CEO religion: Islam	-0.04***			-0.03**	-0.03***
	(0.01)			(0.01)	(0.01)
Older taxpayers	0.03**			0.02**	0.02
	(0.01)			(0.01)	(0.02)
Less than 5 employees		-0.12***		-0.09***	-0.05***
		(0.02)		(0.02)	(0.02)
Access internet for business		0.12***		0.11***	0.09***
		(0.03)		(0.02)	(0.02)
Bank account		-0.04		-0.07	-0.08
		(0.07)		(0.06)	(0.07)
Online trading		-0.07***		-0.07***	-0.05***
		(0.00)		(0.02)	(0.01)
Trade sector		0.11***		0.12***	0.11***
		(0.03)		(0.03)	(0.04)
Account department		0.19***		0.19***	0.19***
		(0.05)		(0.04)	(0.03)
Legal Statuts: SARL		0.02		0.04*	0.06**
		(0.04)		(0.02)	(0.02)
Bank transaction time			-0.01	-0.01**	-0.00
			(0.01)	(0.00)	(0.00)
Mobile Money Knowledge			0.05	0.06	0.03
			(0.06)	(0.05)	(0.04)
sales electronic machine			0.13***	0.07***	0.08***
			(0.00)	(0.01)	(0.01)
Mobile Money Customers			-0.09***	-0.09***	-0.07***
			(0.02)	(0.02)	(0.02)
Tax knowledge index					0.09***
					(0.02)
Older businesses					0.07***
					(0.01)
Interaction with DGI					0.01***
					(0.00)
Tax audit					0.10***
					(0.01)
District FE	Yes	Yes	Yes	Yes	Yes
Observations	1075	1088	1089	1074	1074

Standard errors in parentheses
Outcome is an indicator variable for e-Tax registration.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A6: Determinants of eSINTAX Usage Probit

	(1) Demographics	(2) Business	(3) DFS	(4) All	(5) All+
Female	-0.03***			0.00	0.02***
	(0.00)			(0.01)	(0.00)
Higher education	-0.00			-0.03***	-0.02***
	(0.00)			(0.00)	(0.00)
CEO experience	0.05***			0.00	-0.03***
	(0.01)			(0.01)	(0.01)
CEO religion: Islam	-0.01***			-0.01	-0.01***
	(0.01)			(0.01)	(0.00)
Older taxpayers	0.01			0.01	0.00
	(0.01)			(0.01)	(0.01)
Less than 5 employees		-0.11***		-0.09***	-0.05***
		(0.01)		(0.00)	(0.00)
Access internet for business		0.02***		0.02***	0.02***
		(0.00)		(0.01)	(0.00)
Bank account		-0.09***		-0.10***	-0.09***
		(0.00)		(0.00)	(0.00)
Online trading		-0.03***		-0.03***	-0.00
		(0.00)		(0.00)	(0.00)
Trade sector		0.07***		0.06***	0.04***
		(0.01)		(0.00)	(0.00)
Account department		0.09***		0.09***	0.10***
		(0.01)		(0.01)	(0.01)
Legal Statuts: SARL		0.01*		0.01	0.04***
		(0.01)		(0.01)	(0.01)
Bank transaction time			-0.05***	-0.05***	-0.04***
			(0.00)	(0.00)	(0.00)
Mobile Money Knowledge			0.02***	0.02***	0.00***
			(0.00)	(0.00)	(0.00)
sales electronic machine			0.18***	0.17***	0.18***
			(0.01)	(0.01)	(0.01)
Mobile Money Customers			-0.06***	-0.06***	-0.03***
			(0.01)	(0.00)	(0.00)
Tax knowledge index					0.03***
					(0.00)
Older businesses					0.09***
					(0.00)
Interaction with DGI					-0.05***
					(0.01)
Tax audit					0.11***
					(0.00)
District FE	Yes	Yes	Yes	Yes	Yes
Observations	751	751	762	740	740

Standard errors in parentheses
Outcome is an indicator variable for using eSINTAX.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

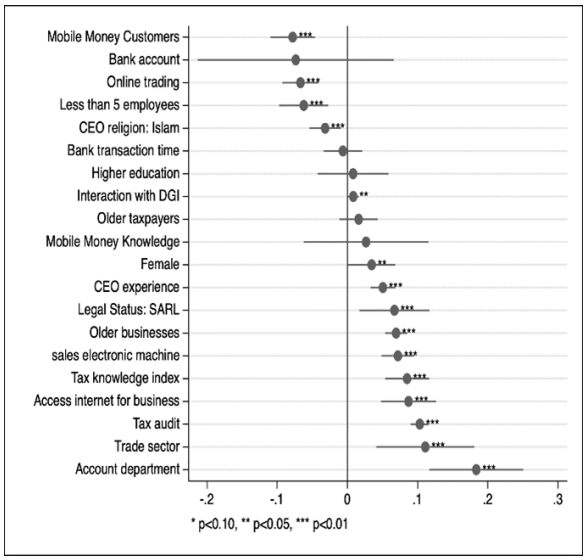
Table A7: Determinants of Using Tax e-Payment payment

	(1) Demographics	(2) Business	(3) DFS	(4) All	(5) All+
Female	-0.03			-0.02	-0.01
	(0.02)			(0.02)	(0.02)
Higher education	0.06*			0.04	0.05
	(0.02)			(0.02)	(0.02)
CEO experience	0.10*			0.07	0.06*
	(0.03)			(0.03)	(0.02)
CEO religion: Islam	0.01**			-0.00	-0.00
	(0.00)			(0.01)	(0.01)
Older taxpayers	0.04			0.04	0.03
	(0.02)			(0.02)	(0.02)
Less than 5 employees		-0.09**		-0.05	-0.02
		(0.02)		(0.02)	(0.02)
Access internet for business		0.03**		0.01**	0.01
		(0.00)		(0.00)	(0.01)
Bank account		-0.01		-0.02	-0.03
		(0.05)		(0.04)	(0.04)
Online trading		-0.04		-0.05	-0.03
		(0.03)		(0.03)	(0.02)
Trade sector		0.04*		0.04	0.04
		(0.01)		(0.02)	(0.02)
Account department		0.09*		0.08*	0.07**
		(0.02)		(0.02)	(0.01)
Legal Statuts: SARL		0.05***		0.05***	0.06***
		(0.00)		(0.00)	(0.00)
Bank transaction time			-0.00	0.01	0.01
			(0.00)	(0.01)	(0.01)
Mobile Money Knowledge			0.03**	0.05**	0.04**
			(0.00)	(0.01)	(0.01)
sales electronic machine			0.12**	0.08**	0.08**
			(0.02)	(0.01)	(0.02)
Mobile Money Customers			-0.05**	-0.03	-0.02
			(0.01)	(0.01)	(0.01)
Tax knowledge index					0.04
					(0.04)
Older businesses					0.01*
					(0.00)
Interaction with DGI					-0.01
					(0.01)
Tax audit					0.07**
					(0.01)
District FE	Yes	Yes	Yes	Yes	Yes
Observations	630	630	630	630	630

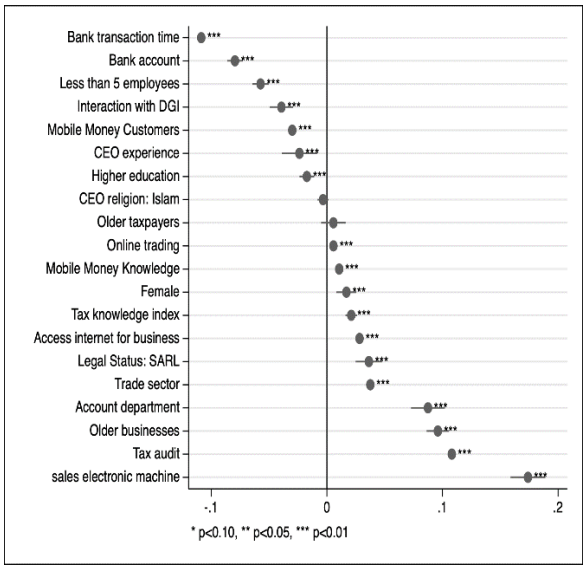
Standard errors in parentheses
Outcome is an indicator variable for using Tax e-payment.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Figure A4: Determinants of eSINTAX

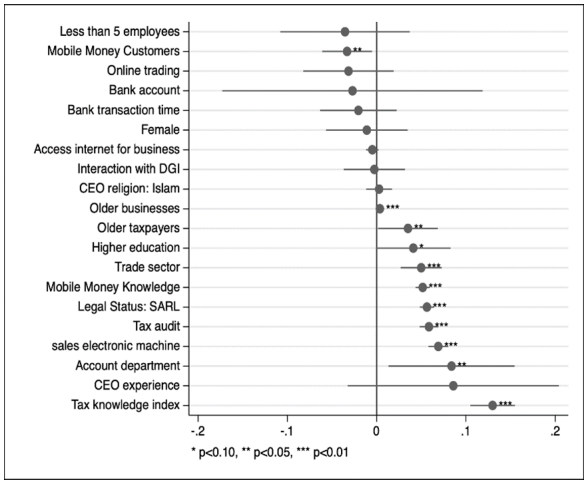
((a)) Registration



((b)) Usage

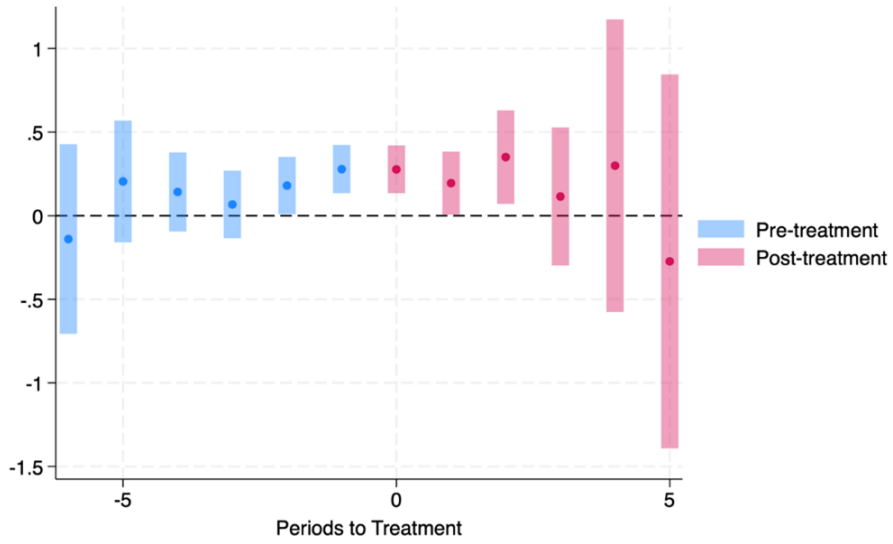


((c)) Tax e-Payment



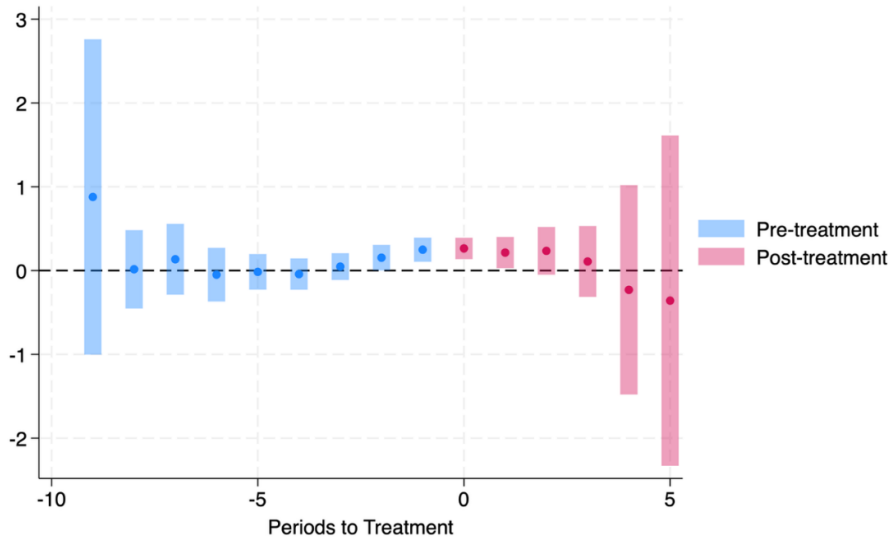
Note: The outcome is a binary variable 0-1 for being registered with the eSINTAX platform, filing through the eSINTAX platform, and paying taxes with digital methods. Source: Authors' own elaborations on data derived from the survey

Figure A5: eSINTAX registration impact on tax declared



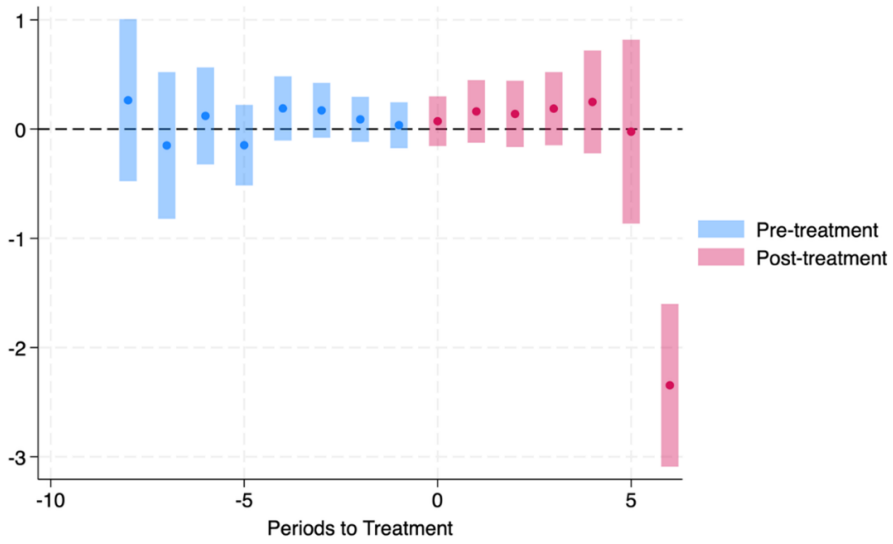
Note: data derived from administration data

Figure A6: eSINTAX filing impact on tax declared



Note: data derived from administration data

Figure A7: Tax e-payment impact on tax paid



Note: data derived from administration data

Table A8: Impact of digital payment on payment on time

	(1) Payment in time	(2) Payment in time
eSINTAX payment	-0.0846***	-0.0361
	(-3.03)	(-1.33)
N	24,207	18,249
Controls	No	Yes
Never-treated average payment in time	0.269	

Note: t-statistics in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.
Source: Authors' own elaboration based on administration data.

Chapter 4

Digital exposure and perceived tax legitimacy: empirical evidence from african countries

This chapter is joint work with Alima TRAORE and Mouhamed ZERBO.

4.1 Introduction

Over the past two decades, the rise of digital technologies has profoundly transformed the informational and social environments of contemporary societies. By reducing the costs of accessing information, multiplying sources of public discourse, and intensifying social interactions, the internet has become a central infrastructure through which individuals form beliefs about public action, evaluate institutions, and develop civic attitudes. Beyond the mere dissemination of information, digital exposure facilitates the circulation of opinions, social norms, and collective representations, thus contributing to shaping collective perceptions of state authority and public institutions (Cialdini, 1996; Wenzel, 2005). On the one hand, digital innovations have improved the relationship between citizens and government by digitalizing some public services and processes, thereby facilitating people's well-being. On the other hand, digital transformation can strengthen citizens' capacity,through better access to information and the diffusion of social norms, to monitor government actions thanks to greater transparency. Indeed, a lack of information about government actions can create a trust crisis and lead to low compliance with the law.

While African countries historically remained on the margins of the diffusion of information and communication technologies (ICT), the continent is now experiencing a rapid expansion of digital connectivity among citizens. This transformation is occurring despite the fact that many African states continue to face limited administrative capacity and relatively low levels of tax revenue mobilization. A growing body of research suggests that digital connectivity may nonetheless contribute to strengthening fiscal capacity. For instance, Gnangnon and Brun (2018b) show that reducing the internet access gap is associated with higher tax revenue mobilization, highlighting the potential role of internet diffusion in processes of state building. Similarly, Adegboye et al. (2022b) find that greater ICT penetration contributes to increased tax revenue mobilization at the global level. In addition, Gnangnon (2020) show that rising internet usage is associated with a greater likelihood and scope of tax reforms in developing countries.

Against this background, this paper examines how digital exposure, measured through

individual internet use, shapes citizens' perceptions of the legitimacy of the state's right to tax in Africa. Specifically, it investigates whether internet exposure influences tax legitimacy by shaping the beliefs, perceptions, and social norms through which individuals evaluate the fairness and legitimacy of taxation. To address this question, we rely on individual-level data from Afrobarometer Round 8, which provide detailed information on internet use, attitudes toward taxation, and perceptions of governance across 34 African countries.

Understanding this relationship is particularly important in the African context, where tax relations between the state and citizens have historically evolved in environments characterized by weak administrative capacity, high levels of informality, and fragile institutional credibility. In such contexts, sustainable tax revenue mobilization cannot rely solely on coercive enforcement mechanisms (Tanzi and Zee, 2000; Keen, 2012). Instead, it depends crucially on citizens' recognition of the legitimacy of the state's right to levy taxes, which is closely linked to perceptions of political representation, transparency of public action, and the provision of public goods (Moore, 2004, 2014; Prichard, 2015). This perspective has given rise to a growing literature on tax legitimacy, understood as citizens' recognition of the state's right to levy and enforce taxes and the acceptance of taxation as a legitimate civic obligation beyond formal enforcement mechanisms (Schmölders, 1959; Frey and Torgler, 2007). Empirical studies consistently show that tax legitimacy is strongly associated with institutional trust, perceptions of corruption, and the quality of governance, particularly in developing countries (Torgler, 2011; Ali et al., 2014).

However, while the institutional and political determinants of tax legitimacy have been extensively studied, the potential role of digital transformations in shaping fiscal attitudes remains largely underexplored. Most existing studies on digitalization and taxation focus on administrative reforms and compliance outcomes, such as the digitalization of tax administrations, e-filing systems, and improvements in enforcement capacity. Much less attention has been devoted to understanding how digital exposure shapes citizens' fiscal beliefs, social norms, and perceptions of tax authority. Yet by expanding access to information, facilitating social comparisons, and amplifying public debates about governance, internet exposure may significantly influence how citizens evaluate public institutions and the legitimacy

of taxation (Cialdini, 1996; Luttmer and Singhal, 2014). In fragile institutional environments, these dynamics may operate through different mechanisms. On the one hand, greater access to information may strengthen perceptions of transparency, accountability, and fiscal reciprocity, thereby reinforcing tax legitimacy. On the other hand, exposure to negative narratives related to corruption, inefficiency, or tax injustice may undermine trust in public institutions and weaken citizens' willingness to recognize the legitimacy of taxation (Luttmer and Singhal, 2014; Soglo and Amedanou, 2023).

Our results reveal a positive and robust association between digital exposure and perceived tax legitimacy, even after controlling for individual socio-economic characteristics and national institutional environments. To better understand the mechanisms underlying this relationship, this paper explores three transmission channels related to the informational and social environments shaped by digital technologies. First, a social interaction channel through which digital exposure increases the use of social media and intensifies online interactions. Second, an informational perception channel whereby internet exposure strengthens individuals' perception of being informed about current events. Third, an information access channel captured by the frequency with which individuals obtain news from the internet. Overall, these mechanisms suggest that digital exposure can influence how citizens perceive public action and, in turn, shape their views about the legitimacy of taxation.

This study contributes to the literature on taxation and development in several ways. First, it extends the literature on tax legitimacy by examining the role of digital exposure in shaping citizens' perceptions of the legitimacy of taxation. Second, it provides new empirical evidence on the relationship between internet exposure and tax legitimacy in Africa, a dimension that remains largely underexplored in the existing literature. Third, the paper proposes a conceptualization of digital exposure as an informational environment that structures fiscal beliefs, social norms, and perceptions of government action. Finally, by identifying the informational and normative channels through which digital exposure influences tax legitimacy, the study highlights the attitudinal foundations of fiscal capacity in contexts characterized by high informality and limited administrative capacity.

The remainder of the paper is structured as follows. Section 2 presents the transmission

channels linking digital exposure to tax legitimacy. Section 3 describes the data and the empirical strategy. Section 4 presents the main results. Section 5 provides robustness checks and explores heterogeneity across different contexts. The final section concludes.

4.2 Transmission channels : how digital exposure shapes tax legitimacy

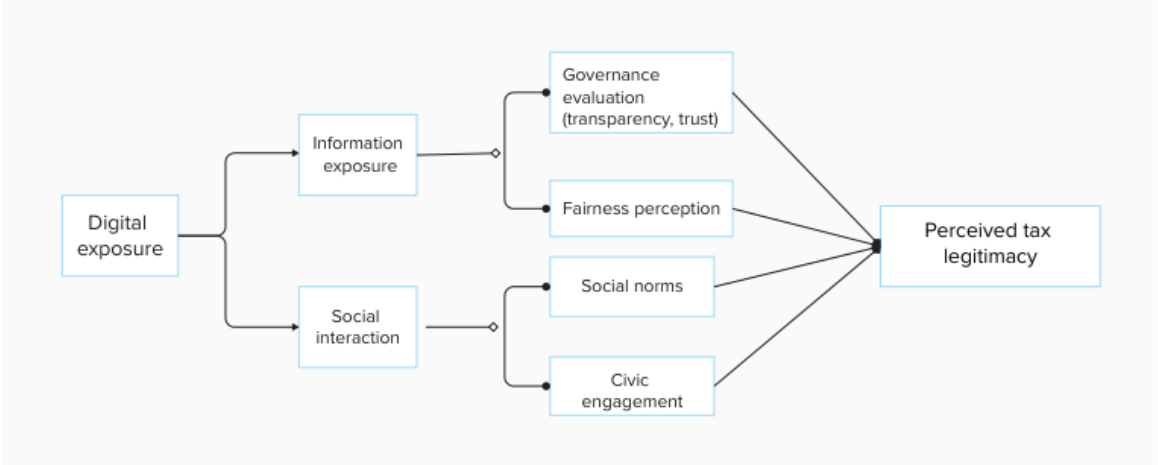
This section identifies the mechanisms through which digital exposure is associated with perceived tax legitimacy, defined as citizens' recognition of the state's right to levy taxes. In contexts characterized by high informality and limited enforcement and sanction capacity, revenue mobilization relies largely on attitudinal factors, including perceptions, social norms, and beliefs that structure the fiscal relationship between the state and citizens. Digital exposure acts on these foundations by transforming the informational environment and social interactions. We conceptualize this link as a sequential process as digital exposure does not directly affect tax legitimacy, but first modifies access to information and social dynamics, which constitute key mediators through which evaluations of governance, perceptions of fairness, and civic engagement are formed (see graph 4.1).

At the informational level, digital exposure transforms the ways in which information relating to taxation, public spending, and state performance is accessed and interpreted. By expanding access to fiscal and political content, the internet can strengthen perceptions of transparency and accountability when the information disseminated is perceived as credible. The literature on the fiscal contract emphasizes that acceptance of taxation depends largely on the perception of a visible and legitimate exchange between taxes paid and public goods provided (Levi, 1988; Moore, 2014; Prichard, 2015). From this perspective, better information about the use of public resources or the implementation of tax reforms is likely to strengthen the perceived legitimacy of tax authority.

However, the digital informational environment is neither neutral nor comprehensive. Algorithmic filtering, disinformation, and the circulation of selective narratives can amplify negative signals related to corruption, mismanagement, or elite privileges. Repeated exposure to this type of content tends to weaken trust in the state and erode perceived tax legitimacy,

even when these narratives only partially reflect institutional realities (Luttmer and Singhal, 2014; Besley, 2020). Digital exposure thus acts as an informational amplifier, capable of reinforcing both favourable and unfavourable perceptions of public action.

Figure 4.1: Transmission channels of digital exposure on perceived tax legitimacy



Source: Authors' design

Digital exposure also influences tax legitimacy through a normative and social channel, by intensifying interactions among citizens and making others' attitudes and behaviours more visible. Social networks and digital platforms facilitate the dissemination of social norms relating to tax compliance and civic responsibility. The literature on conditional cooperation shows that individuals adjust their fiscal attitudes according to what they perceive as dominant or socially acceptable behaviour (Frey and Torgler, 2007; Wenzel, 2005; Alm and Torgler, 2011). By making the discourses and practices of peers more visible, digital exposure reinforces these mechanisms of social comparison.

When online exchanges highlight tax contribution, respect for rules, and collective interest, they tend to strengthen recognition of the legitimacy of the state's right to tax. Conversely, when dominant narratives emphasize tax evasion, administrative inefficiency, or elite non-compliance, they may normalise transgressive behaviours and weaken the normative foundations of taxation. Recent work shows that information about others' behaviour can produce contrasting effects depending on which norm becomes salient in the informational environment (Doerrenberg and Peichl, 2018).

Overall, these informational and normative channels suggest that the relationship between

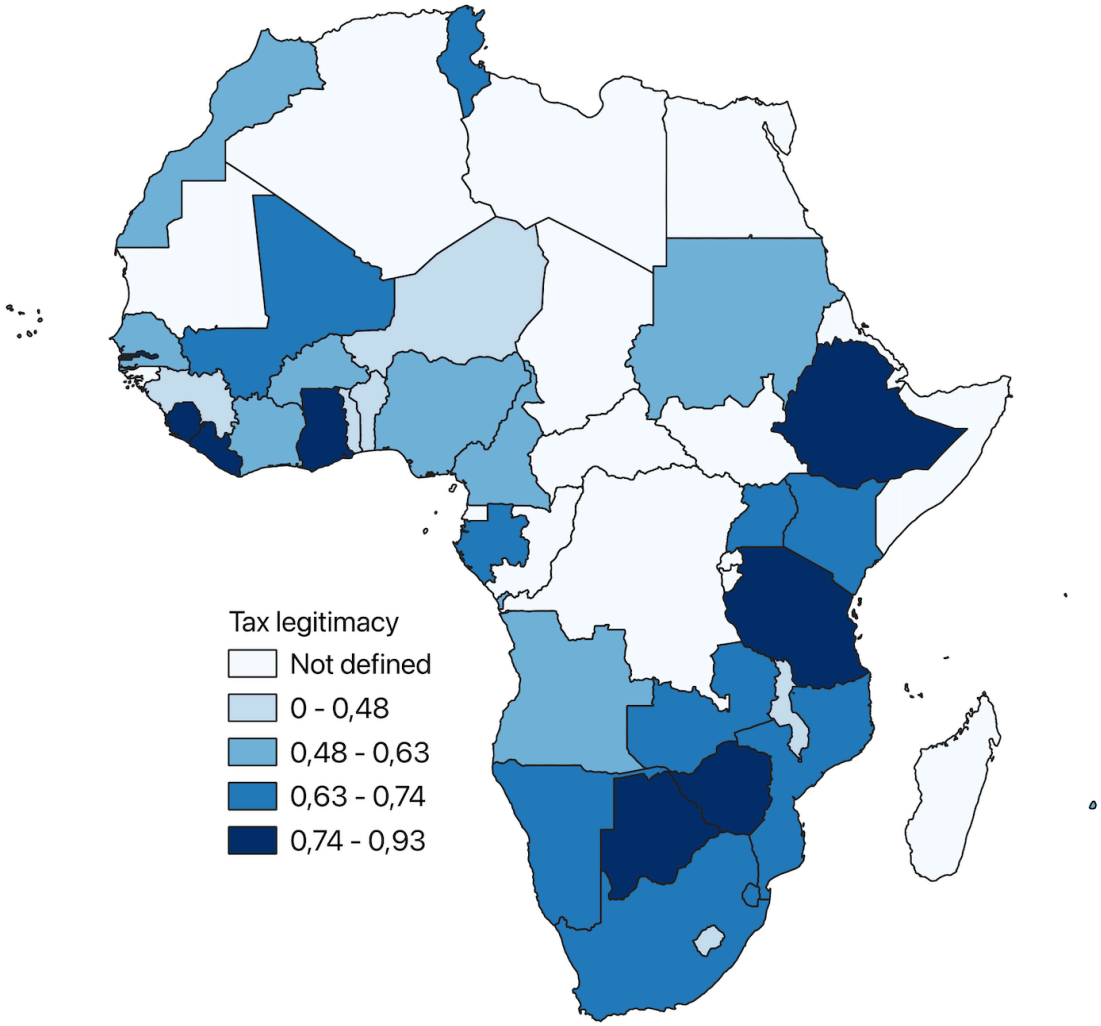
digital exposure and perceived tax legitimacy is mediated by broader evaluations of public action, particularly regarding the quality of governance, fairness of the tax system, and civic inclusion. An extensive literature shows that these dimensions constitute central determinants of tax legitimacy, with taxation being more readily accepted when citizens perceive the state as fair, accountable, and representative of collective interests (Feld and Frey, 2002; Torgler, 2007).

4.3 Estimation strategy and data

4.3.1 Data

The main source of data in this study is the eighth round of the Afrobarometer survey collected in 2022. This survey covers 34 African countries and collects data on people's attitudes on social characteristics, democracy, governance, markets, taxation, and civil society. Then, afrobarometer assesses the social, political, and economic climate in over 30 African countries through face-to-face interviews with nationally representative samples of between 1,200 and 2,400 randomly selected adult citizens, covering both regions/states/provinces and urban/rural areas. The questionnaire is similar across countries, allowing a comprehensive cross-section data for empirical analysis. The baseline sample covering 34 countries encompasses about 44,246 persons. Due to missing data, the sample size decreases by more than 10 percent for most of estimation. The figure 4.2 colored in graduated blue highlight the countries included in this paper. This high-quality and full dataset is particularly relevant to our research on citizens' tax behavior.

Figure 4.2: Average level of Tax legitimacy in Africa



Source : Authors' construction of Afrobarometer data

The main dependent variable captures tax legitimacy and is constructed from afrobarometer Round 8 question Q39A, which asks respondents whether tax authorities have the right to enforce taxes. Responses are recorded on a five-point Likert scale ranging from strongly disagree to strongly agree, with additional categories for refusal and don't know. In the full sample, approximately 66% of respondents agree or strongly agree with the statement.

For most of our estimations, we recode the dependent variable as a binary indicator to align with the chosen empirical strategy. Responses to question Q39A are not ordinal, as one category corresponds to neither agreement nor disagreement. We therefore collapse the response categories into two groups: agree and strongly agree versus disagree and strongly disagree. The neither agree nor disagree category is treated as missing, as it represents less

than 1% of observations and does not reflect a clear perception of tax legitimacy. Then, A value of 1 captures that respondents agree or strongly agree with the above statement, and 0 if they disagree or strongly disagree with the statement. As presented in Figure 4.2, tax legitimacy varies between African countries. Respondents in Zimbabwe, Botswana, Tanzania, Ghana, Gambia, Ethiopia, Liberia, and Sierra Leone exhibit the highest acceptance level of tax authorities' legitimacy to enforce tax payment (more than 75%) while respondents in Malawi, Togo, Benin, Lesotho, Niger, Guinea, and Morocco record a low level of tax enforcement (lower than 50%).

For the main explanatory variables side, i.e., digital exposure, the survey ask question about internet use habits. Question Q92I from afrobarometer is: "How often do you use: The internet?". The following answers are possible: Never, Less than once a month, A few times a month, A few times a week and Every day. Based on these responses, we follow the afrobarometer categorical using 0 for Never, 1 for Less than once a month, 2 for A few times a month, 3 for A few times a week and 4 for Every day. This interest variable highlights the role of internet use frequency.

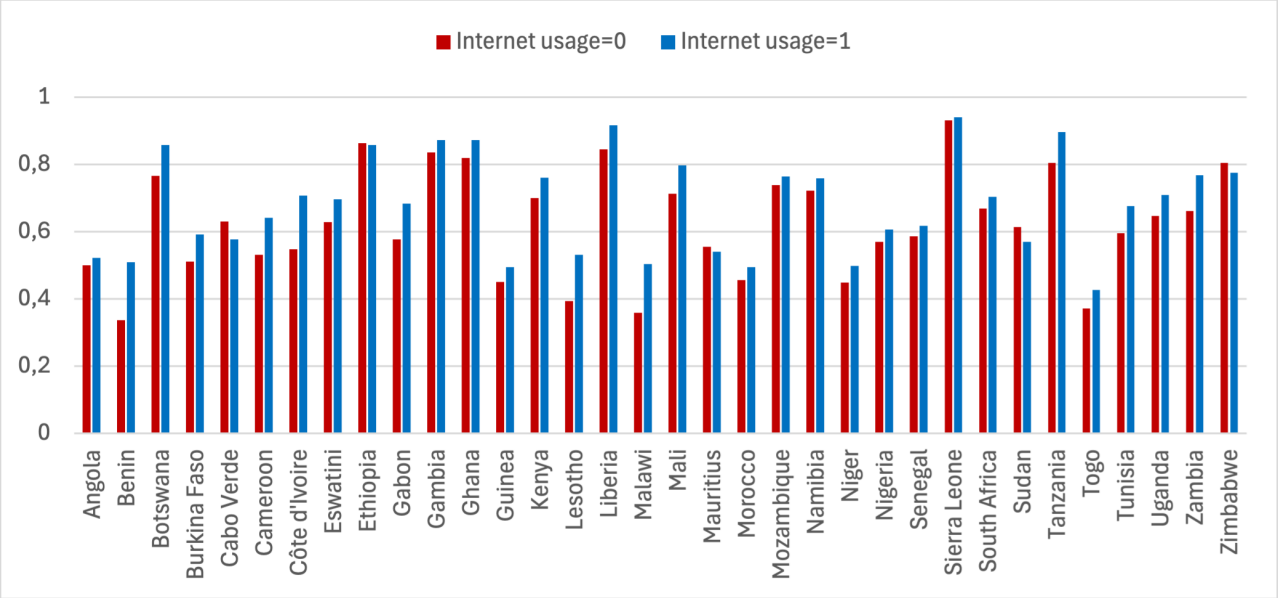
We distinguish two groups of explanatory variables according to their nature. The first group consists of binary variables that take values of 0 or 1. These include gender (1 = female, 0 = male), place of residence (1 = urban, 0 = rural), employment status (1 = Yes, 0 = No), perceived difficulty in finding information on taxes (1 = easy or very easy, 0 = difficult or very difficult), and access to electricity (1 = Yes, 0 = No). The second group consists of categorical variables with more than two categories. These include educational attainment (0 = no formal education, 1 = primary, 2 = secondary, 3 = post-secondary), lived poverty (0 = none, 1 = low, 2 = moderate, 3 = high), and perceived corruption of tax officials (0 = none, 1 = some of them, 2 = most of them, 3 = all of them).

In other parts of the paper, some of the variables described in Tables 4.13 and 4.14 are used for heterogeneity analyses and robustness checks.

Then, we check some statistics to provide evidence of the digital exposure's contribution to tax legitimacy improvement. Figure 4.3 compares the level of tax legitimacy between internet users and non-internet users. About 29 of 34 countries record a higher tax legitimacy level

for internet user than not internet user. This finding gives an overview of the internet use in the tax behavior. Based on the regional disparities between African countries, we check some heterogeneity to highlight the regional analysis. Figure 4.5 reveals that the tax legitimacy is higher for digital exposure except for North Africa were the tax legitimacy is slightly lower.

Figure 4.3: Internet Use and Non-Use by Average Tax legitimacy



Source : Authors' construction of Afrobarometer data

4.3.2 Empirical strategy

We assess the role of digital exposure on perceived tax legitimacy. Based on the binary structure of the dependent variable, we apply logit regression model as the main estimation approach. This model seems more suitable for assessing the influence of a set of covariates on the dichotomous response variables (Cameron and Trivedi, 2005). The *logit* model specifies cumulative logistic distribution as follows:

$$P_i = \frac{e^{Z_i}}{1 + e^{Z_i}} \tag{4.1}$$

where $Z_i = \beta_1 + \beta_2 X_i$ and P_i is the probability of the observed event of tax legitimacy will occur knowing value of the explanatory variables. Z_i denotes the dependent variable (tax legitimacy), while X_i is the explanatory variables. β is represents the estimated coefficients coefficients of explanatory variables. However, the previous equation is non-linear in parameters

and variables. Then, we use the logarithm to linearize the model as presented in the following equation:

$$L_i = ln(\frac{P_i}{1-P_i}) = Z_i = \beta_1 + \beta_2 X_i \tag{4.2}$$

The marginal effects for the logit model can be easily got from the coefficients $\delta p_i/\delta x_{ij} = \lambda(z_{i,t}\beta j$, with $\lambda(z) = \Lambda(z)[1-\Lambda(z)]$, $z_i = X_{i,j}\beta$ the latent index and the probability $p_i = \Lambda(z_i)$. However, all explanatory variables are dummy indicators in our analysis. Then, marginal effects are defined as discrete changes in predicted probabilities rather than derivatives. We denote Y_i our dependent variables (Tax legitimacy), $x_{i,j} \in 0, 1$ a binary covariate representing our interest variable (digital) and $X_{i,j}$ the vector of remaining regressors. The effect of $x_{i,j}$ on the probability of Y_i is computed as follow:

$$\Delta_i = Pr(Y_i = 1|x_{i,j} = 1, X_i) - Pr(Y_i = 1|x_{i,j} = 0, X_i \tag{4.3}$$

where predicted probabilities are from the estimated logit model. This equation allows capturing the change in Y_i probability linked with switching the covariate from 0 to 1, maintaining other characteristics fixed. Next, we summarize these heterogeneous individual effects into average marginal effects (AMEs):

$$AME_k = \frac{1}{N}\sum[\Lambda(X_i\beta \mid x_i = 1) - \Lambda(X_i\beta \mid x_i = 0)] \tag{4.4}$$

where Equation 4.4 represents the average percentage-point change in Y_i probability associated with the presence of the corresponding characteristic.

4.4 Results

4.4.1 Empirical results

This section examines the relationship between digital exposure and individual perceptions of tax legitimacy in Africa. Table 4.1 presents the baseline estimates of the effect of digital exposure on the probability of recognizing the state's right to levy taxes. The reported

coefficients correspond to marginal effects from logit models and can be interpreted as variations in predicted probabilities.

Column [1] presents a bivariate specification in which digital exposure is the only explanatory variable. Digital exposure is positively and significantly associated with tax legitimacy at the 1% level. Individuals who use the internet have a 1.2 percentage point higher probability of perceiving taxation as legitimate compared to non-users, highlighting an unconditional correlation between the two variables.

Column [2] introduces country fixed effects to control for unobserved and time-invariant national characteristics. The effect of digital exposure remains positive and statistically significant, with a larger magnitude (1.9 p.p.). This indicates that the observed association reflects not only structural differences between countries but also within-country variations among individuals.

Column [3] includes individual control variables of a sociodemographic, economic, and institutional nature. The addition of these variables leads to a substantial reduction in the magnitude of the digital exposure coefficient, which becomes statistically insignificant. This attenuation suggests that the unconditional correlation is partly mediated by observable characteristics correlated with internet access, such as education level, economic integration, or access to public services. Without controlling for national heterogeneity, individual variables capture both within-country and between-country variation, diluting the specific effect of internet.

Column [4] presents the full specification, combining individual control variables and country fixed effects. Digital exposure regains a positive and statistically significant effect on tax legitimacy, with a magnitude of 1.0 percentage point. This indicates that, all else being equal and holding national heterogeneity constant, digital exposure is associated with a higher probability of recognizing the legitimacy of taxation. The reappearance of statistical significance suggests that simultaneously controlling for country fixed effects and individual characteristics isolates within-country variation in digital exposure that is not collinear with institutional and infrastructural differences between countries. While smaller than in the bivariate specifications, this coefficient remains economically significant, indicating that digital exposure retains an

independent association with tax legitimacy beyond its correlation with education, income, or institutional perceptions.

Table 4.1: Baseline

Tax legitimacy	[1] All sample	[2] All sample	[3] All sample	[4] All sample
Digital exposure	0.012***	0.019***	-0.002	0.010***
	(0.001)	(0.001)	(0.002)	(0.002)
Age			0.001***	0.001***
			(0.000)	(0.000)
Education level			0.036***	0.034***
			(0.003)	(0.003)
Female			-0.019***	-0.022***
			(0.005)	(0.005)
Work income			0.051***	0.007
			(0.006)	(0.006)
Urban			0.013**	-0.002
			(0.006)	(0.006)
Lived Poverty			-0.030***	-0.020***
			(0.003)	(0.003)
Corruption tax officials			-0.031***	-0.037***
			(0.003)	(0.003)
Diff. find. tax. pay			-0.066***	-0.052***
			(0.005)	(0.006)
Electricity			-0.014**	0.025***
			(0.006)	(0.007)
Observations	44246	44246	36763	36763
Country fixed-effect	No	Yes	No	Yes
Number of countries	34	34	34	34

Note: t-statistics in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.
Source: Authors' own elaboration based on survey data and the reported coefficients correspond to marginal effects.

Regarding control variables in the full specification, age is positively and significantly associated with tax legitimacy, with a marginal effect of 0.1 percentage point per additional year, consistent with the idea that life-cycle experience and accumulated interactions with public institutions strengthen acceptance of taxation. Education level also exerts a positive and significant effect, with a 3.4 percentage point increase in the probability of recognizing tax legitimacy for each additional education level, suggesting that a better understanding of economic mechanisms and redistributive policies strengthens the perceived legitimacy of taxation.

Conversely, being a woman is associated with a 2.2 percentage point lower probability of exhibiting high tax legitimacy. This may reflect differences in exposure to the formal tax system, particularly those linked to labor market segmentation, differentiated career trajectories, and the higher prevalence of informality in many African contexts, where women are proportionally more numerous in the informal sector and have lower participation in the formal labor market.

Work income and urban residence, while significant in column [3], lose their significance once country fixed effects are included in column [4], suggesting that their association with tax legitimacy primarily reflects structural differences between countries rather than individual variations within countries. Concerning institutional and material variables, lived poverty reduces the probability of recognizing tax legitimacy by 2.0 p.p. in column [4], likely reflecting lower contributive capacity and a weakened perception of the benefits of taxation. Perceived corruption of tax officials decreases this probability by 3.7 p.p., highlighting the importance of institutional integrity. Difficulties in identifying the amount of tax to pay reduce tax legitimacy by 5.2 p.p., emphasizing the critical role of transparency and clarity of tax information.

Finally, access to electricity shows a negative coefficient in column [3] (-1.4 p.p.) but becomes positive and significant in column [4] (+2.5 p.p.). This sign reversal underscores the importance of controlling for national heterogeneity. Without country fixed effects, the negative coefficient may reflect spurious correlations related to development differences between countries. Holding national characteristics constant, access to basic infrastructure within a country is associated with higher tax legitimacy, consistent with a fiscal reciprocity mechanism: citizens with access to basic public services are more inclined to recognize the state's right to levy taxes.

Overall, the results indicate that tax legitimacy is determined by a combination of individual characteristics, material living conditions, and institutional quality. digital exposure appears as a statistically and economically significant factor in the full specification, though this association should be interpreted as conditional on observed variables rather than as an established causal relationship. These results call for complementary analyses to examine the mechanisms through which digital exposure may influence tax perceptions and to assess the robustness of these associations across different identification strategies.

4.4.2 Transmission channels

In this section, we examine the mechanisms through which digital exposure is associated with tax legitimacy. The results presented in tables 4.2 and 4.3 highlight two main transmission channels through which digital technologies may influence citizens' attitudes toward taxation. These channels relate to both the informational environment and the normative beliefs associated with fiscal sovereignty.

- **Social medias** [1]: Column [1] of table 4.2 shows that digital exposure is positively and significantly associated with more frequent use of social media, capturing increased social interaction in online spaces. This result suggests that internet access transforms individuals' social environment by intensifying interactions, exchanges of opinions, and exposure to shared narratives related to public affairs and taxation. Column [1] of table 4.3 indicates that social media use is itself positively, though modestly, associated with tax legitimacy. Overall, these results are consistent with the existence of a social interaction channel through which internet use shapes attitudes toward taxation. Through online interactions, individuals are exposed to prevailing norms, peer behaviours, and collective judgments about taxation and public action, which may influence perceptions of legitimacy by reinforcing social norms of compliance, increasing perceived transparency, and strengthening the visibility of the redistributive role of taxation.

- **More information** [2]: Column [2] of table 4.2 shows that digital exposure is positively and significantly associated with the perception that social media make people more informed about current events. This result suggests that greater exposure to the internet enhances individuals' access to information and strengthens their perception of being informed about public affairs. In contexts where access to reliable information about government actions and policies may be limited, digital technologies can expand the informational environment by facilitating the circulation of news and public debate.

[1] Question : : How often do you get news from the following sources: Social media such as Facebook, Twitter, WhatsApp or others?

[2] Question : Regardless of whether you personally use social media yourself, please tell me whether you agree or disagree that social media makes people more informed about current events.

Column [2] of table 4.3 further indicates that this perception of being more informed is strongly and positively associated with tax legitimacy. The magnitude of the coefficient is substantially larger than for the other mechanisms, suggesting that informational factors may play a particularly important role in shaping fiscal attitudes. Overall, these findings support the existence of an informational channel through which digital exposure influences tax legitimacy. By increasing access to information about public affairs, government performance, and the use of public resources, internet exposure may improve citizens' evaluations of state action and strengthen the perceived legitimacy of taxation.

- **Internet news** Internet news[3]: Column [3] of table 4.2 shows that digital exposure is positively and significantly associated with the frequency with which individuals obtain news from the internet. This result indicates that individuals with greater digital exposure are more likely to rely on online sources to access information about current events and public affairs. Column [3] of table 4.3 further shows that the frequency of obtaining news from the internet is positively and significantly associated with tax legitimacy. This finding suggests that individuals who regularly access online news are more likely to perceive taxation as legitimate. One possible explanation is that access to information about public policies, government performance, and public goods provision can shape citizens' evaluations of the state and strengthen perceptions of fiscal reciprocity. In this sense, frequent exposure to online news may contribute to reinforcing the perceived legitimacy of taxation by improving citizens' understanding of the role of taxation in financing public action.

These results suggest that the positive association between digital exposure and tax legitimacy observed in the baseline estimates may partly reflect transformations in the informational environment as well as changes in citizens' normative perceptions. In particular, greater digital exposure appears to expand access to information and to shape the social and cognitive contexts within which individuals evaluate taxation and public authority. It should be noted, however, that these analyses rely on associative evidence and do not formally

[3]Question : How often do you get news from the following sources: Internet?

establish a causal relationship. Nevertheless, the findings indicate that digital technologies may contribute to the dissemination of information and to the strengthening of norms related to responsibility and fiscal sovereignty among African citizens.

Table 4.2: Channels

	[1] Social Media	[2] More information	[3] Internet news
Digital exposure	0.2816***	0.0078***	0.2663***
	(0.0031)	(0.0011)	(0.0032)
Observations	37973	27076	38028
Controls	Yes	Yes	Yes
Country fixed effect	Yes	Yes	Yes
Number of countries	34	34	34

Table 4.3: Correlation

Tax legitimacy	[1]	[2]	[3]
Social Media	0.0057***		
	(0.0018)		
More information		0.1352***	
		(0.0108)	
Internet News			0.0078***
			(0.0019)
Observations	36678	26283	36737
Controls	Yes	Yes	Yes
Country fixed effect	Yes	Yes	Yes
Number of countries	34	34	34

4.5 Sensitivity analysis

4.5.1 Heterogeneity

4.5.1.1 Digital exposure and tax legitimacy by Gender oriented

Several studies emphasize that gender is an important determinant of tax legitimacy, due to differences in social roles, economic participation, and interactions with public institutions

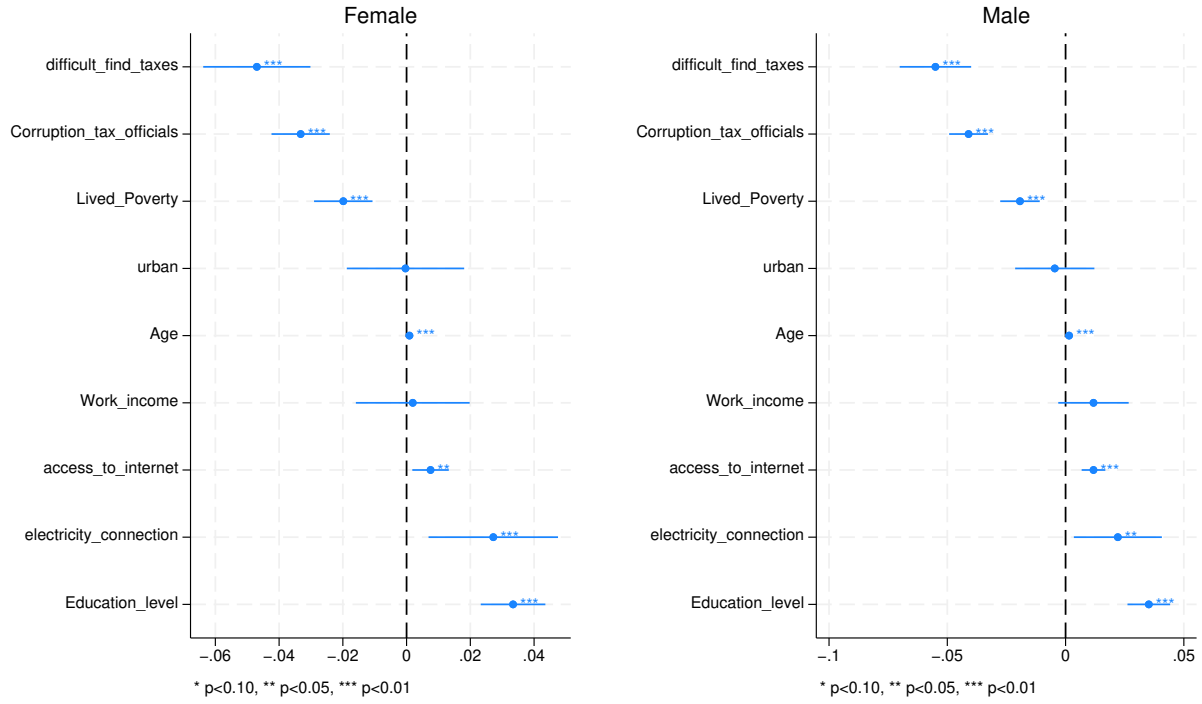
(Torgler, 2007; Ali et al., 2014; Stockard et al., 1988). To examine whether the association between digital exposure and tax legitimacy varies by gender, we estimate separate regressions for women and men. The results, presented in Table 4.5, show that digital exposure is positively and significantly associated with tax legitimacy for both groups. However, the effect is larger for men (4.3 p.p.) than for women (2.9 p.p.), revealing substantial gender-related heterogeneity.

This heterogeneity can be explained by differentiated exposure to formal tax institutions. In many African contexts, men are more frequently engaged in formal economic activities and interact more with tax administration, particularly as household heads or primary income earners. In this context, tax-related information accessible via the internet is likely to more directly influence their perception of the legitimacy of the tax system. Conversely, women, who are more often active in the informal sector and less directly concerned with formal taxation, derive more indirect informational benefits from digital exposure regarding tax matters.

This interpretation is reinforced by the analysis of control variables. Work income significantly affects tax legitimacy only for men (+1.4 p.p.), confirming the link between formal economic participation and tax attitudes for this group. Similarly, the perception of corruption among tax officials exerts a significant negative effect only for men (-3.6 p.p.), consistent with their increased exposure to direct interactions with tax administration. In contrast, difficulties in accessing tax information negatively affect both genders in a comparable manner, suggesting a systemic problem of tax opacity beyond gender differences. The other control variables (education, age, electricity connection) show similar positive effects in both groups.

In sum, while digital exposure promotes tax legitimacy regardless of gender, its differentiated effect likely reflects structural inequalities in relationships with tax institutions, economic insertion, and patterns of digital technology usage between men and women in the African contexts studied.

Figure 4.4: digital exposure on tax legitimacy by gender



Source: Autors' design

4.5.1.2 Digital exposure and tax legitimacy by Urban and Rural

The table 4.6 presents the estimation results according to urban and rural subsamples. digital exposure is positively and significantly associated with tax legitimacy, both in urban and rural areas. The estimated marginal effects suggest that a one-unit increase in digital exposure increases the probability of reporting high tax legitimacy by approximately 1.0 percentage point in urban areas and 0.8 p.p. in rural areas, all else being equal. Although slightly higher in urban areas, the magnitude of the coefficients is comparable between the two contexts.

This similarity in estimates suggests that the association between access to digital information and tax legitimacy is relatively spatially homogeneous. In other words, once effective internet access is ensured, it appears to be linked to more favorable tax attitudes, regardless of place of residence. This result is particularly noteworthy in contexts marked by strong territorial disparities in access to public services and tax administration.

The control variables show generally consistent effects in both subsamples. Age, education level, and access to electricity are positively associated with tax legitimacy, while lived poverty

and perceived difficulty in paying taxes exert a significant negative effect. The perception of corruption among tax officials is also strongly and negatively associated with tax legitimacy, both in urban and rural areas, highlighting the central importance of institutional quality in shaping tax attitudes.

However, heterogeneity emerges regarding labor income, which is positively associated with tax legitimacy in urban areas but not significant in rural areas. This divergence suggests that the economic channels linking income and tax legitimacy may depend on spatial context, possibly due to differences in tax visibility, employment formality, or interaction with tax administration.

4.5.1.3 Digital exposure and tax legitimacy by economic situation

Table 4.7 analyses the association between digital exposure and tax legitimacy according to the level of lived poverty. The results reveal notable heterogeneity in this association along the gradient of economic vulnerability.

Among individuals reporting no lived poverty (column 1), digital exposure is positively associated with tax legitimacy, with a marginal effect of 1.0 percentage point, significant at the 10% level. Although modest, this result suggests that even among economically advantaged groups, access to digital information slightly reinforces positive tax attitudes. However, the limited magnitude of this effect is likely explained by the fact that, in these groups, tax legitimacy relies more heavily on stable economic conditions, solid institutional integration, and already high civic capital.

Among individuals exposed to low lived poverty (column 2), the effect remains significant (0.6 p.p., $p < 0.05$) and becomes stronger (1.5 p.p., $p < 0.01$) among individuals facing moderate lived poverty (column 3). This increased magnitude suggests that individuals in situations of intermediate vulnerability are particularly receptive to the informational resources offered by the internet. For these groups, digital access can strengthen understanding of public action, increase visibility of tax revenue usage, and more broadly, improve perceptions of reciprocity between citizens and the state. (Prichard, 2015).

In contrast, for individuals facing high lived poverty (column 4), the effect of digital exposure is no longer statistically significant. This absence of association suggests that in contexts of severe material deprivation, immediate economic constraints dominate the formation of

tax attitudes. Even when access to information is ensured, it does not appear sufficient to compensate for the deleterious effect of precarity on perceptions of taxation and tax institutions (Ali et al., 2014; Fjeldstad and Tungodden, 2003).

The control variables (education, perceived corruption of tax officials, and perceived difficulty in paying taxes) confirm several regularities observed in previous analyses. Access to electricity shows a significant positive effect only in the two least poor groups, suggesting a threshold role of infrastructural development in shaping tax attitudes.

These results indicate a non-linear relationship between digital access and tax legitimacy along the poverty gradient. The effect is maximized among individuals in situations of moderate economic vulnerability, highlighting that the impact of internet diffusion on tax attitudes depends closely on the socioeconomic context. This finding suggests the existence of thresholds beyond which material constraints limit the capacity of digital information to influence institutional perceptions.

4.5.1.4 Digital exposure and tax legitimacy by African sub-region

Table 4.8 highlights strong regional heterogeneity in the association between digital exposure and tax legitimacy in Africa, suggesting that the effects of digital technology on tax attitudes are closely conditioned by local institutional and political contexts.

The association is strongest and most robust in Southern Africa (column 4), where digital exposure is associated with a 2.2 percentage point increase in the probability of reporting high tax legitimacy. The effect is also significant, though more moderate, in North Africa (1.1 p.p.) and West Africa (0.9 p.p.). In East Africa, the effect remains positive but weak (0.6 p.p.), while in Central Africa, no statistically significant association is detected.

This regional gradient suggests several underlying mechanisms. The magnitude of the effect in Southern Africa, a region characterized by relatively more developed tax institutions and more consolidated democratic governance in certain countries, indicates that access to digital information reinforces tax legitimacy primarily in contexts where institutions already possess a minimum level of credibility (Frey and Torgler, 2007). Conversely, the absence of a significant effect in Central Africa, where the sample size is comparable to North Africa (approximately 3,400 observations), suggests that in environments characterized by low institutional trust or

fragmented governance, exposure to digital technology does not automatically translate into increased adherence to tax norms.

Control variables confirm several regularities while revealing regional specificities. Perceived corruption of tax officials systematically reduces tax legitimacy across all regions, with particularly pronounced effects in North Africa (-6.3 p.p.) and Southern Africa (-5.1 points). Education exerts a robust positive effect everywhere, especially in Central Africa (6.4 points). However, some results diverge: difficulty in paying taxes does not significantly affect tax legitimacy in North Africa, and access to electricity shows a counterintuitive negative effect there (-10.0 p.p.), suggesting region-specific institutional dynamics.

These findings indicate that the internet acts as a conditional amplifier of tax legitimacy rather than an autonomous determinant, with effects strongly dependent on institutional quality and governance contexts. The variation in effect magnitude across regions underscores the importance of accounting for institutional heterogeneity when analyzing tax legitimacy determinants in Africa.

4.5.2 Robustness check

4.5.2.1 Digital exposure and tax legitimacy by institutions quality

Table 4.9 examines the robustness of the relationship between digital exposure and tax legitimacy by successively introducing eight dimensions of institutional quality. The marginal effect of digital exposure remains remarkably stable across all specifications (+1.0 to +1.1 p.p.). This stability, observed despite the introduction of institutional variables strongly correlated with tax legitimacy, suggests that digital exposure exerts an independent effect that cannot be reduced to governance perceptions.

Institutional determinants follow the expected pattern. Corruption, both of tax officials and the general level of corruption [1], (-3.1 to -3.8 p.p.), procedural constraints (-4.6 to -5.0 points), lived poverty (-1.6 to -2.0 points), and unequal treatment [6] (-2.3 points) significantly reduce tax legitimacy (Tanzi and Davoodi, 2001; Fjeldstad and Tungodden, 2003; Doerrenberg and Peichl, 2013; Prichard, 2015; Hsu, 2024), confirming the importance of administrative integrity, perceived fairness, and contributive capacity.

Conversely, indicators of political and institutional legitimacy show significant positive effects: democratic satisfaction [2] (+5.7 p.p.), freedom of expression [3] (+6.3 points), trust in courts [5] (+3.1 points), and conflict management [7] (+5.1 points), consistent with research linking political legitimacy to tax consent (Levi, 1988; Alm and Torgler, 2006; Torgler, 2007). The effect of media freedom [4] appears non-significant (-0.9 point, ns), suggesting that this dimension, while important for thepublic sphere, does not directly influence tax legitimacy once other institutional factors are controlled.

Furthermore, the perception of good use of tax revenue [8] shows the highest positive effect (+10.5 p.p.). This result provides robust empirical support for the theory of fiscal reciprocity: when citizens perceive an effective transformation of taxes into public goods, their tax consent is significantly strengthened (Ortega et al., 2016; Carrillo et al., 2021).

These results suggest that internet acts both as an information amplifier and as a vector for forming institutional beliefs. By facilitating access to information related to corruption, justice, freedom of expression, public finance management, and governance quality, internet strengthens individuals' capacity to evaluate state action and adapt their fiscal behavior accordingly (Kaufmann and Bellver, 2005; Pina et al., 2010). digital exposure thus contributes to shaping tax legitimacy not only directly, but also indirectly, by making more salient the dimensions of accountability, justice, and reciprocity that underpin the fiscal contract.

4.5.2.2 Alternative measure of internet : Mobile phone access to internet

To further test the robustness of our results, we replace the initial measure of digital exposure with an indicator capturing access to the internet through mobile phones (Table 4.10). This alternative measure better reflects individuals' potential exposure to the digital environment in the African context, where mobile phones constitute the primary gateway to internet access.

Focusing on the most comprehensive specification, which includes the full set of individual controls and country fixed effects (column [4]), access to mobile internet remains positively and statistically significantly associated with tax legitimacy. This result suggests that the mere ability to access the internet, rather than the intensity of reported usage, is associated with a stronger recognition of the legitimacy of taxation and fiscal authority.

The persistence of this relationship in the most demanding specification indicates that

the observed association is not driven by measurement choices or by observable individual characteristics and country-specific factors. Instead, it is consistent with the idea that what matters most is individuals' exposure to a broader informational environment.

By facilitating access to information about public action, governance, and the use of tax revenues, mobile internet access may enhance citizens' capacity to evaluate the fiscal contract and to form judgments about the legitimacy of taxation. In settings characterized by limited administrative capacity and uneven state presence, this form of digital exposure appears to be a particularly relevant channel through which perceptions of tax legitimacy are shaped

4.5.2.3 Alternative estimation : Probit

This section assesses the robustness of the baseline findings to an alternative estimation strategy by employing probit models, with average marginal effects reported in Table 4.11. Overall, the probit estimates are very close to those obtained from the logit specifications, both in terms of sign and magnitude. This strong consistency confirms the stability of the results and reinforces the robustness of the observed association between digital exposure and tax legitimacy.

Columns [1] and [2] present bivariate specifications relating digital exposure to tax legitimacy, without and with country fixed effects, respectively. In both cases, digital exposure is positively and statistically significantly associated with tax legitimacy, indicating that greater exposure to the internet is linked to a higher probability of recognizing the legitimacy of taxation, even after accounting for time-invariant cross-country heterogeneity.

When individual-level control variables are introduced (column [3]), the coefficient on digital exposure becomes statistically insignificant, suggesting that part of the unconditional correlation is absorbed by observable individual characteristics. However, once individual controls and country fixed effects are simultaneously included (column [4]), the effect of digital exposure re-emerges as positive and statistically significant. This pattern highlights the importance of jointly controlling for individual heterogeneity and unobserved country-specific institutional factors when assessing the relationship of interest.

Overall, the estimated effects of the control variables are consistent with those obtained in the logit models, supporting the internal coherence of the analysis. Overall, these results confirm the existence of a robust conditional association between digital exposure and tax

legitimacy, regardless of the estimation method employed. As before, the findings should be interpreted as conditional correlations rather than as evidence of a strict causal relationship.

4.5.2.4 Digital exposure and tax legitimacy by frequency of digital exposure

In this section, we highlight the robustness of the effect of digital exposure frequency on tax legitimacy (Table 4.12). For those who use it a few times a month [2], the effect is weakly significant (at the 10% level) and negatively associated with tax legitimacy, suggesting that occasional exposure to digital technologies is not systematically associated with higher recognition of the legitimacy of taxation.recognition of the legitimacy of taxation.

By contrast, once digital exposure becomes more frequent and regular (columns [3] and [4]), the effects turn positive and statistically significant. Individuals who use the internet several times a week [3] exhibit a significantly higher probability of reporting high tax legitimacy (an increase of 3.5 p.p.), and this effect is confirmed, with a comparable magnitude, for those who use the internet on a daily basis [4] (an increase of 3.3 p.p.). This pattern indicates the existence of an intensity threshold beyond which digital exposure is more consistently associated with tax legitimacy.

Overall, these results suggest that it is not occasional access to digital technologies that matters most, but rather repeated and sustained exposure to the online informational environment. More frequent digital exposure is associated with greater exposure to public information, civic debates, and social norms related to governance and taxation, which is consistent with mechanisms of belief formation and evaluation of the fiscal contract that may strengthen the recognition of tax legitimacy.

4.6 Conclusion

This paper analyses the role of digital exposure in the formation of tax legitimacy in Africa, highlighting how changes in the information environment shape citizens' attitudes toward taxation. Drawing on individual-level data from Afrobarometer surveys and a wide range of empirical specifications, the study provides new insights into the behavioral foundations of tax capacity in contexts characterized by high informality, limited administrative capacity, and a continued reliance on compulsory compliance.

The results show first that digital exposure is robustly associated with a higher probability of expressing strong tax legitimacy. This relationship holds across different measures of digital exposure, actual digital exposure, access via mobile phones, and frequency of use, as well as across estimation methods and robustness checks. The findings also indicate that the effect is not linear. Occasional exposure to digital technologies is insufficient to change fiscal attitudes, whereas regular and repeated use is required to generate significant effects. This suggests that the impact of the internet depends less on sporadic access than on sustained immersion in an expanded information environment.

Second, the analysis shows that the internet influences tax legitimacy primarily through identifiable intermediate mechanisms. digital exposure increases exposure to political and civic information, improves perceptions of state performance and accountability, particularly in the provision of public goods, and strengthens support for the idea that national development should be financed through domestic resources. These dimensions are themselves positively associated with tax legitimacy, indicating that the internet operates by shaping the beliefs through which citizens assess the legitimacy of taxation and their fiscal relationship with the state.

Third, the heterogeneity analyses reveal that the effect of the internet varies substantially across African sub-regional contexts. The impact is stronger in regions where institutional credibility, the visibility of public action, and administrative capacity are relatively, higher and weaker or even insignificant in contexts characterized by fragmented governance and weak state capacity. These results suggest that the internet primarily acts as an amplifier of existing institutional dynamics rather than as a substitute for governance quality.

These findings should nevertheless be interpreted in light of several limitations. Afrobarometer data cover all adult citizens and do not allow a precise distinction between actual taxpayers and non-taxpayers. The survey does not provide detailed information on fiscal deterrence mechanisms or on the effective capacity of tax administrations. Institutional indicators rely on subjective perceptions, and the cross-sectional nature of the data limits strict causal identification. Nonetheless, the consistency of the results across numerous specifications and robustness checks strengthens the credibility of the relationships identified.

In terms of economic policy implications, the results suggest several lessons for economic and fiscal policies in Africa. First, strategies aimed at expanding internet access and reducing the digital divide can generate indirect benefits for domestic resource mobilization by strengthening tax legitimacy. Digital inclusion policies, particularly through the expansion of the mobile internet, improved affordability, and better infrastructure quality, thus appear as relevant complements to traditional tax reforms. Second, the findings underscore the importance of accompanying digital transformation with active policies promoting transparency, public communication, and accountability. The internet enhances tax legitimacy only insofar as it enables citizens to access credible information on public action, the provision of public goods, and the use of tax revenues. Governments would therefore benefit from investing in the online dissemination of accessible, understandable, and verifiable budgetary information, as well as in digital tools that foster interaction between administrations and citizens. Finally, the observed heterogeneity suggests that digital policies must be closely aligned with institutional reforms. In contexts of low state credibility, expanding internet access alone is insufficient to strengthen tax legitimacy and may even increase the visibility of governance failures. Digitalization policies should thus be designed as complements to broader efforts to improve governance quality, public sector performance, and tax justice.

Overall, this paper shows that the digitalization of the information environment can serve as a long-term lever for strengthening fiscal attitudes, provided it is embedded in a coherent strategy combining digital inclusion, public transparency, and improvements in institutional capacity. The internet thus emerges not as a standalone technological solution, but as a structuring tool for consolidating the fiscal contract and sustainably strengthening tax capacity in developing countries.

Appendix

Table 4.4: Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Perceived tax legitimacy	44687	.659	.474	0	1
Digital exposure	47507	1.564	1.767	0	4
Age	47806	36.794	14.367	18	80
Education level	47909	1.488	.991	0	3
Female	48084	.5	.5	0	1
Work income	47908	.338	.473	0	1
Lived Poverty	47595	1.672	.935	0	3
Trust tax authotit	44399	1.37	1.065	0	3
Corruption tax off	42212	1.406	.864	0	3
difficult find taxes	43352	.676	.468	0	1
Urban	48084	.453	.498	0	1
phone access to internet	47830	.43	.495	0	1
electricity connection	47959	.571	.495	0	1
social media news	47324	1.594	1.793	0	4
raise corruption	45992	.584	.493	0	1
democracy satisfaction	46621	.439	.496	0	1
freedom to say	47615	.71	.454	0	1
Media freedom	46692	.626	.484	0	1
Trust courts of law	46041	1.572	1.087	0	3
Unequally treatment	46118	1.624	1.062	0	3
conflict good management	46194	.489	.5	0	1
good usage tax revenue	41713	.582	.493	0	1
More information	32254	.923	.266	0	1
Internet news	47410	1.46	1.759	0	4

Table 4.5: Digital exposure and tax legitimacy by gender

Tax legitimacy	[1] Female	[2] Male
Digital exposure	0.029***	0.043***
	(0.010)	(0.008)
Age	0.017**	0.030***
	(0.008)	(0.007)
Education level	0.065***	0.049***
	(0.012)	(0.010)
Work income	0.002	0.014*
	(0.009)	(0.008)
Urban	0.003	-0.001
	(0.009)	(0.008)
Lived Poverty	-0.052***	-0.045***
	(0.014)	(0.013)
Corruption tax officials	-0.010	-0.036***
	(0.012)	(0.011)
Diff. find. tax. pay	-0.052***	-0.060***
	(0.009)	(0.008)
Electricity	0.038***	0.036***
	(0.010)	(0.009)
Observations	17581	19348
Country fixed-effect	Yes	Yes
Number of countries	34	34

Note: t-statistics in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.
Source: Authors' own elaboration based on survey data and the reported coefficients correspond to marginal effects.

Table 4.6: Digital exposure and tax legitimacy by urban vs rural

Tax legitimacy	[1] Urban	[2] Rural
Digital exposure	0.010***	0.008***
	(0.003)	(0.003)
Age	0.001***	0.001***
	(0.000)	(0.000)
Education level	0.032***	0.038***
	(0.005)	(0.005)
Female	-0.023***	-0.021***
	(0.007)	(0.007)
Work income	0.019**	-0.006
	(0.008)	(0.009)
Lived Poverty	-0.017***	-0.023***
	(0.004)	(0.004)
Corruption tax officials	-0.036***	-0.039***
	(0.005)	(0.004)
Diff. find tax. pay	-0.052***	-0.050***
	(0.008)	(0.008)
Electricity	0.024**	0.028***
	(0.011)	(0.010)
Observations	16997	19766
Country fixed-effect	Yes	Yes
Number of countries	34	34

Note: t-statistics in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.
Source: Authors' own elaboration based on survey data and the reported coefficients correspond to marginal effects.

Table 4.7: Digital exposure and tax legitimacy by poverty level

Tax legitimacy	[1] No poverty	[2] Low Lived Poverty	[3] Moderate Lived Poverty	[4] High Lived Poverty
Digital exposure	0.010*	0.006**	0.015***	0.006
	(0.006)	(0.003)	(0.003)	(0.004)
Age	0.002***	0.002***	0.001**	0.000
	(0.001)	(0.000)	(0.000)	(0.000)
Education level	0.035***	0.033***	0.027***	0.041***
	(0.010)	(0.006)	(0.006)	(0.008)
Female	-0.012	-0.033***	-0.005	-0.036***
	(0.015)	(0.009)	(0.009)	(0.012)
Work income	0.015	-0.003	0.026**	-0.011
	(0.015)	(0.009)	(0.011)	(0.014)
Urban	-0.023	-0.019*	0.009	0.014
	(0.017)	(0.010)	(0.011)	(0.015)
Corruption tax officials	-0.056***	-0.027***	-0.040***	-0.039***
	(0.009)	(0.005)	(0.005)	(0.007)
Diff. find. tax. pay	-0.061***	-0.049***	-0.040***	-0.058***
	(0.015)	(0.009)	(0.010)	(0.014)
Electricity	0.119***	0.038***	0.008	0.011
	(0.024)	(0.012)	(0.012)	(0.016)
Observations	3867	12333	12515	8048
Country fixed-effect	Yes	Yes	Yes	Yes
Number of countries	34	34	34	34

Note: t-statistics in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.
Source: Authors' own elaboration based on survey data and the reported coefficients correspond to marginal effects.

Table 4.8: Digital exposure and tax legitimacy by african sub-region

Tax legitimacy	[1] Central Africa	[2] East Africa	[3] North Africa	[4] Southern Africa	[5] West Africa
Digital exposure	0.006	0.006*	0.011*	0.022***	0.009***
	(0.006)	(0.003)	(0.006)	(0.005)	(0.003)
Age	0.002**	0.001***	0.004***	0.001***	0.000
	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)
Education level	0.064***	0.034***	0.033***	0.032***	0.033***
	(0.013)	(0.006)	(0.011)	(0.011)	(0.005)
Female	-0.027	-0.027***	-0.013	-0.028*	-0.018**
	(0.018)	(0.009)	(0.019)	(0.015)	(0.009)
Work income	0.060***	0.004	0.021	0.016	-0.014
	(0.020)	(0.009)	(0.021)	(0.017)	(0.010)
Urban	-0.001	-0.014	-0.013	-0.010	0.004
	(0.023)	(0.011)	(0.020)	(0.017)	(0.011)
Lived Poverty	0.001	-0.022***	-0.015	-0.005	-0.031***
	(0.010)	(0.005)	(0.011)	(0.009)	(0.005)
Corruption tax officials	-0.033***	-0.026***	-0.063***	-0.051***	-0.038***
	(0.010)	(0.005)	(0.012)	(0.009)	(0.005)
Diff. find. tax. pay	-0.066***	-0.056***	0.003	-0.025	-0.069***
	(0.019)	(0.010)	(0.019)	(0.017)	(0.009)
Electricity	0.085***	0.038***	-0.100***	0.010	0.018
	(0.025)	(0.012)	(0.028)	(0.019)	(0.011)
Observations	3418	11100	3310	4178	14757
Country fixed-effect	Yes	Yes	Yes	Yes	Yes
Number of countries	3	9	3	5	14

Note: t-statistics in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Source: Authors' own elaboration based on survey data and the reported coefficients correspond to marginal effects.

Table 4.9: Digital exposure and tax legitimacy by institutions

Tax legitimacy	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Digital exposure	0.010***	0.010***	0.010***	0.010***	0.010***	0.010***	0.010***	0.011***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Age	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Education level	0.035***	0.036***	0.034***	0.034***	0.036***	0.036***	0.035***	0.036***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)
Female	-0.021***	-0.021***	-0.021***	-0.021***	-0.021***	-0.022***	-0.021***	-0.021***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)
Work income	0.008	0.007	0.007	0.009	0.008	0.007	0.007	0.010
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Urban	-0.003	0.001	-0.001	-0.003	0.001	-0.002	-0.003	0.003
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.007)
Lived Poverty	-0.019***	-0.016***	-0.017***	-0.020***	-0.017***	-0.017***	-0.018***	-0.017***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Corruption tax officials	-0.034***	-0.034***	-0.036***	-0.038***	-0.031***	-0.034***	-0.034***	-0.031***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Diff. find. tax. pay	-0.050***	-0.047***	-0.048***	-0.050***	-0.047***	-0.050***	-0.048***	-0.046***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Electricity	0.023***	0.025***	0.026***	0.024***	0.028***	0.025***	0.025***	0.027***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Raise corruption level	-0.038***							
	(0.006)							
Democracy satisfaction		0.057***						
		(0.006)						
freedom to say			0.063***					
			(0.006)					
Media freedom				-0.009				
				(0.005)				
Trust courts of law					0.031***			
					(0.003)			
Unequally treatment						-0.023***		
						(0.003)		
Conflict good management							0.051***	
							(0.006)	
Good usage tax revenue								0.105***
								(0.006)
Observations	36248	36410	36623	36216	36264	36235	36149	33637
Country fixed-effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of countries	34	34	34	34	34	34	34	34

Table 4.10: Digital exposure and tax legitimacy by alternative internet

Tax legitimacy	[1]	[2]	[3]	[4]
Digital exposure	0.046***	0.064***	0.016***	0.041***
	(0.005)	(0.005)	(0.006)	(0.006)
Age			0.012**	0.023***
			(0.005)	(0.005)
Education level			0.057***	0.055***
			(0.007)	(0.008)
Female			-0.021***	-0.025***
			(0.005)	(0.005)
Work income			0.056***	0.008
			(0.005)	(0.006)
Urban			0.015**	0.000
			(0.006)	(0.006)
Lived Poverty			-0.033***	-0.047***
			(0.009)	(0.009)
Corruption tax officials			-0.029***	-0.024***
			(0.008)	(0.008)
Diff. find. tax. pay			-0.072***	-0.057***
			(0.005)	(0.006)
Electricity			0.002	0.037***
			(0.006)	(0.007)
Observations	44469	44469	37074	37074
Country fixed-effect	No	Yes	No	Yes
Number of countries	34	34	34	34

Note: t-statistics in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.
Source: Authors' own elaboration based on survey data and the reported coefficients correspond to marginal effects.

Table 4.11: Digital exposure and tax legitimacy by probit estimation

Tax legitimacy	[1]	[2]	[3]	[4]
Digital exposure	0.012***	0.019***	-0.002	0.010***
	(0.001)	(0.001)	(0.002)	(0.002)
Age			0.001***	0.001***
			(0.000)	(0.000)
Education level			0.036***	0.034***
			(0.003)	(0.003)
Female			-0.019***	-0.022***
			(0.005)	(0.005)
Work income			0.051***	0.007
			(0.005)	(0.006)
Urban			0.013**	-0.003
			(0.006)	(0.006)
Lived Poverty			-0.030***	-0.020***
			(0.003)	(0.003)
Corruption tax officials			-0.031***	-0.037***
			(0.003)	(0.003)
Diff. find. tax. pay			-0.065***	-0.051***
			(0.005)	(0.006)
Electricity			-0.015**	0.024***
			(0.006)	(0.007)
Observations	44246	44246	36763	36763
Country fixed-effect	No	Yes	No	Yes
Number of countries	34	34	34	34

Note: t-statistics in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.
Source: Authors' own elaboration based on survey data and the reported coefficients correspond to marginal effects.

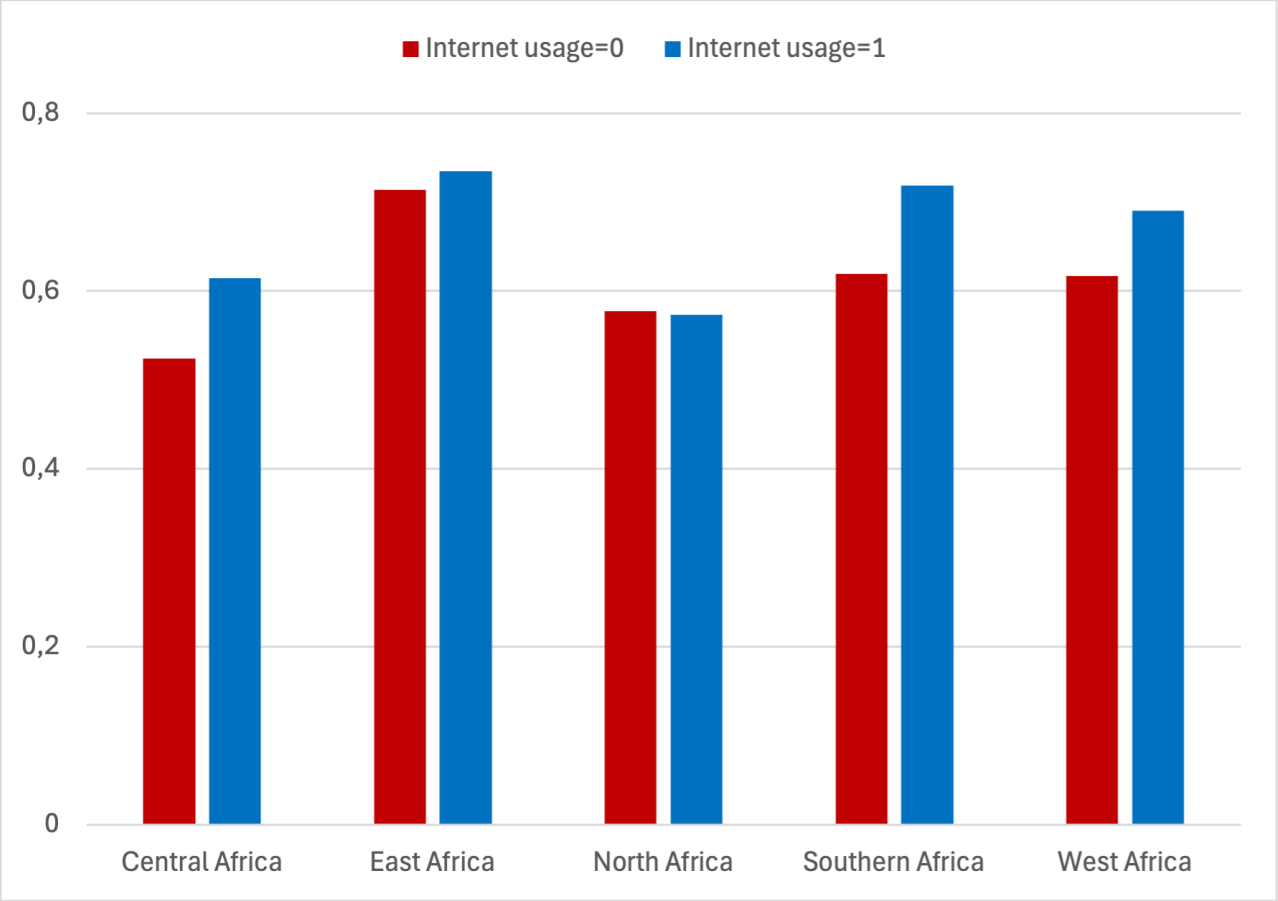
Table 4.12: Digital exposure level

	[1] Less than once a month	[2] A few times a month	[3] A few times a week	[4] Every day
Digital exposure1	0.005			
	(0.014)			
Digital exposure2		-0.022*		
		(0.013)		
Digital exposure3			0.035***	
			(0.009)	
Digital exposure4				0.033***
				(0.008)
Age	0.001***	0.001***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
Education level	0.036***	0.037***	0.034***	0.035***
	(0.005)	(0.005)	(0.004)	(0.004)
Female	-0.017**	-0.020***	-0.018***	-0.022***
	(0.007)	(0.007)	(0.007)	(0.006)
Work income	-0.011	-0.009	-0.009	0.006
	(0.009)	(0.009)	(0.008)	(0.007)
Urban	0.000	0.001	-0.001	-0.001
	(0.009)	(0.009)	(0.008)	(0.007)
Lived Poverty	-0.020***	-0.018***	-0.021***	-0.022***
	(0.004)	(0.004)	(0.004)	(0.004)
Corruption tax officials	-0.032***	-0.034***	-0.033***	-0.037***
	(0.004)	(0.004)	(0.004)	(0.004)
Diff. find. tax.	-0.060***	-0.058***	-0.058***	-0.055***
	(0.008)	(0.008)	(0.007)	(0.007)
Electricity	0.022**	0.025***	0.024***	0.030***
	(0.009)	(0.009)	(0.009)	(0.008)
Observations	19680	20131	23123	28522
Country fixed-effect	Yes	Yes	Yes	Yes
Number of countries	34	34	34	34

Note: t-statistics in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Source: Authors' own elaboration based on survey data and the reported coefficients correspond to marginal effects.

Figure 4.5: Internet Use and Non-Use by regional Tax legitimacy



Source : Authors' construction of Afrobarometer data

Table 4.13: Description of the interview questions and modality of responses (1/2)

Variable	Question	Value label	Codage
Tax_legitimacy_dummy	For each of the following statements, please tell me whether you disagree or agree: The tax authorities always have the right to make people pay taxes.	1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly agree, 8=Refused, 9=Dont know, -1=Missing	1.Agree, Strongly agree; 0. Strongly disagree, Disagree; Missing. Otherwise
Internet_usage	How often do you use: The Internet?	0=Never, 1=Less than once a month, 2=A few times a month, 3=A few times a week, 4=Every day, 8=Refused, 9=Dont know, -1=Missing	0.Never; 1.Less than once a month; 2.A few times a month; 3.A few times a week; 4.Every day; Missing. Otherwise
Age	How old are you?	998=Refused, 999=Dont know, -1=Missing	
Education level			
Female	Respondents gender	1=Male, 2=Female	1. Female; 0. Male
Work_income	Do you have a job that pays a cash income? [If yes, ask] Is it full-time or part-time? [If no, ask:] Are you presently looking for a job?	0=No, not looking, 1=No, looking, 2=Yes, part time, 3=Yes, full time, 8=Refused, 9=Dont know, -1=Missing	1. Yes, part time, Yes, full time; 0. No, not looking, No, looking; Missing. Otherwise
Urban			
Lived_Poverty			
Corruption_tax_officials	How many of the following people do you think are involved in corruption, or havent you heard enough about them to say: Tax officials?	0=None, 1=Some of them, 2=Most of them, 3=All of them, 8=Refused, 9=Dont know/Havent heard, -1=Missing	0.None; 1.Some of them; 2.Most of them; 3.All of them; Missing. Otherwise
difficult_find_taxes	Based on your experience, how easy or difficult is it to do each of the following: To find out what taxes and fees you are supposed to pay to the government?	1=Very easy, 2=Easy, 3=Difficult, 4=Very difficult, 8=Refused, 9=Dont know, -1=Missing.	1. Difficult, Very difficult; 0. Very easy, Easy; Missing. Otherwise
electricity_connection	Do you have an electric connection to your home from the national power grid?	0=No, 1=Yes, 8=Refused, 9=Dont know, -1=Missing	1. Yes; 0. No; Missing. Otherwise
phone_access_to_internet	Does your phone have access to the internet?	0=No, does not have internet access, 1=Yes, has internet access, 7=Not applicable, 8=Refused, 9=Dont know, -1=Missing	1. Yes, has internet access; 0. No, does not have internet access; Missing. Otherwise
freedom_to_say	In this country, how free are you: To say what you think?	1=Not at all free, 2=Not very free, 3=Somewhat free, 4=Completely free, 8=Refused, 9=Dont know, -1=Missing	1. Somewhat free, Completely free; 0. Not at all free, Not very free; Missing. Otherwise

Table 4.14: Description of the interview questions and modality of responses (2/2)

Variable	Question	Value label	Codage
good_usage_tax_revenue	Do you agree or disagree with each of the following statements: The government usually uses the tax revenues it collects for the well-being of citizens.	1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly agree, 8=Refused, 9=Dont know, -1=Missing.	1. Agree, Strongly agree; 0. Strongly disagree, Disagree; Missing. Otherwise
conflict_goodmanagement	How well or badly would you say the current government is handling the following matters, or havent you heard enough to say: Preventing or resolving violent conflict?	1=Very badly, 2=Fairly badly, 3=Fairly well, 4=Very well, 8=Refused, 9=Dont know/Havent heard enough, -1=Missing	1. Fairly well, Very well; 0. Very badly, Fairly badly; Missing. Otherwise
Unequally_treatment	In your opinion, how often, in this country: Are people treated unequally under the law?	0=Never, 1=Rarely, 2=Often, 3=Always, 8=Refused, 9=Dont know, -1=Missing	0.Never; 1.Rarely; 2.Often; 3.Always; Missing. Otherwise
Trust_courts_of_law	How much do you trust each of the following, or havent you heard enough about them to say: Courts of law?	0=Not at all, 1=Just a little, 2=Somewhat, 3=A lot, 8=Refused, 9=Dont know/Havent heard, -1=Missing	0.Not at all; 1.Just a little; 2.Somewhat; 3.A lot; Missing. Otherwise
Media_freedom	Which of the following statements is closest to your view? Choose Statement 1 or Statement 2. Statement 1: The media should have the right to publish any views and ideas without government control. Statement 2: The government should have the right to prevent the media from publishing things that it disapproves of.	1=Agree very strongly with Statement 1, 2=Agree with Statement 1, 3=Agree with Statement 2, 4=Agree very strongly with Statement 2, 5=Agree with neither, 8=Refused, 9=Dont know, -1=Missing	1. Agree very strongly with Statement 1, Agree with Statement 1; 0. Agree with Statement 2, Agree very strongly with Statement 2; Missing. Otherwise
democracy_satisfaction	Overall, how satisfied are you with the way democracy works in?	0=The country is not a democracy, 1=Not at all satisfied, 2=Not very satisfied, 3=Fairly satisfied, 4=Very satisfied, 8=Refused, 9=Dont know, -1=Missing	1. Fairly satisfied, Very satisfied; 0. The country is not a democracy, Not at all satisfied, Not very satisfied; Missing. Otherwise
raise_corruption_level	In your opinion, over the past year, has the level of corruption in this country increased, decreased, or stayed the same?	1=Increased a lot, 2=Increased somewhat, 3=Stayed the same, 4=Decreased somewhat, 5=Decreased a lot, 8=Refused, 9=Dont know, -1=Missing	1. Increased a lot, Increased somewhat; 0. Stayed the same, Decreased somewhat, Decreased a lot; Missing. Otherwise
social_media_news	How often do you get news from the following sources: Social media such as Facebook, Twitter, WhatsApp or others?	"0=Never, 1=Less than once a month, 2=A few times a month, 3=A few times a week, 4=Every day, 8=Refused, 9=Dont know, -1=Missing"	0.Never; 1.Less than once a month; 2.A few times a month; 3.A few times a week; 4.Every day; Missing. Otherwise

Chapter 5

General Conclusion

Cette thèse analyse l'amélioration de la capacité fiscale des pays en développement à l'ère du numérique, en mettant en évidence le rôle central de la digitalisation dans la mobilisation des recettes, la conformité fiscale et la légitimité de l'impôt. En combinant des approches macroéconomiques, microéconomiques et comportementales, elle montre que la capacité fiscale ne peut être appréhendée uniquement comme une question technique ou administrative, mais qu'elle résulte d'interactions complexes entre technologies numériques, institutions et comportements des contribuables. La digitalisation apparaît ainsi comme un facteur transversal, capable d'agir simultanément sur la mobilisation des recettes, la conformité observée et le consentement à l'impôt.

Les résultats empiriques montrent que la digitalisation constitue un levier important de renforcement de la capacité fiscale, tout en soulignant que ces effets sont conditionnels et hétérogènes. Le premier chapitre montre que la diffusion et l'usage des technologies numériques sont associés à une augmentation des recettes fiscales non extractives dans les pays en développement. Cet effet apparaît plus fortement lié à l'usage effectif des TIC qu'à leur simple disponibilité, suggérant que la digitalisation ne produit des gains fiscaux que lorsqu'elle est effectivement intégrée dans les pratiques économiques et administratives. Les résultats mettent également en évidence des différences selon le niveau de revenu et la qualité institutionnelle, ce qui suggère que la digitalisation agit davantage comme un facteur de consolidation des capacités existantes.

Le deuxième chapitre apporte un éclairage microéconomique complémentaire en analysant l'adoption et les effets des services fiscaux électroniques sur la conformité fiscale des petites et moyennes entreprises au Burkina Faso. Les résultats montrent que la digitalisation améliore la conformité fiscale, en particulier à travers une meilleure ponctualité des déclarations et des paiements. Les effets sur les montants collectés demeurent limités à court terme, mais la réforme contribue à structurer des comportements de conformité plus réguliers et plus prévisibles. Ce chapitre met également en évidence le rôle des perceptions des contribuables, en montrant que les outils numériques sont associés à une amélioration de la confiance, de la transparence perçue et du sentiment d'équité. Ces résultats suggèrent que les gains fiscaux issus de la digitalisation passent autant par des mécanismes institutionnels que par des changements dans la relation

entre l'administration fiscale et les contribuables.

Le troisième chapitre complète l'analyse en s'intéressant aux fondements comportementaux de la capacité fiscale. Il montre que l'exposition digitale est associée à une légitimité fiscale plus élevée en Afrique. Cet effet s'explique notamment par des transformations de l'environnement informationnel et social des citoyens. En particulier, l'accès accru aux informations en ligne, la perception d'être mieux informé sur les affaires publiques et l'intensification des interactions sur les réseaux sociaux contribuent à façonner la manière dont les citoyens évaluent l'action publique et la légitimité de l'impôt. L'analyse met ainsi en évidence que la digitalisation de l'environnement informationnel peut renforcer le consentement à l'impôt en améliorant l'accès à l'information et la compréhension du rôle de la fiscalité dans le financement de l'action publique. Toutefois, ces effets demeurent fortement dépendants du contexte institutionnel. Dans les pays où la crédibilité de l'État et la visibilité des services publics restent faibles, l'exposition digitale peut également amplifier les perceptions négatives de l'action publique plutôt que renforcer la légitimité fiscale. Ces résultats suggèrent que la digitalisation ne peut produire des effets durables sur la capacité fiscale que si elle s'inscrit dans un cadre institutionnel perçu comme légitime et crédible.

Par ailleurs, Les implications de politique publique issues de cette thèse sont multiples. Premièrement, les stratégies de digitalisation fiscale doivent être conçues comme des réformes institutionnelles de long terme, et non comme de simples projets informatiques. Les investissements dans les infrastructures numériques doivent être accompagnés de réformes visant à renforcer la transparence, la simplicité et la prévisibilité des procédures fiscales. Deuxièmement, la digitalisation doit s'accompagner de dispositifs d'accompagnement ciblés, en particulier pour les petites entreprises et les contribuables disposant de faibles capacités administratives ou numériques. Troisièmement, les politiques digitales doivent être accompagner des efforts visant à améliorer la communication fiscale et la redevabilité de l'État, afin que les gains d'efficacité administrative se traduisent par un renforcement du consentement à l'impôt. Enfin, les résultats soulignent la nécessité d'adapter les réformes numériques aux contextes nationaux, en tenant compte des capacités institutionnelles et des inégalités d'accès au numérique.

Tel tout travail scientifique, cette thèse présente des limites. Les analyses macroéconomiques reposent sur des indicateurs agrégés de digitalisation qui ne permettent pas de distinguer finement les différentes composantes des réformes numériques ni leur séquençage. L'analyse microéconomique se concentre sur un pays et un dispositif spécifique, ce qui limite la généralisation des résultats à d'autres contextes. L'analyse comportementale repose sur des données transversales, ce qui limite l'identification causale et ne permet pas de distinguer précisément les contribuables effectifs des non-contribuables. Par ailleurs, la thèse n'aborde pas directement les effets redistributifs de la digitalisation fiscale, alors que les perceptions de justice fiscale jouent un rôle central dans la formation de la morale fiscale.

Enfin, cette thèse ouvre plusieurs pistes de recherche futures. L'exploitation de données longitudinales individuelles permettrait d'analyser plus finement les dynamiques de formation et d'évolution de la morale fiscale dans le temps, en distinguant les effets d'exposition progressive aux technologies numériques des ajustements de court terme. Par ailleurs, l'articulation entre digitalisation fiscale, informalité et justice fiscale méritent des approfondissements, en particulier à travers l'étude du rôle complémentaire des outils numériques de traçabilité, tels que la facturation électronique et les dispositifs fiscaux électroniques, dans la réduction de l'informalité, l'élargissement de l'assiette fiscale et l'amélioration de l'équité fiscale. Des analyses comparatives entre pays ayant adopté ces technologies à des degrés variables permettraient de mieux identifier les conditions institutionnelles et administratives sous lesquelles la digitalisation produit des effets durables. Plus largement, comprendre comment l'ensemble des technologies numériques, de la déclaration et du paiement en ligne à la facturation électronique et à la diffusion d'information publique, contribue à la construction et à la consolidation d'un contrat fiscal crédible constitue un agenda de recherche central pour accompagner les trajectoires de développement des pays à faible et moyen revenu.

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