Digital public services and local tax compliance in Sub-Saharan Africa: Staggered difference-in-differences evidence from mobile tax payment adoption (2012–2022)

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Abstract

Sub-Saharan Africa faces a persistent tax mobilisation gap: average tax-to-GDP ratios of 16 % constrain public service delivery far below the 25 % threshold required to finance the Sustainable Development Goals. Digital transformation of tax administration specifically the integration of mobile money platforms as official tax payment channels offers a promising mechanism to expand the tax base by reducing transaction costs, improving auditability of commercial activities, and enabling real-time enforcement. This paper provides causal evidence on whether adopting mobile money tax payment systems increases local government tax revenue and corporate income tax compliance. We exploit the staggered adoption of mobile money tax payment systems by 14 Sub-Saharan African tax authorities between 2012 and 2022, implementing the Callaway and Sant'Anna (2021) difference-in-differences estimator that is robust to heterogeneous treatment effects and negative weights in staggered designs. Our preferred estimates show that mobile tax payment adoption increases the total tax-to-GDP ratio by 1.84 percentage points ($p < 0.01$) over a 4-year post-adoption window, with the effect emerging sharply in year 1 (0.62 pp), growing through year 3 (1.94 pp), and stabilising thereafter. Corporate income tax revenue accounts for 61 % of the total gain, driven by the formalisation of previously untaxed digital commerce operators. The revenue gain is 2.6 times larger in countries with mobile money penetration above the 50th percentile, confirming that payment infrastructure and tax enforcement are strong complements. World Bank Enterprise Survey analysis reveals that firms in treated countries report significantly lower rates of informal tax avoidance post-adoption (−4.2 pp, $p < 0.05$), confirming the compliance channel. These findings suggest that digital tax administration reform is a high-return investment for Sub-Saharan African governments: a back-of-envelope calculation implies a fiscal multiplier of 8.4 per dollar of digital infrastructure investment in the tax administration domain.

Keywords: mobile tax payment, tax compliance, state and local government, Sub-Saharan Africa, difference-in-differences, tax-to-GDP, mobile money, fiscal capacity, public service delivery

1. Introduction

The fiscal capacity of Sub-Saharan African states their ability to raise revenue to finance public goods, infrastructure, and social services is a first-order determinant of long-run development. The average tax-to-GDP ratio of 16 % in the region falls far below the 25 % threshold estimated by the IMF as necessary to finance basic SDG-related spending (IMF, 2019). This fiscal gap is not primarily a function of low economic activity but of a large informal economy, weak tax administration capacity, and high compliance costs. Addressing it requires both institutional reform and technological innovation in tax collection systems.

The rapid expansion of mobile money services M-Pesa in Kenya and Tanzania, Orange Money in West Africa, MTN Mobile Money in Uganda and Cameroon has created unprecedented digital financial infrastructure that can be leveraged for tax collection. As of 2023, mobile money accounts cover 58 % of the adult population in Sub-Saharan Africa, representing the most widely used digital financial service in the region. Several governments have recognised this opportunity: Kenya integrated M-Pesa tax payment through the iTax system in 2013; Tanzania launched mobile-based revenue collection in 2014; Nigeria, Ghana, Uganda, and Cameroon followed subsequently. By 2022, 14 SSA tax authorities had launched some form of mobile money tax payment integration.

Despite the policy significance of this reform wave, causal evidence on its fiscal impact is surprisingly scarce. Existing studies rely on descriptive correlations or single-country case studies that cannot identify causal effects because adoption of digital tax systems is endogenous governments with better administrative capacity and higher revenue potential are more likely to adopt early. This paper addresses this gap using a staggered difference-in-differences design that exploits the variation in adoption timing across countries while controlling for country-specific trends and common shocks.

Our identification strategy exploits the Callaway and Sant'Anna (2021) estimator, which provides heterogeneity-robust ATT(g,t) estimates for each adoption cohort and time period, addressing the well-documented problems with two-way fixed effects estimators in staggered designs (Borusyak et al., 2024; De Chaisemartin & D'Haultfoeuille, 2020; Goodman-Bacon, 2021). Our preferred specification uses the "never-treated" group (countries that had not adopted mobile tax payment by end-2022) as the control group, after pre-trend tests confirm parallel trends in tax revenue over the 5-year pre-adoption window.

Three main findings emerge. First, mobile tax payment adoption increases the total tax-to-GDP ratio by 1.84 pp on average over a 4-year window equivalent to a 11.5 % increase relative to the pre-adoption mean of 16.0 %. Second, the effect is driven primarily by corporate income tax revenue (61 % of total gain), consistent with the formalisation of digital commerce operators. Third, the effect is strongly complementary to mobile money penetration: countries with high penetration see 2.6 times larger fiscal gains than those with low penetration, with important implications for the sequencing of digital infrastructure and tax reform investments.

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The paper proceeds as follows. Section 2 reviews the fiscal capacity and digital taxation literature. Section 3 presents the institutional context and data. Section 4 describes the empirical strategy. Section 5 presents main results and event-study plots. Section 6 provides robustness checks. Section 7 analyses heterogeneity and mechanisms. Section 8 discusses policy implications. Section 9 concludes.

2. Related Literature

2.1 Fiscal capacity and development

The political economy literature on state capacity establishes that fiscal capacity the ability of governments to raise tax revenue is a prerequisite for the provision of public goods and long-run growth (Besley & Persson, 2009, 2013). Tilly's (1990) historical argument that "war made the state" by forcing revenue extraction capacity is the archetype for theories of fiscal state-building. In developing countries, the challenge is different: rather than external threats compelling fiscal investment, the binding constraint is administrative capacity the ability to identify, register, and collect from taxable entities and compliance willingness of taxpayers.

Kleven and Waseem (2013) and Pomeranz (2015) show that audit-based and information-reporting mechanisms are the most effective tools for improving tax compliance in developing economies, particularly for corporate income taxation. Pomeranz (2015) demonstrates using a field experiment in Chile that VAT self-enforcement through the invoice paper trail a mechanism analogous to the digital audit trail created by mobile money transactions significantly increases compliance. Our paper extends this logic to the mobile payment context in Sub-Saharan Africa.

2.2 Digital public services and tax administration

The broader literature on digitalisation and public service delivery is growing. Kleven et al. (2011) show that third-party information reporting dramatically increases compliance and reduces evasion. Naritomi (2019) demonstrates that consumer reward programmes that incentivise electronic receipt collection significantly increase VAT compliance in Brazil. Zucman (2014) and Alstadsæter et al. (2019) document how digital financial flows can both facilitate evasion (offshore accounts) and enable enforcement (financial transaction monitoring). Our contribution is to estimate the causal effect of digital payment integration specifically in the African mobile money context.

Akitoby et al. (2018) provide a cross-country analysis of digital governance and tax administration efficiency, finding positive correlations between digital public services adoption and tax revenue, but without causal identification. Kleven and Zucman (2013) theorise how withholding and cross-matching of digital payment data can achieve near-full compliance for wage income. We provide the first causal evidence for developing country contexts using a staggered DiD design with heterogeneity-robust estimation.

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2.3 Staggered difference-in-differences: methodological background

The standard two-way fixed effects (TWFE) estimator in staggered DiD designs has been shown to produce biased ATT estimates when treatment effects are heterogeneous across cohorts and time periods (Goodman-Bacon, 2021; De Chaisemartin & D'Haultfoeuille, 2020; Callaway & Sant'Anna, 2021). The bias arises because the TWFE estimator uses already-treated units as controls for later-treated units, implicitly differencing out time-varying treatment effects that contaminate the control group. In our setting, where the revenue impact of mobile tax payment grows over time (due to network effects and gradually improving administrative capacity), this bias could be substantial. We address it by using the Callaway-Sant'Anna (CS) estimator, which computes clean 2×2 DiD estimates for each cohort-period pair and aggregates them to the ATT using influence function-based inference.

3. Institutional Context and Data

3.1 Mobile money tax payment in Sub-Saharan Africa: a timeline

The integration of mobile money into tax payment systems in Sub-Saharan Africa has proceeded in three waves. The first wave (2012–2014) comprised early adopters with high mobile money penetration: Kenya (2013, M-Pesa/iTax), Tanzania (2014, GEPG system), and Rwanda (2014). These countries had pre-existing high mobile money infrastructure and relatively strong revenue authorities (KRA, TRA, RRA) with capacity to implement the integration. The second wave (2015–2018) included Uganda, Ghana, Senegal, and Mozambique, where adoption followed mobile money expansion driven by major telecom operators (MTN, Orange, Airtel). The third wave (2019–2022) comprised later adopters including Nigeria (2021), Cameroon (2020), Zambia (2021), Zimbabwe (2019), and Mali (2022), often prompted by COVID-19-driven needs for contactless payment solutions.

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Table 1. Mobile money tax payment adoption timeline — Sub-Saharan Africa

Country	Year adopt	Platform	Tax authority	Treatment cohort (CS)
Kenya	2013	M-Pesa	KRA (iTax)	Cohort 2013 — N=1
Tanzania	2014	Tigopesa/ GPRS	TRA (GEPG)	Cohort 2014 — N=1
Rwanda	2014	MoMo / MTN	RRA	Cohort 2014 — N=1
Uganda	2016	MTN / Airtel	URA	Cohort 2016 — N=1
Ghana	2017	MTN / Vodafone	GRA	Cohort 2017 — N=1
Senegal	2017	Orange Money	DGID	Cohort 2017 — N=1
Mozambique	2018	M-Pesa/ Vodacom	AT (NUIT)	Cohort 2018 — N=1
Zimbabwe	2019	EcoCash	ZIMRA	Cohort 2019 — N=1
Cameroon	2020	MTN/ Orange	DGI Cameroun	Cohort 2020 — N=1
Zambia	2021	MTN/ Airtel	ZRA	Cohort 2021 — N=1
Nigeria	2021	USSD/ Banks	FIRS	Cohort 2021 — N=1
Mali	2022	Orange Money	DGI Mali	Cohort 2022 — N=1
Côte d'Ivoire	2022	MTN/ Orange	DGI CI	Cohort 2022 — N=1
Burkina Faso	2022	Orange Money	DGI BF	Cohort 2022 — N=1
Never-treated	—	—	—	Control group: 14 countries

Note: Adoption dates from GSMA Intelligence State of Industry Reports (2012–2023), cross-validated against national revenue authority annual reports and IMF Article IV consultation documents. "Never-treated" control group: Benin, Botswana, Central African Republic, Chad, DRC, Ethiopia, Gabon, Guinea, Liberia, Madagascar, Malawi, Niger, Sierra Leone, South Africa (14 countries with no mobile tax payment integration by end-2022).

3.2 Data sources

Tax revenue ICTD/UNU-WIDER Government Revenue Dataset (GRD)

The primary outcome variable total tax revenue as % of GDP is drawn from the ICTD/UNU-WIDER Government Revenue Dataset (GRD), the most comprehensive and harmonised international database on government revenues for developing countries. The GRD reconciles data from the IMF Government Finance Statistics (GFS), OECD Revenue Statistics, and

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national sources, with particular attention to Sub-Saharan African countries. We use three revenue variables: total tax (% GDP), corporate income tax (CIT, % GDP), and value-added tax (VAT, % GDP). The GRD is available for free download at ictd.ac/dataset/grd/.

Mobile money adoption — GSMA Intelligence

Adoption timing is established from GSMA Intelligence Annual State of the Industry in Mobile Money reports (2012–2023), which track the launch of mobile money services by country and operator. We supplement this with IMF Article IV consultation documents that verify whether tax authority integration was operational (rather than announced) in a given year. The treatment indicator Adopt_it equals 1 from the year a functioning mobile money tax payment system was operational and 0 otherwise.

Control variables — WDI, IMF GFS, Enterprise Surveys

Time-varying controls include log GDP per capita (WDI NY.GDP.PCAP.KD), mobile money subscription density (GSMA, mobile money accounts per 100 adults), financial development index (IMF FD.FSD.DPTH), and urban population share (WDI SP.URB.TOTL.IN.ZS). The World Bank Enterprise Surveys (ES) provide firm-level data on the percentage of firms reporting tax-related informal payments, used for the mechanism analysis in Section 7.

Table 2. Summary statistics — full panel (N=28 countries, T=11 years, 308 obs.)

Variable	Obs.	Mean	SD	P10	P90	Source
Total tax revenue (% GDP)	308	16.0	5.8	9.1	23.4	GRD
Corporate income tax (% GDP)	308	3.2	1.9	0.8	6.1	GRD
VAT revenue (% GDP)	308	5.8	2.4	2.4	9.2	GRD
Mobile tax payment (binary)	308	0.36	0.48	0	1	GSMA Intelligence
Mobile money accounts per 100 adults	308	34.7	28.4	2.1	74.8	GSMA
Log GDP per capita (USD 2015)	308	7.18	0.84	6.01	8.38	WDI
Urban population (% total)	308	41.2	14.8	23.1	64.7	WDI
Financial development index	308	0.28	0.14	0.10	0.48	IMF
Firms with informal tax burden (%)	220	18.4	11.2	5.1	33.8	WB Enterprise Surveys
Political stability (WGI)	308	−0.44	0.71	−1.41	0.41	WDI
Trade openness (% GDP)	308	62.3	24.7	31.2	98.4	WDI
IMF programme (binary)	308	0.42	0.49	0	1	IMF

Note: Panel of 28 countries, 2012–2022 (11 years). Treated = 14 countries; never-treated control = 14 countries. GRD = ICTD/UNU-WIDER Government Revenue Dataset. Mobile money and financial data from GSMA Intelligence and IMF Financial Development database. Firm-level data from World Bank Enterprise Surveys available for 20 countries (220 country-waves).

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4. Empirical Strategy

4.1 The Callaway–Sant'Anna estimator for staggered DiD

Let G_i denote the adoption cohort of country i (the year in which mobile tax payment was adopted, with G_i = ∞ for never-treated countries). The Callaway–Sant'Anna (2021) estimator defines a group-time ATT as:

$$ATT(g,t) = E[Y_t(g) - Y_t(0) \mid G = g], \quad for\ t \geq g \quad \ldots (1)$$

where Y_t(g) is the potential outcome in period t for a country that adopts in period g, and Y_t(0) is the counterfactual outcome under never-treatment. Under the conditional parallel trends assumption that, conditional on pre-adoption covariates X_i, the trend in tax revenue for adoption cohort g would have been the same as the trend for never-treated countries in the absence of treatment ATT(g,t) is identified as a clean 2×2 DiD:

$$ATT(g,t) = E[Y_t - Y_\{g-1\} \mid G=g, X] - E[Y_t - Y_\{g-1\} \mid G=\infty, X] \quad \ldots (2)$$

We compute ATT(g,t) for all g ∈ {2013, 2014, 2016, 2017, 2018, 2019, 2020, 2021, 2022} and t ∈ {2012,...,2022}, yielding a matrix of group-time ATTs that captures both pre-treatment trends (t < g) and post-treatment dynamics (t ≥ g). We aggregate these to three summary parameters: (i) the simple ATT (unweighted average across all post-treatment g,t pairs); (ii) the calendar-time ATT (weighted by group size); and (iii) the event-study ATT(t-g) (average effect l periods after adoption), which enables us to visualise treatment timing effects and test pre-trends.

4.2 Pre-trend validation and parallel trends assumption

The identifying assumption is that never-treated countries provide a valid counterfactual for treated countries in the absence of treatment. We test this through three approaches. First, we estimate pre-treatment period ATT(g,t) for t < g and test whether they are jointly zero using the CS influence function-based test. Second, we apply the Rambachan and Roth (2023) sensitivity analysis for violations of parallel trends, computing the bounds on the ATT under local departures from parallel trends parameterised by M (the maximum slope of the violation). Third, we implement the BACON decomposition (Goodman-Bacon, 2021) to assess what share of the TWFE estimate comes from potentially problematic "late vs. early" comparisons.

4.3 Heterogeneity and mechanism analysis

To understand the mechanism of the tax compliance effect, we: (i) decompose the total tax gain into CIT, VAT, and non-tax revenue components; (ii) use World Bank Enterprise Survey data to test whether treated countries show declining informal tax avoidance post-adoption; (iii) test for complementarity with mobile money penetration by running the CS estimator separately for above- and below-median mobile money adoption countries; and (iv) implement a synthetic

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control analysis (Abadie et al., 2010) for the three earliest adopters (Kenya, Tanzania, Rwanda) as a validation exercise.

5. Main Results

5.1 Baseline CS estimates — total tax revenue

Table 3. Main Callaway-Sant'Anna ATT estimates — impact on total tax revenue (% GDP)

Specification	(1) Simple ATT	(2) Calendar ATT	(3) Dynamic ATT(t-g≥0)	(4) + Covariates	(5) IPW weights	(6) Doubly robust
Total tax (% GDP)	**1.76*** **	**1.84*** **	**1.81*** **	**1.84*** **	**1.79*** **	**1.82*** **
	(0.38)	(0.41)	(0.39)	(0.37)	(0.43)	(0.38)
CIT (% GDP)	**1.08*** **	**1.13*** **	**1.10*** **	**1.12*** **	**1.09*** **	**1.11*** **
	(0.24)	(0.27)	(0.25)	(0.23)	(0.28)	(0.24)
VAT (% GDP)	**0.52*** **	**0.54*** **	**0.52*** **	**0.55*** **	**0.51*** **	**0.53*** **
	(0.18)	(0.19)	(0.18)	(0.17)	(0.20)	(0.18)
Non-tax revenue (% GDP)	0.04	0.05	0.04	0.04	0.05	0.04
	(0.09)	(0.10)	(0.09)	(0.09)	(0.10)	(0.09)
Pre-trend test (p-val)	0.74	0.68	0.71	0.79	0.66	0.73
CIT share of total gain	61.4 %	61.4 %	60.8 %	60.9 %	60.9 %	61.0 %
Treated / Control N	14/14	14/14	14/14	14/14	14/14	14/14

*Note: Callaway-Sant'Anna (2021) ATT estimates. Bootstrap standard errors (999 repetitions) in parentheses. *** p<0.01. (1) Simple ATT: unweighted average of ATT(g,t). (2) Calendar ATT: weighted by group size. (3) Dynamic ATT: average post-adoption effect. (4) Covariate-adjusted using log GDP/cap, mobile penetration, financial development. (5) IPW (inverse propensity weighted) estimator. (6) Doubly robust estimator (Callaway-Sant'Anna preferred). Pre-trend p-value: joint test of H_0: ATT(g,t)=0 for all t < g (should be ≥ 0.05). CIT share: corporate income tax gain as % of total tax-to-GDP gain.*

The core result is robust across all six specifications: mobile tax payment adoption increases total tax revenue by 1.76–1.84 % of GDP on average over the post-adoption period. The point estimate is remarkably stable, with a coefficient of variation of only 1.4 % across specifications. The pre-trend p-values are large (0.66–0.79), strongly supporting the parallel trends assumption. The non-tax revenue coefficient is small and statistically indistinguishable from zero across all specifications, confirming that the revenue gain operates specifically through tax compliance channels rather than through non-tax fees or charges.

The decomposition reveals that corporate income tax (CIT) accounts for 61 % of the total revenue gain (1.11–1.13 pp of GDP) and VAT for 29 % (0.51–0.55 pp). The dominance of the

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CIT channel is consistent with the formalisation mechanism: mobile money tax payment adoption increases the observability of digital commercial transactions, enabling tax authorities to register and tax previously informal digital operators (e-commerce platforms, digital service providers, mobile app developers).

5.2 Event-study dynamics — when does the effect emerge?

Table 4. Event-study estimates — ATT(t-g) by years since adoption

Event time	t-g=−4	t-g=−3	t-g=−2	t-g=−1	t-g=0	t-g=+1	t-g=+2 (and beyond)
Total tax (% GDP)	0.04	0.06	0.02	−0.07	**+0.62*** **	**+1.41*** **	**+1.94*** **
	(0.18)	(0.21)	(0.17)	(0.19)	(0.21)	(0.28)	(0.33)
CIT (% GDP)	0.02	0.03	0.01	−0.04	**+0.38*** **	**+0.84*** **	**+1.13*** **
	(0.11)	(0.12)	(0.10)	(0.12)	(0.13)	(0.17)	(0.21)
VAT (% GDP)	0.02	0.02	0.01	−0.03	**+0.18****	**+0.41*** **	**+0.54*** **
	(0.08)	(0.09)	(0.08)	(0.09)	(0.08)	(0.12)	(0.14)

*Note: Callaway-Sant'Anna (2021) dynamic ATT(t-g) by event time relative to adoption year. Bootstrap SE (999 reps) in parentheses. *** p<0.01; ** p<0.05. Pre-treatment event times (t-g ∈{−4, −3, −2, −1}) should be zero under parallel trends — confirmed. The revenue effect builds gradually: 0.62 pp in year 0, 1.41 pp in year +1, stabilising at 1.94 pp from year +2 onward.*

The event-study dynamics in Table 4 reveal that the revenue effect emerges gradually. In the year of adoption (t-g=0), the total tax gain is already significant at 0.62 pp of GDP reflecting early adopters who file and pay via mobile money in the first year. By year +1, the effect more than doubles to 1.41 pp, as the mobile payment infrastructure reaches critical mass and tax authority auditing systems are fully integrated with mobile money transaction data. By year +2 and beyond, the effect stabilises at 1.94 pp somewhat above the simple ATT estimate of 1.84 pp as later cohorts which adopted under more mature infrastructure conditions achieve faster scale-up. Critically, the pre-adoption period estimates (t-g ∈ {−4, −3, −2, −1}) are small, statistically insignificant, and show no systematic trend, providing strong support for the parallel trends identifying assumption.

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6. Robustness Checks

Table 5. Robustness checks — mobile tax payment and total tax-to-GDP

Specification	(R1) TWFE (baseline)	(R2) Goodman -Bacon	(R3) Synthetic Control	(R4) Exclude ear. adopters	(R5) Placebo adopt. year	(R6) Alternative outcome (IMF GFS)
ATT estimate	**2.12*** **	**1.91*** **	**1.88*** **	**1.79*** **	0.08	**1.77*** **
	(0.44)	(0.43)	(RMSPE)	(0.42)	(0.39)	(0.41)
Pre-trend test	N/A	0.71	N/A	0.77	0.68	0.75
N obs.	308	308	3 units	266	308	280
Notes	Biased? Comp. to CS	BACON decomp. weighted	KEN+TZA+RWA 1:1 synth.	Excl. 2013+ 2014 cohorts	Adopt yr+3 placebo	IMF GFS total revenue

Note: R1: standard TWFE — larger than CS by 15%, suggesting positive treatment effect heterogeneity inflation from forbidden comparisons (Goodman-Bacon, 2021). R2: Goodman-Bacon decomposition reveals that 82% of the TWFE estimate comes from "clean" never-vs-treated comparisons. R3: Synthetic control for the 3 earliest adopters (Kenya, Tanzania, Rwanda) — RMSPE-normalised effect of 1.88pp consistent with main estimate. R4: excluding the 2013-2014 cohorts to address influence of outliers. R5: placebo test using adoption year +3 as false treatment — no significant effect confirms that pre-trends are flat. R6: alternative revenue data source (IMF Government Finance Statistics) confirms robustness to data source.

7. Heterogeneity and Mechanisms

7.1 Mobile money penetration complementarity

Table 6. Heterogeneity by mobile money penetration — CS ATT(total tax)

Sub-sample	N treated countries	CS ATT (total tax)	CS ATT (CIT)	Ratio ATT / Full sample
Full sample	14	**1.84*** **	**1.13*** **	1.00×
		(0.38)	(0.27)	
High MM penetration (>median)	7	**2.61*** **	**1.62*** **	1.42×
		(0.51)	(0.38)	
Low MM penetration (≤median)	7	**1.01** **	**0.61** **	0.55×
		(0.48)	(0.29)	
Difference (High − Low)	—	**1.60*** **	**1.01*** **	—
		(0.52)	(0.38)	
Very high MM (>60%)	4	**3.22*** **	**2.01*** **	1.75×
		(0.68)	(0.48)	

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*Note: CS ATT(g,t) estimated separately for above- and below-median mobile money penetration subsamples. Median mobile money accounts: 34.7 per 100 adults (at adoption year). High MM penetration: ≥35/100 adults (Kenya, Tanzania, Rwanda, Ghana, Uganda, Senegal, Mozambique). Low MM: <35/100 adults (Zimbabwe, Cameroon, Zambia, Nigeria, Mali, Côte d'Ivoire, Burkina Faso). Bootstrap SE (999 reps). *** p<0.01; ** p<0.05.*

The complementarity between mobile money infrastructure and tax enforcement is striking. Countries with above-median mobile money penetration at the time of adoption achieve revenue gains 2.6 times larger than below-median countries (2.61 pp vs. 1.01 pp). Among countries with very high mobile money penetration (>60 per 100 adults: Kenya, Tanzania, Rwanda, Ghana), the gain reaches 3.22 ppmore than triple the below-median effect. This finding has direct implications for the sequencing of digital tax reform: adopting mobile tax payment before adequate mobile money infrastructure is in place yields substantially smaller fiscal gains, suggesting that investment in mobile money expansion is a prerequisite for maximising the tax compliance benefit.

7.2 Firm-level mechanism: reduced informal tax avoidance

Table 7. Enterprise Survey mechanism analysis — informal tax burden pre vs. post adoption

Outcome: % firms with informal tax payments	Pre-adoption mean	Post-adoption mean	DiD estimate (CS ATT)	p-value
Treated countries — All	21.4	17.2	**−4.2****	0.024
Treated countries — High MM	18.6	12.1	**−6.5*****	0.006
Treated countries — Low MM	24.2	22.4	−1.8	0.341
Never-treated countries	19.8	20.1	+0.3	0.871
Difference-in-differences (net)	—	—	**−4.5****	0.019

*Note: % firms reporting informal tax payments drawn from World Bank Enterprise Surveys. Pre = survey wave immediately before adoption; Post = first survey wave ≥2 years after adoption. Available for 20 of 28 countries. DiD estimate: treated post-adoption change minus never-treated change. *** p<0.01; ** p<0.05. The low MM subgroup shows no significant change, consistent with the complementarity result in Table 6.*

8. Policy Implications

8.1 Fiscal multiplier of digital tax administration investment

The revenue gain of 1.84 pp of GDP from mobile tax payment adoption can be used to compute an implicit fiscal multiplier for digital tax infrastructure investment. The average cost of integrating mobile money into tax collection systems based on GSMA and World Bank estimates is approximately USD 3–5 million per country for the initial API integration, system testing, and taxpayer onboarding. For the median SSA country with a GDP of approximately USD 20 billion, 1.84 pp of GDP represents additional annual tax revenue of USD 368 million per year. Discounted over a 10-year horizon at 5 % discount rate, the present value of the revenue gain is approximately USD 2.84 billion. The implied fiscal multiplier is thus USD 2.84 billion / USD 4 million ≈ 710 an extraordinary return. Even under conservative assumptions

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(halving the ATT and doubling the cost), the multiplier remains above 100, suggesting that digital tax administration reform is among the highest-return development investments available to SSA governments.

8.2 Policy sequencing

Our heterogeneity evidence (Table 6) implies a critical sequencing recommendation: mobile money infrastructure investment should precede mobile tax payment reform. Countries with below-median mobile money penetration should first focus on expanding mobile money access through appropriate regulation, interoperability mandates, and agent network development before investing in tax payment integration. The revenue gain below the 35-per-100-adult threshold is less than half the above-threshold gain, suggesting that the marginal return to tax administration investment is substantially lower in low-penetration environments.

A second sequencing implication concerns the complementarity between electronic payment transparency and tax enforcement capacity. Countries that adopt mobile tax payment without simultaneously investing in auditing systems and revenue authority staff capacity to analyse mobile money transaction data will capture less of the potential compliance gain. The Enterprise Survey evidence (Table 7) shows that the compliance effect is concentrated in high-mobile-money-penetration countries, where the density of traceable transactions provides the greatest audit trail benefit.

9. Conclusion

This paper provides causal evidence that digital public services specifically the integration of mobile money platforms as official tax payment channels significantly increase local government tax revenue in Sub-Saharan Africa. Using the Callaway-Sant'Anna (2021) staggered difference-in-differences estimator applied to 28 countries over 2012-2022, we find an average treatment effect of 1.84 percentage points of GDP (an 11.5 % increase), with 61 % of the gain driven by corporate income tax formalisation of digital commerce operators.

Three findings stand out for policy design. First, the revenue effect is substantially larger in countries with high mobile money penetration (2.61 pp vs. 1.01 pp for below-median penetration), implying that mobile financial infrastructure and digital tax administration are strong complements. Second, the event-study dynamics reveal that the full effect takes 2 years to materialise, suggesting that early performance monitoring should account for this ramp-up period. Third, the enterprise survey evidence confirms that the compliance improvement operates through a reduction in informal tax avoidance, consistent with the audit trail mechanism.

These findings have implications beyond Sub-Saharan Africa for any low- and middle-income context with expanding mobile payment infrastructure particularly in South Asia and the Pacific where analogous complementarity between digital financial inclusion and fiscal capacity may be exploited. Future research should examine the welfare implications of the

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increased formalization, including potential employment effects and the distributional impact of extending the tax net to previously informal digital commerce operators.

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