

When enforcement goes digital: Balancing revenue, costs, and welfare in modern tax systems

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Abstract

This paper documents the rise of digital compliance measures, such as e-invoicing, e-reporting, and electronic fiscal devices, in value-added tax (VAT) systems and discusses their welfare implications. Drawing on emerging evidence from advanced and developing economies, we find substantial revenue gains from these interventions but also highlight their highly regressive compliance costs, which disproportionately burden small firms. Using a simple normative framework, we show that overlooking heterogeneity in compliance costs across firm sizes risks overstating welfare gains. The paper underscores the importance of tailoring digital compliance strategies to country-specific contexts, particularly in developing economies where implementation capacity and informality pose significant challenges.

Keywords: Tax Administration and Compliance; Value-Added Tax; Digital Tax Technologies

JEL Classification: H26; H25; H20

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I Introduction

In 1989, Hernando de Soto published his groundbreaking analysis of Peru's informal economy, arguing that excessive regulatory barriers incentivize economic actors to operate informally, thus limiting formal economic growth and development (de Soto, 1989). Around the same period, Mayshar (1990) incorporated Adam Smith's four components of tax costs—administration, substitution, active noncompliance, and passive compliance—into a coherent tax compliance model to contend that the technology of tax collection is as important as the traditional concerns of efficiency and equity. These works profoundly influenced thinking across development economics and public finance in the early 1990s and helped forge a strong consensus in favor of simpler, less burdensome tax systems.

The value-added tax (VAT) was a relatively new tax at the time, and its design was accordingly affected by this consensus more than any other tax. For example, in a manual published to guide countries adapting the new tax, the IMF recommended that wherever possible the VAT system should prioritize simplicity, imposing as little compliance burden as possible. Importantly, it recommended that "the [VAT] return form must be simple and include only information that is essential to the proper administration of the tax". In line with this recommendation, the IMF also proposed a standardized, single-page VAT return form—illustrated in Figure I—requiring firms to report the aggregate values of sales and purchases along with relevant tax variables only. This simple return form was adopted by almost all countries in the 1990s.

Recently, however, this consensus on simpler tax systems has begun to erode. Many countries have now introduced measures requiring firms to provide micro-level details of all their transactions rather than only aggregates. These requirements differ in scope and frequency: some apply universally, others only to selected transactions or firms; some require manual, once-a-month submission, others mandate real-time electronic reporting through e-invoicing. But the purpose of all these requirements is to ensure that all firm trade is visible to the revenue authority. More than 40 countries—including Spain, Italy, Belgium, China, India, Brazil, and Mexico—have already implemented such systems and many others are planning to do so. Where already adapted, the coverage of such systems is being expanded and the underlying technologies are being upgraded. This policy framing paper examines the implications of moving from simple, single-page-return based VAT systems to comprehensive, real-time, transaction-level reporting based systems. In particular, we discuss

how this shift impacts firms' compliance burdens, alters overall tax compliance, and under what conditions can enhance economic welfare.

II Adoption of Digital Compliance Measures

These new reporting requirements—which we refer to collectively as digital compliance measures—can be broadly classified into the following four distinct types.

- (i) **E-Invoicing:** It requires businesses to issue invoices in a standardized electronic format and to transmit them through a government-designated platform. The purpose of e-invoicing is to allow automatic, real-time cross-matching of supplier sales records with buyer purchase records.
- (ii) **E-Reporting:** It requires businesses to submit transaction-level details of their sales and purchases electronically at the time of filing of their VAT returns. Although countries use different labels for these systems, we refer to them collectively as e-reporting in this paper.
- (iii) **Electronic Fiscal Devices (EFDs):** These are government-mandated point-of-sale systems that automatically record, validate, and transmit transaction data in real-time to tax authorities. These devices are usually deployed in the retail and hospitality sectors, though in principle they can be applied at any point in the supply chain.
- (iv) **Standard Audit File for Tax (SAF-T):** It requires businesses to periodically extract and submit detailed transactional data from their internal accounting systems in a harmonized electronic format. The purpose of these systems is to facilitate standardized audits by tax authorities.

These measures have been adopted widely. The top panel of Figure II shows that more than 40 countries have either implemented or are planning to implement e-invoicing in their VAT system. These countries include both developed and developing countries. To illustrate how extensive these schemes are in their scope and sophistication, we provide in Appendix A the details of five such schemes from a range of diverse countries.

The bottom panel of Figure II illustrates the adoption of Electronic Fiscal Devices (EFDs) around the world. EFDs are most commonly implemented in developing and

emerging economies, where tax administrations face greater challenges in monitoring a large number of small firms operating in fragmented and often informal markets. Countries in Sub-Saharan Africa (e.g., Kenya, Tanzania, Rwanda) and Eastern Europe (e.g., Bulgaria, Romania) have been among the most active adopters, viewing EFDs as a cost-effective means to widen the tax base and improve revenue mobilization.

It is important to note that none of these digital compliance technologies are perfectly safe, as firms have developed increasingly sophisticated methods to manipulate them. For instance, in jurisdictions where electronic fiscal devices have been implemented, firms have often circumvented them by installing "zappers" or using phantom-ware to tamper or erase transaction data before it is transmitted to tax authorities. Similarly, even in jurisdictions with mandatory e-invoicing, firms can tamper or delete invoices before they are transmitted to tax authorities, undermining the integrity of the system. In response, governments have continually introduced new safeguards and technical enhancements to close these loopholes. For example, two local tax authorities in China—Shenzhen and Beijing—are now piloting e-invoicing platforms built on blockchain technology, which promises tamper-proof storage and improved audit trails. Yet even blockchain-based systems, while effective at preventing post-entry manipulation, cannot guarantee that the data initially entered into the system reflects the true underlying transaction, leaving scope for misreporting at the source. This highlights a fundamental limitation of all such technologies: while they can strengthen administrative capacity and deter certain types of evasion, they cannot fully eliminate the risks posed by intentional misreporting or collusion between buyers and sellers.

III Economics of Digital Compliance Measures

Digital compliance measures are a distinct form of enforcement intervention within tax systems. Like any other enforcement intervention, their purpose is to enhance the government's ability to monitor and verify economic transactions, thereby increasing the revenue it is able to collect. While such interventions can strengthen enforcement and reduce tax evasion, they are not without costs: they impose additional compliance cost on firms and additional administrative cost on the government. From a welfare perspective, any such intervention will be socially desirable and hence optimal only if the social value of the additional revenue it generates exceeds the social value of the costs it imposes. In the simple framework of [Keen & Slemrod \(2017\)](#), this

condition has been formalized as follows

$$(1) \Delta \text{Welfare} = (\varphi - 1) \Delta \text{Revenue} - \varphi \Delta \text{Administrative Cost} - \Delta \text{Compliance Cost}.$$

Here φ is the marginal value of public funds. Because each additional dollar of revenue represents a transfer from the private sector to the government, its social value depends on by how much the marginal value of public funds (φ) exceeds one. The administrative costs are weighted by φ because they are financed through distortionary taxation, amplifying their social burden relative to private compliance costs.

This simple framework suggests that two assumptions are likely driving policy-makers toward adopting digital compliance measures. First, the third-party information generated by these measures strengthens enforcement, which in turn raises additional revenue for the government (Kleven *et al.*, 2011; Pomeranz, 2015; Naritomi, 2019). Second, recent technological innovations have substantially lowered the costs of such measures by reducing the compliance cost for firms to provide electronic information and by reducing the administrative cost for the government to process such information. To some extent, both these assumptions remain untested. For example, we do not know how much new third-party information these measures generate, as in many cases they just simply make the third-party information already available to tax authorities more accessible and easier to process. Furthermore, we do not know how much additional revenue the new information generated by these measures produce. The answers to these questions depend to a large extent on what types of tax evasion are prevalent in VAT systems around the world and which of these evasion types the digital compliance measures can counter effectively.

Tax evasion in VAT systems can be broadly categorized into three distinct types, each with different implications for enforcement (see Pomeranz, 2015 or Waseem, 2019 for more details). The first, *unilateral evasion*, occurs where one party to an economic transaction reports it to the government, while the other party does not. Such evasion does not require coordination between trading partners and is relatively easy to detect using computerized cross-checking of supplier and purchaser records. The second type, *collusive evasion*, involves coordination between trading partners to create consistent but fictitious documentation—such as matching false invoices—to conceal underreported transactions. This form of evasion is considerably harder to detect, as the fabricated records appear internally consistent in automated cross-

checking systems. Finally, *flying invoices* and *missing trader* frauds represent more sophisticated schemes requiring coordination among multiple actors (Waseem, 2023). In these types of frauds, firms generate invoices for goods or services that were never actually supplied or suppliers disappear after collecting VAT from customers without remitting it to the government. In this case as well, the sales and purchase records are internally consistent and therefore unlikely to fail cross matching. This implies that the only form of tax evasion the digital compliance measures can detect automatically is the unilateral evasion. By making more third-party information available to the revenue authority in easily-accessible and timely manner, they may also facilitate the detection of other forms of evasion, although it would require further effort by the revenue authority in the form of tax audit (Best *et al.*, 2021).

IV Do Digital Compliance Measures Work?

The empirical literature assessing the revenue impacts of digital compliance measures is still nascent, but emerging evidence points to substantial gains in tax collection and compliance. Bellon *et al.* (2022) use administrative data on over 53,000 firms in Peru to show that the introduction of e-invoicing increased sales, purchases, and value-added reported by firms by more than 5% in the first year, with effects growing to 10-15% by the fourth quarter after adoption. In Rwanda, Kotsogiannis *et al.* (2025) document that e-invoicing raised firms' net VAT payments and markedly improved audit efficiency: while the direct effect of e-invoicing on compliance was relatively modest, its combination with audits yielded a substantial increase in VAT payments, averaging approximately to US\$32,000 per firm. Similarly, Mascagni *et al.* (2021) show that the deployment of electronic sales registration machines in Ethiopia generated a 48% rise in VAT revenue. Complementing these findings, Ahmed *et al.* (2025), analyzing the rollout of e-reporting in Pakistan, estimate a nearly 30% increase in VAT remittances by firms following the reform. Together, these studies underscore the potential of digital compliance measures to enhance tax enforcement and mobilize revenue, particularly when integrated into broader administrative strategies.

The empirical evidence on the effectiveness of EFDs is however mixed. An influential IMF study of EFD programs concludes that EFDs are "not a silver bullet" for compliance—they work only as part of a broader strategy targeting underlying non-compliance risks (Casey & Castro, 2015). Several East African countries rolled out EFDs in the 2000s, with varied results. Kenya, the earliest adopter in 2005, saw no

sustained increase in VAT receipts attributable to EFDs, as many businesses circumvented use of the machines. Tanzania's 2010 EFD introduction initially suffered low compliance and poor follow-up, yielding disappointing revenue impact. Rwanda implemented the scheme in 2014 and achieved high rollout (over 75% of VAT payers acquired EFDs within months), yet an evaluation found only a 5.4% rise in VAT revenue—far below expectations. The Rwanda Revenue Authority itself noted the overall impact of EFDs on tax yields was "disappointing" as many sellers still failed to issue receipts or found ways around the system (Eilu, 2018). Common challenges included lack of effective monitoring (tax officials rarely cross-checking EFD data vs. returns), weak enforcement of receipt issuance, technical glitches, and taxpayer resistance to the added costs.

Notably, EFD initiatives that did pair technology with enforcement show better outcomes. A recent field experiment in Tanzania tested surprise inspections and taxpayer education to boost EFD usage (Bachas & Manang, 2025). The intervention led to a small but significant uptick in recorded sales: about 2% increase in daily sales reported, and a 4% increase in the number of receipts issued, relative to the control group. However, these gains were concentrated among larger firms, and an information campaign without inspections had no effect. The lesson is that many businesses will only consistently use EFDs if they believe non-compliance will be detected and penalized.

One vulnerability of digital compliance measures lies in poor data entry protocols and the lack of harmonization in reporting standards, which can result in widespread mismatches between sales and purchase data. *Almunia et al. (2024)* analyze Uganda's e-reporting system to show that sellers and buyers reported different transaction values in 79% of firm-pair-month observations, despite invoices being easily cross-checked. Such mismatches, often stemming from firms' reporting errors rather than deliberate evasion, can overwhelm revenue authorities by diverting enforcement resources toward reconciling inconsistent data rather than combating intentional tax evasion. This risk is particularly acute in low-capacity settings, where administrative systems may lack the sophistication needed to distinguish between evasion and genuine mistakes, leading to significant inefficiencies in enforcement.

Overall, the empirical evidence demonstrates that while digital compliance measures can significantly improve tax compliance and revenue collection, their effectiveness depends critically on implementation design and institutional context. The most successful implementations combine mandatory requirements with positive in-

centives, effective taxpayer support systems, and strong institutional commitment. Countries considering digital compliance measures therefore should focus on building institutional capacity and designing comprehensive implementation strategies rather than simply adopting technological solutions.

V Collection Costs of Digital Compliance Measures

That digital compliance measures increase tax revenue does not by itself imply that these systems are welfare enhancing, as their implementation also entails significant costs. On the one hand, businesses face higher compliance burdens, including investments in new technologies, changes to internal processes, and ongoing costs of maintaining systems that meet regulatory requirements. On the other hand, governments incur substantial administrative expenses to develop, deploy, and monitor these digital infrastructures, as well as to train personnel and enforce compliance effectively. In this section, we examine these compliance and administrative costs in detail, considering their magnitude, distribution across firms and sectors, and implications for the overall welfare impact of digital compliance measures.

Empirical evidence on the costs firms incur to comply with different taxes remains limited, particularly in low- and middle-income countries. Importantly, what matters for the welfare analysis is the marginal costs of digital compliance measures rather than the total compliance cost, as these incremental burdens directly inform the trade-offs policymakers face. In a recent study, [Ahmed *et al.* \(2025\)](#) estimate these costs by conducting a large-scale firm survey in Pakistan. They estimate both the overall compliance costs associated with VAT and the additional marginal costs firms incur to comply with the introduction of e-reporting, which requires firms to submit transaction-level details of all sales and purchases in digital format every month. Their main result is illustrated in the top panel of [Figure III](#). It shows the total costs firms incur to prepare and file their VAT return, expressed as a percentage of VAT remitted by the firm and grouped by the size (turnover) decile of the firm. The results exhibit a strong negative relationship between firm size and relative compliance costs: firms in the lowest turnover deciles face disproportionately high compliance burdens, with costs exceeding 100% of VAT remitted for the smallest firms. In contrast, larger firms in the top turnover deciles incur substantially lower relative compliance costs, falling to below 20% for the largest firms. This pattern highlights the regressive nature of compliance costs, which place a far heavier burden on smaller firms relative

to their tax liabilities, underscoring the importance of considering firm heterogeneity in evaluating the welfare implications of digital compliance measures. The firm survey conducted by [Ahmed et al. \(2025\)](#) further shows that over three-quarters of these costs are attributable to e-reporting itself, reflecting the greater effort required to report transaction-level data compared to just aggregate values.

The World Bank also periodically conducts tax compliance cost surveys across a range of developing and transition countries. [Coolidge \(2012\)](#) synthesizes findings from these surveys. One of their key results is presented in the bottom panel of [Figure III](#). It is important to emphasize that these results are not directly comparable to those from Pakistan. It is because they capture the aggregate costs of complying with *all* taxes in contrast to the Pakistani results, which focus solely on the costs of preparing and filing of VAT returns. Nonetheless, one can easily see the regressive nature of compliance costs here as well: small firms face disproportionately high compliance costs relative to their turnover, while larger firms bear significantly lower burdens.

Like the World Bank, the European Commission (EC) also periodically conducts comprehensive surveys to assess tax compliance costs across member states. In its latest report ([European Commission, 2022](#)), the EC uses a standardized cost model to estimate compliance burdens in 20 member countries, covering both direct and indirect taxes. [Figure IV](#) presents the estimated compliance costs for indirect taxes, disaggregated by firm size and industry. As with the World Bank studies, these figures reflect total compliance costs. The first panel highlights the strongly regressive nature of these costs: micro-enterprises face disproportionately high costs, averaging 50-60% of revenue, whereas large firms bear significantly lower relative costs, closer to 25-30%. The second panel shows industry-level variation, with sectors such as wholesale and retail trade, professional services, and accommodation and food services reporting the highest compliance costs, in some cases exceeding 50% of revenue. Finally, [Figure V](#) illustrates the country-level results, revealing substantial heterogeneity across EU member states. Luxembourg, Slovenia, and Greece exhibit the lowest compliance costs, often below 20%, while Italy and Czechia stand out with extreme burdens, where compliance costs for smaller firms exceed 100% of revenue.

In sum, the empirical evidence from three different sources shows that compliance costs are not only substantial but also strongly regressive. This strong heterogeneity by firm size underscores the importance of conducting welfare analysis that explicitly accounts for firm size. Importantly, even if average compliance costs across all firms appear modest, they may nonetheless be prohibitively high for small and medium

sized firms, potentially discouraging formalization and undermining broader policy objectives.

The second component of collection costs comprises the expenses governments incur to develop, deploy, and monitor digital compliance measures. To our knowledge, there are no studies that systematically estimate these costs separately. But in general administrative costs of tax collection tend to be low. The most comprehensive data on such costs comes from the OECD's *Tax Administration Series*, which provides comparative indicators of tax administration efficiency. The most recent dataset covers 58 advanced and emerging economies in 2015. Importantly, the OECD series estimates the ratio of annual administrative costs incurred by a revenue body to the total revenue collected (net of refunds) by it, typically expressed as the cost of collecting 100 units of revenue. As shown in Figure VI, most OECD countries spend between 0.5% and 1.5% of collected revenue on tax administration. Strikingly, this ratio is very similar for non-OECD countries (see bottom panel), indicating that even in less advanced economies, administrative spending on tax collection remains a small fraction of revenue.

VI Do Digital Compliance Measures Improve Welfare?

Under the normative framework of [Keen & Slemrod \(2017\)](#) mentioned in section III, an enforcement intervention raises social welfare if the social value of the additional revenue it generates exceeds the social value of the collection costs it imposes. A central parameter in evaluating this trade-off is the marginal value of public funds (MVPF) denoted by φ . The MVPF varies across countries and projects, depending on the benefits of public spending and the efficiency costs of taxation. A commonly cited estimate in the literature, which we also use in our calculations below, comes from [Cellini *et al.* \(2010\)](#), who estimate an MVPF of 1.5 for infrastructure spending in California public school districts.

As discussed in Section IV, digital compliance measures generate substantial increases in government revenue, with empirical estimates ranging from 5% to 48% across different implementations and contexts, though the distribution of these estimates clusters toward the lower end of this range. Applying an MVPF of 1.5 implies that only half of the additional revenue translates into a net social welfare gain, as the other half offsets the distortionary costs of taxation. Taking a mid-range estimate of a 24% increase in revenue and adjusting for an MVPF of 1.5 suggests that the corre-

sponding rise in social welfare would be approximately 12%.

Administrative costs of tax collection are weighted by the marginal value of public funds because these costs are financed through revenue raised via distortionary taxation. As shown in Section V, governments typically spend around 1% of collected revenue on administrative activities related to tax collection. If we assume that each additional dollar of revenue raised imposes the same administrative cost as existing revenue, then at an MVPF of 1.5 there would be a welfare loss of 1.5% for each dollar of the additional revenue. For a revenue gain of 24%, this translates into a welfare loss of roughly 0.36% ($1.5\% \times 24\%$). This calculation suggests that, under the assumption of constant administrative cost per dollar raised, the incremental welfare loss on account of administrative costs may generally be small relative to the revenue gains and therefore can reasonably be ignored from the welfare calculations.

In contrast to administrative costs, compliance costs borne by firms are substantial and cannot be ignored in welfare analysis. We present evidence on these compliance costs from three different sources in section V. Of these, *Ahmed et al. (2025)* is specially relevant to our context, as they specifically estimate the additional compliance costs imposed by a digital compliance measure. Their study shows that for small and medium enterprises, compliance costs can exceed 100% of VAT remitted, while for large firms the corresponding figure is around 15%. Strikingly, they also document that more than three-quarters of these costs are attributable to e-reporting requirements—the digital compliance measure introduced by Pakistan in 2008. Incorporating these compliance costs into the welfare framework will nullify all revenue gains, suggesting that the net welfare impact of such measures is likely to be negative for the majority of firms, except those at the upper end of the size distribution where economies of scale in compliance sharply reduce the relative burden.

VII Policy Roadmap: Implementing Digital Compliance

The welfare calculations above highlight a critical trade-off in the design and implementation of digital compliance measures. While these interventions can generate substantial welfare gains by increasing government revenue and strengthening enforcement, their distributional effects are highly uneven. It is largely because the costs of complying with these measures vary widely across large and small firms. *Brockmeyer et al. (2024)* document that more than 80% of VAT revenue is typically collected from the largest 20% of firms. As a result, compliance costs even if they

appear modest as an aggregate share of VAT revenue may still be prohibitively large for small and medium sized firms. Ignoring this heterogeneity can lead even well-intentioned reforms to failure by exacerbating informality and related outcomes of SMEs. To mitigate these adverse effects, we suggest that policymakers, particularly those in developing countries, should take the following steps before implementing digital compliance measures at scale.

Create digital infrastructure. The primary rationale for digital compliance tools is to generate reliable third-party information that can be productively used for pre-filling, cross-checking, and risk-based enforcement. Before introducing digital enforcement at scale, revenue authorities should establish prerequisites: unique taxpayer and invoice identifiers; harmonized data structures; verified master data for counterparties and products; secure, stable APIs; and clear protocols for data correction and versioning. These foundations both raise the detection value of third-party data and lower the volume of spurious mismatches that otherwise swamp enforcement capacity and derail ambitions for pre-filled returns.

Protect small firms. Because compliance costs are strongly regressive, design choices must explicitly differentiate by firm size and sector. Practical levers for this purpose include: high initial thresholds with phased reductions; large-taxpayer pilots before SME roll-out; simplified regimes or composition schemes for micro firms; and lower reporting frequency and aggregate-only reporting for small filers. Complementary measures, such as vendor accreditation of low-cost software, open-source reporting tools, shared service providers, can also reduce fixed compliance costs that disproportionately burden smaller firms.

Sequence and scope reforms. In high-informality settings, these measures should be first implemented where third-party information is most credible: B2G procurement, large-buyer supply chains, and sectors with electronic payments penetration. Reforms should choose the lightest effective instrument, such as e-reporting batched with returns rather than real-time clearance, consistent with the administrative capacity. Where foundations are weak, policy should prioritise core registries, identity resolution, and payments integration before mandating transaction-level reporting for SMEs.

Build an evidence and learning agenda. To avoid average-based misdiagnosis, authorities should measure outcomes by firm size and sector and publish both revenue and compliance cost indicators. Priority areas for evidence generation should include: (i) causal estimates of administrative costs specific to digital tools; (ii) firm-level compliance cost panels through time; (iii) experiments on thresholds and reporting frequency; (iv) audits that test whether digital data reduces false positives and negatives; and (v) long-run effects on firm formalisation, entry, exit, and productivity.

Invest in taxpayer services. Developing countries must substantially expand taxpayer education and support services before and during digital transformation. This includes multilingual help desks, video tutorials, on-site training for SMEs, and partnerships with business associations to provide peer support. The cost of these services is minimal compared to the compliance burden reduction they achieve.

Improve the effectiveness of EFDs. To ensure that EFDs deliver meaningful compliance gains, they should become part of a coherent compliance strategy rather than standalone hardware mandates. Any manipulation of EFDs should be minimized with risk-based inspections and consumer-side incentives. Relatedly, only low-cost, tamper-resistant devices and software should be used, and there should be periodic risk-based integrity checks (including remote firmware audits). EFD feeds could be integrated with taxpayer registries, e-invoicing (where present), and payment data to enable real-time anomaly detection. Finally, device uptime, receipt density, and audit yield should be monitored via public dashboards.

VIII Conclusion

This paper has examined the rise of digital compliance measures in value-added tax systems and assessed their potential welfare impacts through the lens of a simple normative framework. We brought together emerging empirical evidence from around the world on the revenue effects, administrative costs, and firm-level compliance burdens associated with interventions such as e-invoicing, e-reporting, and electronic fiscal devices. Our analysis shows that while these measures can generate substantial increases in reported sales and tax collections—ranging from 5% to 48% in existing studies—the welfare implications are far from straightforward. Administrative costs

of implementing and maintaining these systems appear modest relative to revenue gains and are unlikely to alter the welfare calculus. In contrast, the compliance costs borne by firms, particularly small ones, are large and highly regressive. For micro and small firms, these costs can easily exceed 100% of VAT remitted, raising concerns about the net welfare impact of digital compliance measures for the majority of firms outside the top of the size distribution. Governments therefore must carefully evaluate whether the expected enforcement benefits of such measures justify imposing the collection costs they entail before implementing them at scale.

References

- AHMED, MUHAMMAD, BADRAN, MOHAMED, NAWAZ, NASREEN, & WASEEM, MAZHAR. 2025. At What Cost? Curtailing Tax Evasion in the Digital World. ICTD Working Paper.
- ALMUNIA, MIGUEL, HJORT, JONAS, KNEBELMANN, JUSTINE, & TIAN, LIN. 2024. Strategic or confused firms? evidence from "missing" transactions in Uganda. *Review of Economics and Statistics*, **106**(1), 256–265.
- BACHAS, PIERRE, & MANANG, FREDRICK. 2025. Tax Compliance: Enforcing the Use of Electronic Fiscal Devices. CEPA Working Paper.
- BELLON, MATTHIEU, DABLA-NORRIS, ERA, KHALID, SALMA, & LIMA, FEDERICO. 2022. Digitalization to improve tax compliance: Evidence from VAT e-Invoicing in Peru. *Journal of Public Economics*, **210**, 104661.
- BEST, MICHAEL, SHAH, JAWAD, & WASEEM, MAZHAR. 2021. Detection Without Deterrence: Tax Audits with Limited Fiscal Capacity. Working Paper, University of Manchester.
- BROCKMEYER, ANNE, MASCAGNI, GIULIA, NAIR, VEDANTH, WASEEM, MAZHAR, & ALMUNIA, MIGUEL. 2024. Does the Value-Added Tax Add Value? Lessons Using Administrative Data from a Diverse Set of Countries. *Journal of Economic Perspectives*, **38**(1), 107–32.
- CASEY, PETER, & CASTRO, PATRICIO. 2015. *Electronic Fiscal Devices (EFDs) An Empirical Study of their Impact on Taxpayer Compliance and Administrative Efficiency*. International Monetary Fund.

- CELLINI, STEPHANIE RIEGG, FERREIRA, FERNANDO, & ROTHSTEIN, JESSE. 2010. The Value of School Facility Investments: Evidence from a Dynamic Regression Discontinuity Design*. *The Quarterly Journal of Economics*, **125**(1), 215–261.
- COOLIDGE, JACQUELINE. 2012. Findings of tax compliance cost surveys in developing countries. *eJTR*, **10**, 250.
- DE SOTO, HERNANDO. 1989. *The other path*. Harper & Row New York.
- EILU, EMMANUEL. 2018. Adoption of electronic fiscal devices (EFDs) for value-added tax (VAT) collection in Kenya and Tanzania: a systematic review. *The African Journal of Information and Communication*, **22**, 111–134.
- EUROPEAN COMMISSION. 2022. *Tax compliance costs for SMEs – An update and a complement – Final report*. Publications Office of the European Union.
- IMF. 1991. IV. Invoices, Books of Account, and Tax Return Forms for VAT. *In: Value-Added Tax*. International Monetary Fund.
- KEEN, MICHAEL, & SLEMROD, JOEL. 2017. Optimal tax administration. *Journal of Public Economics*, **152**(aug), 133–142.
- KLEVEN, HENRIK J., KNUDSEN, MARTIN B., KREINER, CLAUS THUSTRUP, PEDERSEN, SØREN, & SAEZ, EMMANUEL. 2011. Unwilling or Unable to Cheat? Evidence From a Tax Audit Experiment in Denmark. *Econometrica*, **79**(3), 651–692.
- KOTSOGIANNIS, CHRISTOS, SALVADORI, LUCA, KARANGWA, JOHN, & MURASI, INNOCENTE. 2025. E-invoicing, tax audits and VAT compliance. *Journal of development economics*, **172**, 103403.
- MASCAGNI, GIULIA, MENGISTU, ANDUALEM T, & WOLDEYES, FIREW B. 2021. Can ICTs increase tax compliance? Evidence on taxpayer responses to technological innovation in Ethiopia. *Journal of Economic Behavior & Organization*, **189**, 172–193.
- MAYSHAR, JORAM. 1990. On measures of excess burden and their application. *Journal of Public Economics*, **43**(3), 263–289.
- NARITOMI, JOANA. 2019. Consumers as tax auditors. *American Economic Review*, **109**(9), 3031–72.

- OECD. 2015. *Tax Administration 2015: Comparative Information on OECD and Other Advanced and Emerging Economies*. OECD Publishing, Paris.
- POMERANZ, DINA. 2015. No Taxation without Information: Deterrence and Self-Enforcement in the Value Added Tax. *American Economic Review*, **105**(8), 2539–2569.
- WASEEM, MAZHAR. 2019. Information, Asymmetric Incentives, or Withholding: Understanding the Self-Enforcement of Value-added Tax. Working Paper, University of Manchester.
- WASEEM, MAZHAR. 2023. Overclaimed refunds, undeclared sales, and invoice mills: Nature and extent of noncompliance in a value-added tax. *Journal of Public Economics*, **218**, 104783.

FIGURE I: VAT RETURN FORM RECOMMENDED BY IMF

Chart 5. Example of a Monthly VAT Return and Payment Form

Form # V.A.T.-002	TAX PERIOD		Serial No. [00]
[01]	MONTH	YEAR	
L A B E L	[02] FIRM/LAST NAME [03] MIDDLE NAME [04] TAX ID. NUMBER (TIN)		
	[05] NAMES		
	[06] ADDRESS	[07] COUNTY/MUNICIPALITY	
	[08] TELEPHONE	[09] ECONOMIC ACTIVITY CODE	
	<small>Note: To be filled out only if identification label provided by the Tax Administration is incorrect or incomplete.</small>		

	To Deduct (Tax Credit)	Due (Tax Debit)
NO TRANSACTIONS DURING THE PERIOD If no transactions during the period mark with an "X" [11]		
FROM PREVIOUS MONTH		
VAT Credit from Previous Month	[12] +	
Refund Requested (Exporters Only)	[13] - ()	
MONTH'S PURCHASES		
Exempt or Non-Creditable Purchases	[31]	
Imports (5%)	[33] +	
Imports (18%)	[35] +	
Purchases from Domestic Suppliers (5%)	[37] +	
Purchases from Domestic Suppliers (18%)	[39] +	
MONTH'S SALES		
Exempt Sales	[51]	
Exports	[52]	
Sales to Other VAT Taxpayers (5%)		[54] +
Sales to Other VAT Taxpayers (18%)		[56] +
Sales to Final Consumers (5%)		[58] +
Sales to Final Consumers (18%)		[60] +
TOTALS	[P] =	[S] =
If "P" (VAT—Purchases) is Larger than "S" (VAT—Sales) Enter Difference here .. =	VAT Credit To be carried forward to following month →	[14]
If "S" (VAT—Sales) is Larger than "P" (VAT—Purchases) Enter Difference here .. =	Total Due If Paid On Time	[15] =
	Penalties:	
	Fine for Late Payment	[16] +
	Fine for Late Filing	[17] +
	Total Actually Paid	[18] =

I declare under oath that the information provided in this document is true and correct.

(Signature)

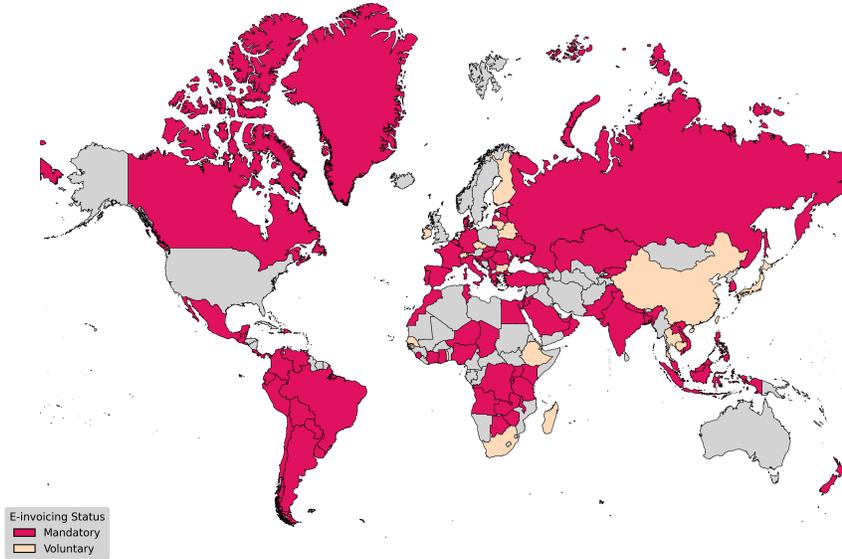
Source: IMF (1991)

Notes: This figure illustrates the VAT return form recommended by the IMF in its policy guide (IMF, 1991). In addition to basic firm information, the form requires businesses to report their monthly purchases and sales, disaggregated by source (domestic versus foreign) and by tax rate (reduced rate versus standard rate). The final section of the return focuses on tax calculations, where firms must specify the amount of tax charged on their sales, the tax credits claimed on purchases, and any adjustments for carry-forwards from previous periods. This design reflects the IMF's emphasis on simplicity while ensuring that essential information for tax administration is collected.

FIGURE II: ADOPTION OF DIGITAL COMPLIANCE MEASURES

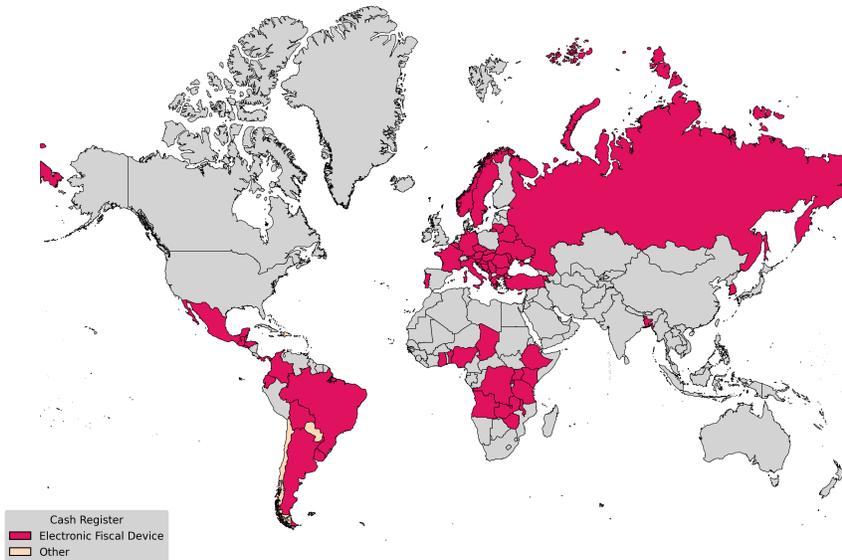
A: E-Invoicing

E-invoicing Implementation Status



B: Electronic Fiscal Devices

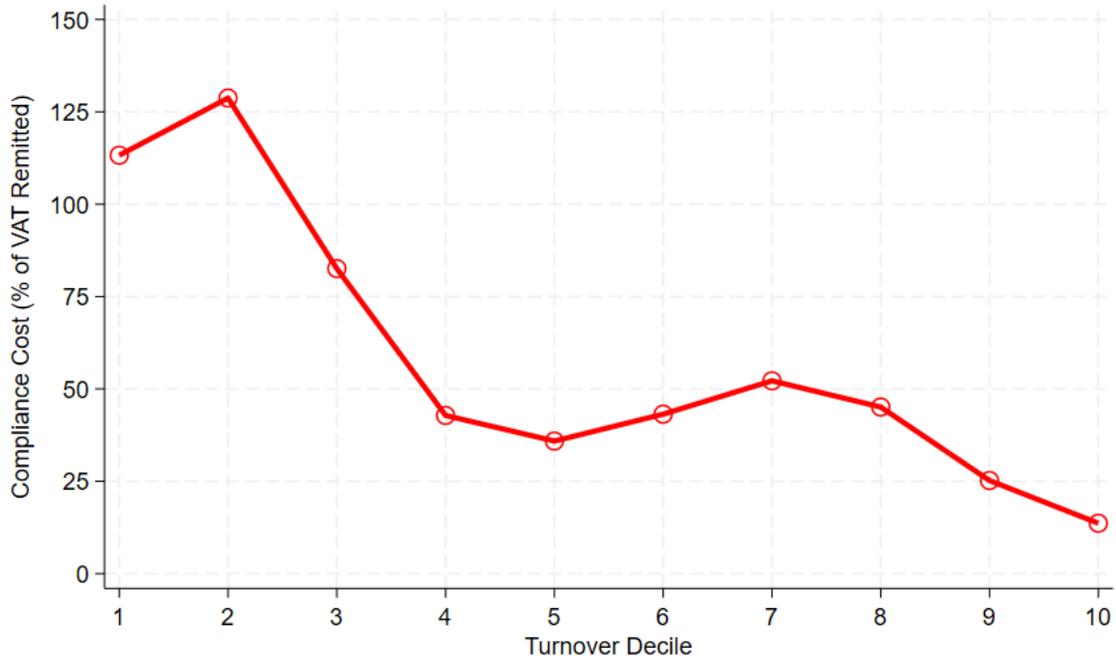
Electronic Fiscal Devices



Notes: This figure illustrates the global adoption of digital compliance measures in VAT systems. The top panel highlights countries that have already implemented or are in the process of implementing e-invoicing systems, while the bottom panel shows countries that have adopted electronic fiscal devices (EFDs) to record and transmit transaction data. The patterns reflect the rapid spread of these technologies across both advanced and developing economies in recent years. The figure is based on the author's own calculations using publicly available data on tax administration reforms.

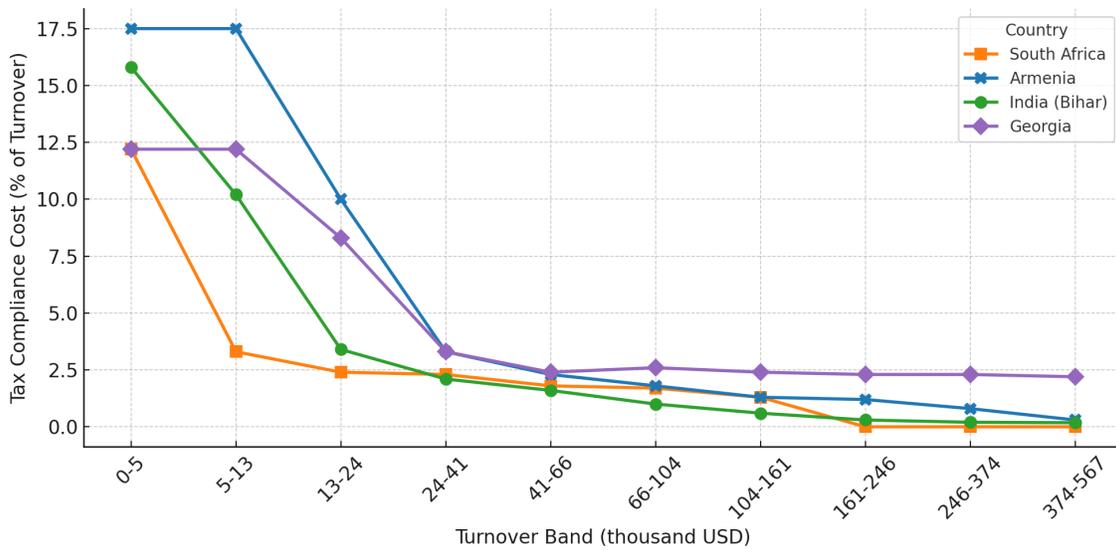
FIGURE III: COMPLIANCE COST BY FIRM SIZE

A: Pakistan



Source: *Ahmed et al. (2025)*

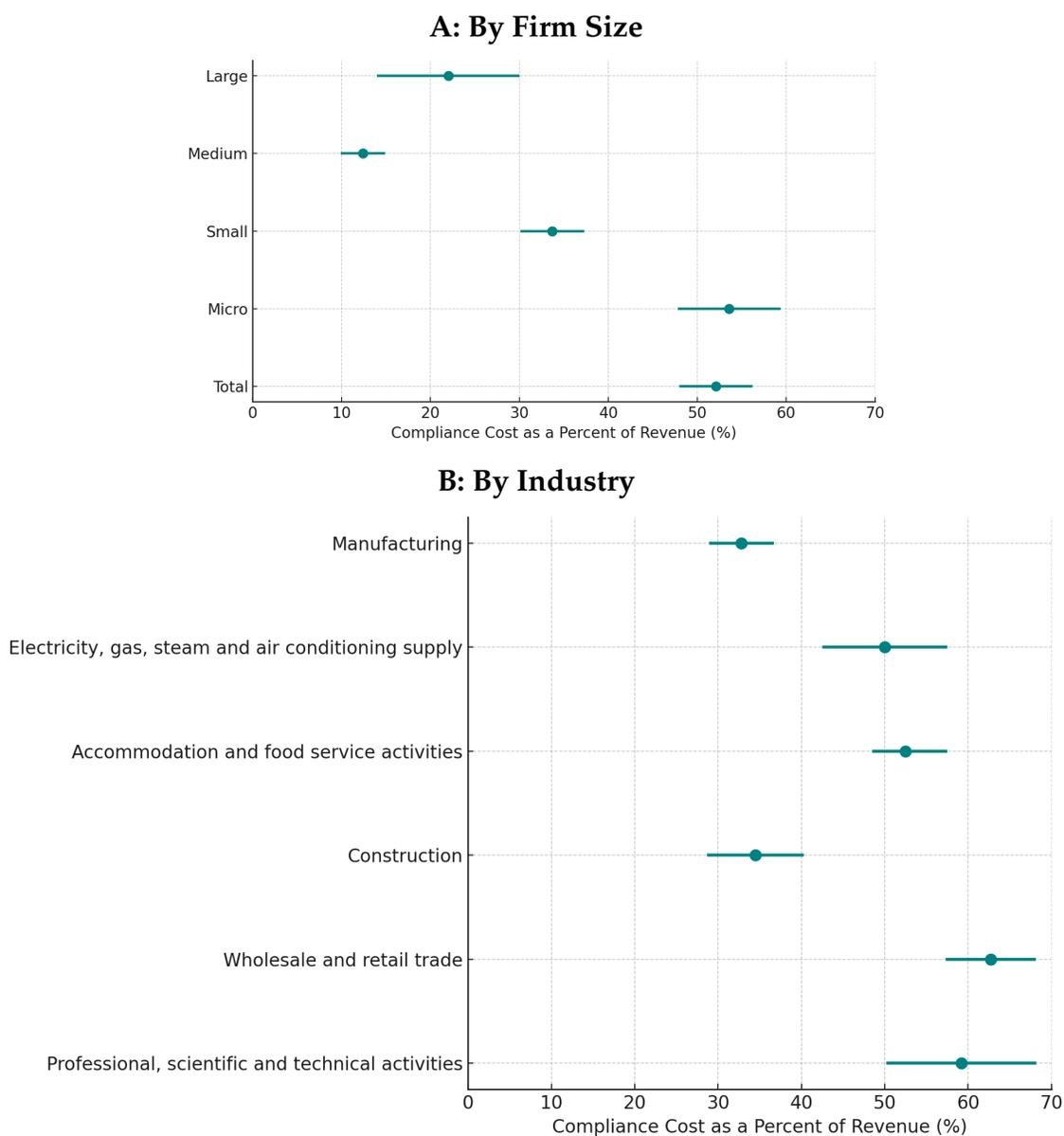
B: Developing Countries



Source: *Coolidge (2012)*

Notes: This figure illustrates the compliance costs firms incur in meeting compliance requirements. The top panel presents estimates from *Ahmed et al. (2025)* for Pakistani firms, showing total costs of preparing and filing VAT returns as a percentage of VAT remitted during the same period. Strikingly, nearly three-quarters of these costs arise from e-reporting, which requires firms to submit transaction-level details of all sales and purchases, in contrast to the simpler one-page VAT return form. The bottom panel reports compliance costs from *Coolidge (2012)*, based on World Bank Compliance Cost Surveys, where costs are estimated for all taxes and expressed as a percentage of firm turnover. Both panels highlight the regressive nature of compliance costs, which are disproportionately high for smaller firms and decline sharply with firm size. The figure is based on the authorsâ own calculations.

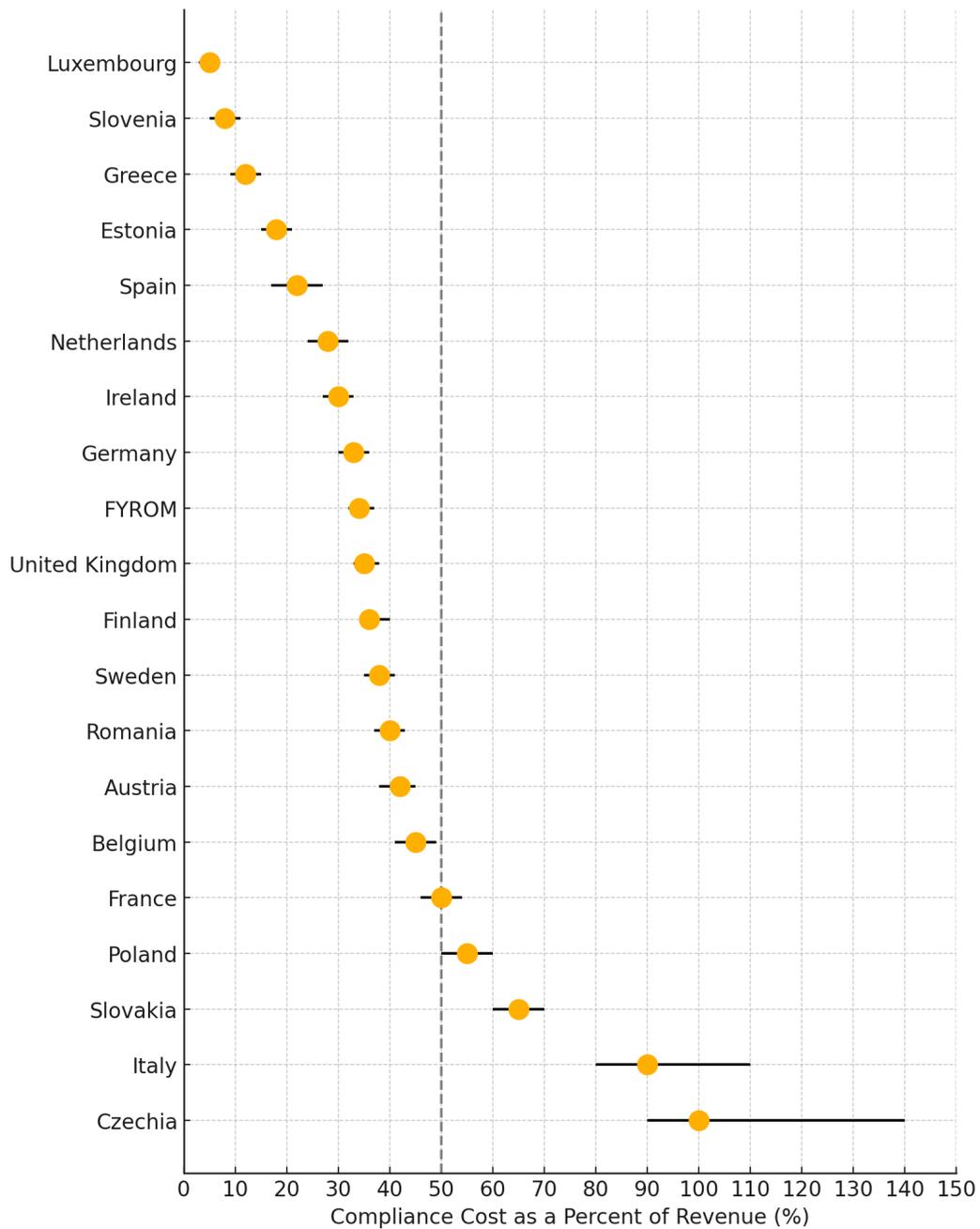
FIGURE IV: COMPLIANCE COST IN EUROPEAN UNION



Source: [European Commission \(2022\)](#)

Notes: This figure illustrates the compliance costs firms face in meeting tax obligations in the EU. We use data from the [European Commission \(2022\)](#). Top panel show compliance costs by firm size and the bottom by industry. Panel A shows that compliance costs, expressed as a percentage of revenue, are highly regressive: micro and small enterprises face disproportionately high costs, approaching 50-60% of revenue on average, while large firms experience considerably lower relative burdens, closer to 25-30%. Panel B highlights variation across industries, with sectors such as wholesale and retail trade, professional, scientific and technical activities, and accommodation and food services reporting the highest compliance costs. In contrast, manufacturing exhibits the lowest relative costs among the industries shown.

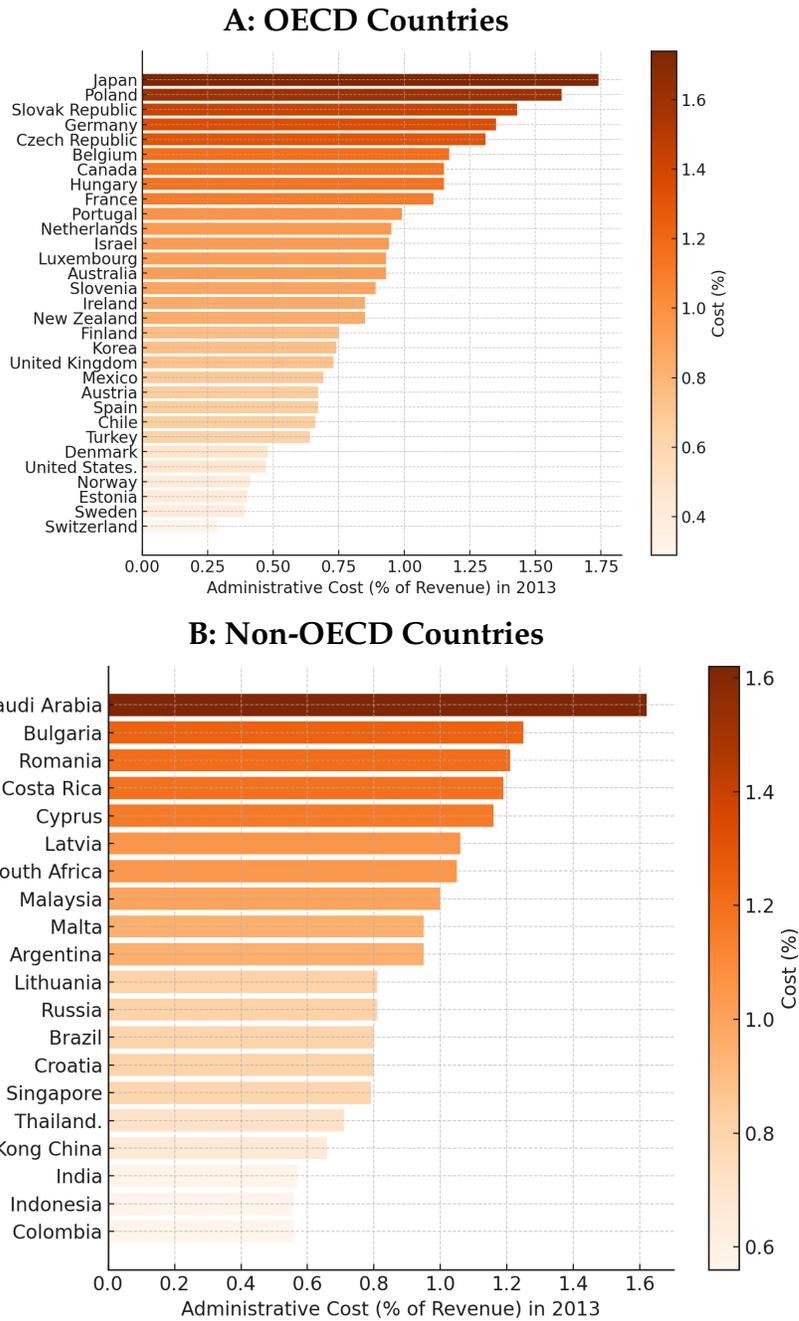
FIGURE V: COMPLIANCE COST IN EUROPEAN UNION



Source: [European Commission \(2022\)](#)

Notes: This figure shows the compliance costs of tax obligations across European countries using data from the [European Commission \(2022\)](#). Compliance costs are expressed as a percentage of revenue and reflect the total costs firms incur to comply with tax requirements. The figure reveals substantial cross-country variation: Luxembourg, Slovenia, and Greece exhibit the lowest relative compliance costs, often below 20%, while Italy and Czechia report extreme burdens, with costs exceeding 90-100% of revenue for smaller firms. The dashed vertical line indicates the average compliance cost across all countries.

FIGURE VI: ADMINISTRATIVE COST



Source: [OECD \(2015\)](#)

Notes: This figure shows the administrative costs of tax collection across countries, expressed as a percentage of total revenue collected, using data from [OECD \(2015\)](#). Panel A reports these costs for OECD countries, while Panel B presents corresponding figures for non-OECD economies. Across both panels, administrative costs are generally low, typically ranging between 0.3% and 1.7% of revenue. While Japan and Poland display the highest ratios among OECD countries, Switzerland and Sweden exhibit the lowest. Similarly, in the non-OECD sample, Saudi Arabia and Bulgaria record relatively higher costs, whereas Colombia and Indonesia show much lower ratios. These patterns highlight the overall efficiency of tax administrations globally, with only modest variation across income levels.

A E-Invoicing Schemes Around the World

Spain: Spain's Suministro Inmediato de Información is an advanced electronic invoicing system that requires businesses to electronically report detailed transaction-level VAT data to the tax authority in near real-time. Implemented in 2017, the scheme initially applied to large businesses with annual turnover exceeding €6 million, VAT groups, and companies registered under the monthly VAT refund regime. It's scope is now being progressively extended to cover nearly all transactions across the economy.

Italy: Italy's Sistema di Interscambio (SdI) is a centralized "clearance" e-invoicing platform that has required electronic invoice transmission for B2G transactions since 2014, and was extended on 1 January 2019 to include mandatory e-invoicing for virtually all domestic B2B and B2C transactions. Its scope has widened further over time: cross-border invoices have been captured via SdI since July 2022, and as of January 2024 all VAT-registered micro-enterprises (down to €25,000 in turnover) are now also required to comply.

China: China's nationwide, fully digitalized e-Fapiao system requires all VAT-related invoices—both general and special—to be issued, transmitted, validated, and archived electronically via a unified platform, a rollout completed following an extensive pilot phase across major provinces from 2021 to 2023 and finalized on 1 December 2024. The system encompasses real-time issuance of e-invoices and mandates secure digital storage and tracking of these invoices.

India: India's GST e-invoicing system, introduced on 1 October 2020 implements a clearance-based model under which taxpayers exceeding specified turnover thresholds must first submit electronic B2B, B2G, export, and reverse-charge invoices to a central Invoice Registration Portal (IRP) for validation, issuance of a unique Invoice Reference Number (IRN), and QR code generation. This mandate has progressively broadened through a phased reduction in the annual turnover threshold from ₹500 crore to ₹5 crore by August 2023. Further reforms effective from 1 April 2025 require uploading all e-invoices within 30 days of issuance for firms with turnover above ₹10 crore.

Brazil: Brazil operates a sophisticated clearance-based national e-invoicing framework under the Nota Fiscal Eletrônica regime, mandated since 2006 for nearly all B2B and B2G transactions and requiring suppliers to digitally sign XML invoices, trans-

mit them to state tax authorities for real-time validation, and retain them for a minimum of five years. Over time, this framework has evolved into a multi-document architecture encompassing distinct formats, including one e-form for services, another for transport, and another for communications, with ongoing reforms aiming to unify these under a national standard by 2026.

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