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Working Paper **GOK-AERC-UCPH-DERG-005**

Bringing Rigour and Evidence to Economic Policy Making in Africa

AFRICAN ECONOMIC RESEARCH CONSORTIUM

COSORTIUM POUR LA RECHERCHE ÉCONOMIQUE EN AFRIQUE

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AERC Working Paper GOK-AERC-UCPH-DERG-005
African Economic Research Consortium, Nairobi
February 2025

THIS RESEARCH STUDY was supported by a grant from the African Economic Research Consortium. The findings, opinions and recommendations are, however, those of the author and do not necessarily reflect the views of the Consortium, its individual members or the AERC Secretariat.

Published by: The African Economic Research Consortium
P.O. Box 62882 - City Square
Nairobi 00200, Kenya

Acknowledgements

The African Economic Research Consortium (AERC) would like to acknowledge the Royal Danish Embassy - Nairobi (for financial support) and the implementation partners including Development Economics Research Group at the University of Copenhagen (UCPH-DERG), Kenya Institute of Public Policy Research and Analysis (KIPPRA), Kenya Revenue Authority (KRA), Kenya National Bureau of Statistics (KNBS) & Central Bank of Kenya (CBK) (for technical and intellectual support). The AERC is also grateful to the project steering committee and the stakeholders for in-depth comments and suggestions that shaped this paper from inception to completion. The findings, opinions and recommendations are those of the authors and do not necessarily reflect the views of the Consortium, its individual members or the AERC Secretariat.

Abstract

This paper leverages administrative tax data from Kenya to make several contributions to our understanding of personal income taxation in developing countries. First, we exploit recent tax reforms to credibly estimate the elasticity of income to changes in marginal tax rates from a taxpayer panel with state-of-the-art methods, a novelty in the context of Sub-Saharan Africa. We find a value of 0.3 for our sample of individuals in the upper half but not at the top of the income distribution, which conceals large disparities between inelastic public workers and a rather elastic private sector. Second, we combine administrative tax data with household survey data to address the shortcomings of each of these data sources in measuring income inequality and assess the success of income taxes and potential modifications to them in reducing post-tax income inequality. We also triangulate these data sources to quantify the compliance gap due to compliance at 23% of potential revenue, mainly attributable to self-employed workers. Finally, we rely on these tools to investigate the possibilities Kenyan policymakers have and the trade-offs they face when aiming to collect further revenue in an efficient and progressive manner.

1. Introduction

The determination of the income tax structure requires policymakers to carefully weigh efficiency, equity and revenue maximization goals. If anything, these tradeoffs are even sharper for policymakers in Sub-Saharan Africa, where all these competing aims seem pressing enough to deserve priority. On the one hand, governments in the region are often in urgent need to enhance domestic revenue mobilization to scale up social protection schemes and invest in public good provision while reigning on increasing levels of public debt and reducing their reliance on external donors. Personal Income Taxes (PIT) have an important role to play for this purpose, as they account for a large share of tax revenue, which, according to OECD data, are however substantially smaller as a share of GDP in low income and emerging countries (2.1% and 3.1%, respectively), as compared to 8.3% in OECD countries.

On the other hand, personal income taxes have typically been assigned a prominent role in income redistribution by classical optimal tax theory and indeed have been shown to have a relevant equalizing effect in emerging and, especially, higher income economies. A sufficiently progressive PIT seems an appealing instrument to reign in the large income inequalities that characterize many economies in Sub-Saharan Africa.

However, achieving robust economic growth that raises living standards across the population remains a fundamental goal for policymakers, who may thus want to minimize the distortions induced by income taxes on the choices of economic agents. A priori, African policymakers have reasons to be particularly wary of substantial responses to increased taxation, which can take the form of tax planning and avoidance and hamper formalization. In addition, lower income taxes can spur economic activity by increasing the disposable income of households and boosting consumer spending.

A sound understanding of the implications of different PIT schemes is an essential pre-requisite for undertaking informed reforms that achieve the goals set by policymakers. While ample evidence from high-income countries on PIT is available, lessons may not always extrapolate to Sub-Saharan Africa, or more generally developing countries, due to differences in state capacity, institutional arrangements and economic structure, among other factors. In this paper, we aim to expand the evidence base on the impact of PIT in a developing economy along several fronts. We study these issues in the context of Kenya, a lower-middle income country whose GDP per capita was around 2,100 US$ in 2023. Some of the lessons drawn might be useful for other Sub-Saharan countries, which face a set of shared challenges.

For this purpose, we mainly rely on rich tax administrative data from the Kenya Revenue Authority (KRA). We observe all Paye-As-You-Earn (PAYE) returns filed by employers to report the incomes of their employees, and we link them to individual income tax returns. This taxpayer panel dataset includes information at an annual frequency on incomes, tax benefits and tax liabilities for over 2 million individuals per year between 2015 and 2022.

Our first main contribution is to quantify how incomes respond to changes in income taxes. Economic theory predicts that higher marginal tax rates may incentivize individuals to earn and/or report lower incomes. Thus, quantifying the scope of taxpayers' behavioral responses is essential to obtain a realistic assessment of the consequences of potential PIT reforms. The income captures relative changes in income as a reaction to relative changes in marginal net-of-tax rates, with higher values implying a stronger reduction in income following an increase in tax rates. The Elasticity of Taxable Income (ETI), which should be understood as an aggregate of various mechanisms such as labor supply responses or tax planning, is then sufficient to determine the revenue implications of changes in marginal tax rates.

We exploit a recent tax reform and the availability of detailed employee panel data to provide reliable estimates of income elasticities. In the wake of Covid-19, modifications to the PIT structure were introduced, which increased marginal tax rates for the first effective taxpayers. We assess the consequences of the latter change on reported taxable and gross incomes. We obtain these estimates using state-of-the-art methods in Jakobsen and Søgaard (2022), which put forward a clean empirical design that allows to convincingly isolate the impact of tax changes from other factors leading to differential growth trends along the income distribution. This can be done by incorporating an additional pre-reform period. An important feature of this approach is that it allows us to verify the core assumption upon which rests the validity of our estimates, akin to the parallel trend assumption routinely checked in difference-in-difference studies.

We estimate elasticities for Kenyan taxpayers earning approximately KES 400,000 to 1 million annually in 2022 (equivalent to around USD 3,250 to 8,100 at 2022 exchange rates). We find headline values of 0.3 for taxable income and 0.16 for gross income over a three-year period. This implies that taxpayers that saw the reform increased their marginal tax rates from 25% to 30% reduced their pre-tax taxable (gross) income by around 2% (1.07%) on average. These values are moderate in comparison to the international evidence reviewed in Neisser (2021), and especially when compared to the findings of an emergent literature on top income earners in Sub-Saharan Africa (Jouste et al. (2023), Axelson et al. (2024)). However, they mask substantial heterogeneity across more responsive private and less responsive public workers, who constitute a substantial share of the sample.

With this exercise, we contribute to a large literature on the estimation of income elasticities. Be it due to its policy relevance or due to the important methodological challenges regarding its estimation, the ETI has recently attracted enormous attention from the literature: see Feldstein (1995), Gruber and Saez (2002), Kleven and Schultz (2014) or Weber (2014) for some notorious contributions, and Saez, Slemrod and Giertz (2012) and Neisser (2021) for reviews. Nevertheless, as pointed out in Axelson et al. (2024), most studies have taken place in the context of high-income countries, partly due to data constraints. It is intuitively clear that the shape and scope of income responses to taxation might be quite different in developing economies due to, among others, high informality and constraints to enforcement.

Our key contribution to this literature is incorporating state-of-the-art, credible approaches exploiting plausibly exogenous variation in marginal tax rates introduced by tax reforms to the estimation of the ETI in Sub-Saharan Africa. These methods have not been used yet in the African context, except for concurrent work on South Africa in Axelson et al. (2024), because they require several years of panel data at the individual level, which is not commonly available. For instance, the closely related recent study of top income earner responses to a tax reform in Uganda in Jouste et al. (2023) is constrained to using cross-sectional data. A major advantage of approaches based on panel data with respect to cross-sectional studies is the ability to deal more convincingly with endogeneity by assigning treatment status (predicted exposure to the tax reform) based on lagged income, see Saez, Slemrod and Giertz (2012).

A further distinctive element of the elasticity estimation in this study is the focus on a different segment of the income distribution. Much of the existing emerging literature assessing responses to income and wealth taxation in developing countries reviewed in Bachas, Jensen and Gadenne (2024) has focused on top income earners. We thus provide complementary evidence on a set of individuals that account for a substantial share of tax revenue and whose responses to taxation might arguably be more representative of the average citizen than those of the very rich. Furthermore, the weight of this type of taxpayer on aggregate PIT revenue can only be expected to increase along with improved state capacity, economic growth and the formalization of employment (Jensen, 2022). Behavioral responses to income taxations for income regions other than the top have been previously analyzed in South Africa using inflationary bracket creep (Kemp, 2019) and bunching methods (Pillay, 2021). These methods are less likely to provide meaningful elasticity estimates due to the lack of saliency of tax rate changes and pervasive optimization frictions, respectively.

Another contribution of this paper is the integration of administrative and household survey data in the spirit of the inequality literature (Blanchet, Flores and Morgan, 2022; Pikétty, Saez and Zucman, 2018) to provide accurate estimates of the distributional impact of PIT. Existing literature has typically evaluated the progressivity of tax systems or reforms in developing countries using household surveys (Inchauste and Lustig, 2017; Lastunen et al. 2024). It is, however, well known from studies of inequality and informality that household surveys fail to capture the top of the income distribution (Lustig, 2019; Ravallion, 2022; Pikétty, Saez and Zucman, 2012), and that the formal employees covered by administrative tax data are not representative of the whole population. We show how combining both data sources can substantially alter the conclusions on the impacts of tax reforms - as well as of the overall impact of personal income tax on inequality, which is substantially lower than could be expected when looking at tax data. This study differs from recent efforts by McNabb and Oppel (2023) to quantify the impact of the PIT on income inequality across Africa using data from the World Inequality Database on income distributions, as we have direct access to unit-level data from primary sources on comparable income concepts.

We also provide evidence on the magnitude of the PIT gap due to non-compliance. Broadening the tax base is usually considered a key objective for tax authorities (KRA, 2021), which is often framed as a challenge to increase compliance with tax regulations considering the small share of individuals paying income tax. However, it seems clear that the tax-exemption threshold emerges as a competing explanation, since it lies above the incomes earned by a large share of the Kenyan population. Our headline estimates quantify the PIT gap at 23% of potential income. Self-employed workers account for around 80% of this gap, and informal employees for the remaining 20%.

Finally, we incorporate these inputs and combine them insights from the literature to analyze ex-ante the equity, efficiency and revenue implications of possible reforms of the PIT in Kenya. Usual goals for policymakers include enhancing the inequality-reducing impact of the personal income tax, stimulating economic activity or increasing revenue collection. We focus on analyzing potential reforms that meet at least two of these three criteria.

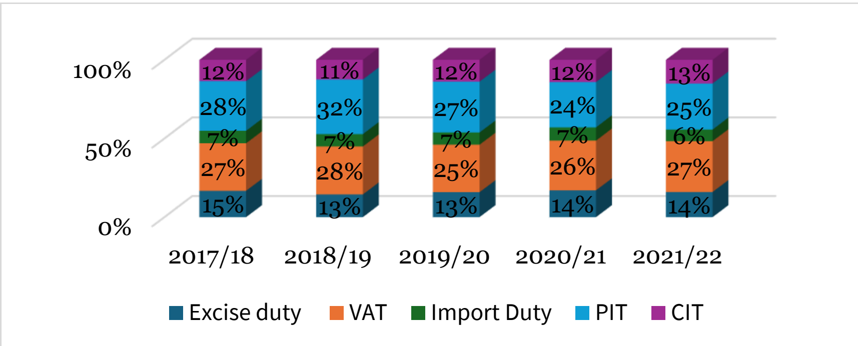
The rest of the paper is structured as follows. The next section provides some background on PIT in Kenya. Section 3 describes the data. Section 4 focuses on the estimation of personal income, while Section 5 deals with the integration of survey and tax data and the quantification of the revenue gap.

Section 6 outlines the conclusions from applying our findings to PIT reform in Kenya, while Section 7 briefly discusses the implications of our analysis for income taxation in developing countries.

1. Background: Personal Income Taxation in Kenya

In Kenya, the PIT is charged on an individual's gross income received regarding employment, business or services rendered save for allowed deductions, including exempted incomes such as mortgage interest and pension contributions, personal relief and insurance relief. The majority of PIT (over 95% on average between FY 2017/18 to FY 2021/22) is generated by a wage withholding tax system in which companies deduct a portion of employees' pay in the form of Pay As You Earn (PAYE) tax and send that tax to the Kenya Revenue Authority (KRA) before the ninth day of the following month. To reconcile the tax withheld with their overall tax liability, PIT taxpayers file tax returns annually.

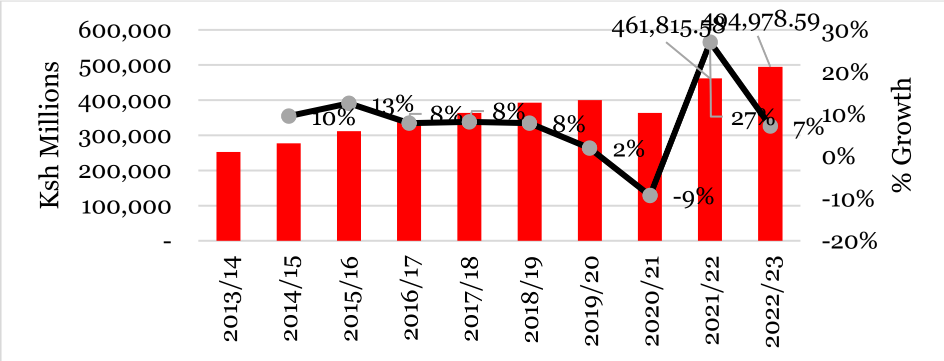
Figure 1: Revenue performance



Source: Kenya Revenue Authority (2017/18-2021/22)

For the period FY 2017/18 to FY 2021/22, the average contribution of PAYE to the exchequer revenue was 26.9%, while the self-employed tax share was about 0.6%. Personal income taxation plays an important role for domestic revenue mobilization, as it accounted for the largest share of the total exchequer revenue over the last five fiscal years, averaging 27% for this period (Figure 1). However, total tax revenues from PIT have been generally increasing in absolute terms (Figure 2) but falling in relative terms, both as a share of total tax revenues (from a contribution of 32% in 2018/19 to 25% in 2021/22) and as a ratio to GDP (the ratio moved from 5.7% in 2017 to 4.9% in 2021).

Figure 2: Growth in PAYE, 2014 to 2023



Source: Kenya Revenue Authority

The Kenyan tax system has certain progressive features, such as a relatively high weight of direct taxes such as PIT compared to indirect taxes (Thomas, 2023) or the large share of tax incidence borne by the richest segment of the population (World Bank, 2018). The PIT structure also displays some progressive characteristics, such as the use of graduated tax bands with Marginal Tax Rates (MTR) increasing in income (Table 1) and the exemption of low-income earners from paying income taxes in practice through personal relief. However, there are some limitations to the progressivity of the system among taxpayers, the large majority of which face MTRs between 25% and 30%.

Table 1: Personal Income Tax Brackets and applicable tax rates, 2004-2023

Year	Annual Taxable Income (Ksh)	Rate	Year	Annual Taxable Income (Ksh)	Rate
2004	First 121,968 Next 114,912 Next 114,912 Next 114,912 Over 466,704	10% 15% 20% 25% 30%	2017	First 134,165 Next 126,403 Next 126,403 Next 126,403 Over 513,374	10% 15% 20% 25% 30%
2018	First 147,580 Next 139,043 Next 139,043 Next 139,043 Over 564,709	10% 15% 20% 25% 30%	2020	First 288,000 Next 200,000 Next 200.000 Next 688,000	10% 15% 20% 25%
2021	First 288,000 Next 100,000 Over 388,000	10% 25% 30%	2023	First 288,000 Next 100,000 Next 5,612,000 Next 3,600,000 Over 9,600,000	10% 25% 30% 32.5% 35%

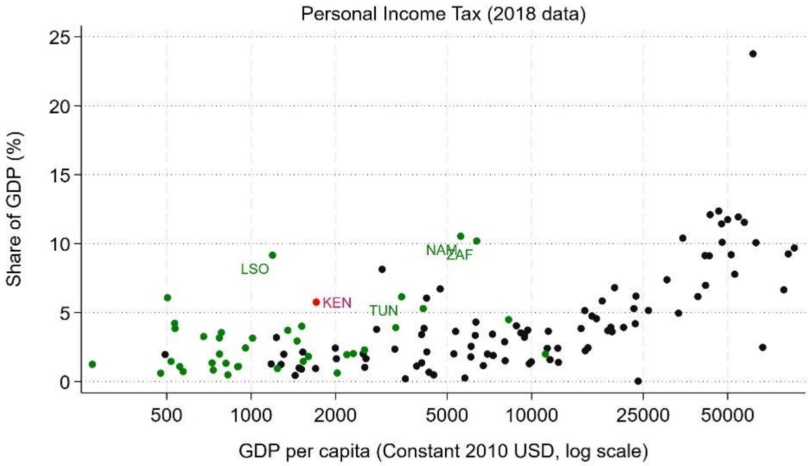
Source: Finance Act, various issues

The structure of Kenya's income tax bands shows both similarities and differences when compared with that of other African nations, as shown in Table A.1.1 Aiming to distribute the tax burden equitably, African countries have generally adopted progressive taxation of individual incomes - as indicated by increasing tax rates as income rises - and implemented a tax-free threshold (0%) or tax rebates providing financial relief to individuals with lower incomes. However, there is substantial variation across countries in key features of their tax system, such as the level of minimum reportable income or tax relief, or the number of tax brackets. Countries such as South Africa and Namibia, which stand out for their relatively higher PIT-to-GDP ratios, share a seven-band structure gradually raising taxes over a rather wide range (18% to 45% in the case of South Africa). Other countries such as Rwanda have opted for a more straightforward structure with four bands.

Many of Kenya’s challenges with income taxation are shared with other developing countries. As an illustration, the concentration of the income tax burden on a rather reduced segment of the population is a common phenomenon in lower and middle-income countries (Bachas, Jensen and Gadenne, 2024), and the low share of PIT revenue to GDP in developing countries is commonly attributed to the small segment of the population paying this tax, especially those working in the public sector and large private firms. In 2022, the Kenyan labor force included around 19 M individuals, of which 2.4M filed income through the PAYE system in an average month. The two main sources of PAYE tax revenues in Kenya are the public sector and large firms, respectively contributing 39% and 35% over the last 5 years.

Those common challenges are reflected in the fact that, according to recent cross-country comparisons in Bachas, Gadenne and Jensen (2024) illustrated in Figure 3, countries with a similar income to Kenya tend to collect less personal income tax, and PIT as a share of GDP only starts rising systematically at much higher income levels. However, the recent gradual decline of Kenya’s PIT to GDP ratio seems not to be a common pattern among regional peers (Figure A.1.1)

Figure 3: PIT to GDP Ratios. Cross-country comparisons



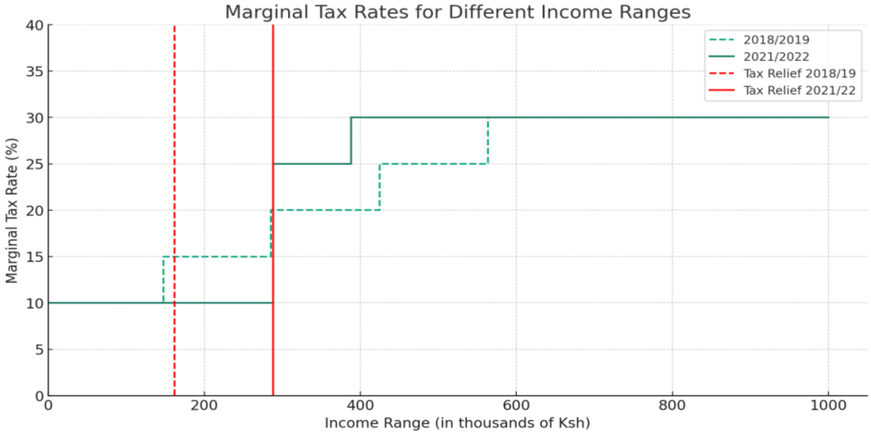
Source: Bachas, Jensen and Gadenne (2024). Kenya (red) and African countries (green) highlighted by authors.

Beyond income taxes, take-home pay is further reduced by several social contributions. These include contributions to the National Hospital Insurance Fund (NHIF) and National Social Security Fund (NSSF). The NHIF contributions range from Kshs 500 to Kshs 1700 per employee per month while those to NSSF stayed at Kshs 200 until 2022. After our study period, the introduction of the 1.5% Affordable Housing Levy (AHL), the review of the NSSF contributions with effect from February 2023 and the anticipated 2.75% contributions towards the Social Health Insurance Fund (SHIF) in July 2024 have further increased the share of income claimed by social contributions.

PIT reform

The Kenyan PIT structure has been remarkably stable over the last two decades. As can be seen in Table 1, reforms in 2017 and 2018 amended the levels of tax brackets to account for inflation but preserved the general tax structure and even tax rates. However, the two subsequent reforms implemented in April 2020 and January 2021 introduced substantial modifications.

Figure 4. Tax reforms in 2019/20: Marginal tax rates



Note: The figure shows the progression of marginal tax rates following the reforms in 2020 and 2021. The vertical red lines represent the tax-exemption thresholds implicitly defined by personal relief.

Figure 4 shows the combined effects of these changes, which took place in two steps. In 2020, policymakers prioritized sheltering taxpayers from economic distress, increasing personal relief by over 70% and generally decreasing MTRs at all income levels. However, the thresholds for the MTRs of 25% and 30% were subsequently lowered in 2021 to compensate for decreasing revenues, resulting in higher MTRs for the first effective taxpayers than in 2019. Another consequence of these reforms was the reduction of tax brackets from five to three. Since the reforms were introduced as a response to a large unexpected global shock after a period of stability in MTRs, we can rule out adaptive responses in the pre-reform period. We will hence use them as a source of exogenous variation in MTRs for the purpose of estimating the income elasticity.

2. Data

This study mainly draws on detailed administrative tax data provided by the Kenyan Revenue Authority (KRA). We use the universe of Paye-As-You-Earn (PAYE) returns. We observe gross incomes at a yearly frequency. The data allows us to observe gross employment income, tax benefits, taxable income, tax paid, and to infer tax reliefs, all of that at a yearly frequency. The number of observations grows from around 2.2M observations in 2015 to around 2.9M observations in 2022. Even if not all individuals in the data report paying taxes or earning incomes above the implicit tax-exemption threshold, we henceforth loosely refer to them as “taxpayers”.

Using anonymized taxpayer numbers, we combine data from PAYE with data from personal income tax returns filed by individuals (the so-called P9 form). Individuals in the PAYE system are often missing from P9 data (25% of cases), probably because they just do not file their taxes. However, for 71% of observations, taxpayer numbers can be linked across P19 and P10, and employment incomes exactly match across sources in most (88%) of those cases. When a discrepancy exists, we privilege PAYE data on employment income, since those returns are filed by employers, and third-party reporting that has been shown to foster truthful reporting (Kleven et al., 2011), which is in line with the perceptions of Kenyan tax officials of PAYE returns as a more reliable data source. Non-employment income is then added from the P9 return, which is also taken as the preferred source for tax benefits. Finally, the small share of observations (4%) for which only personal income returns are available partly consists of people deriving their income from other sources than employment, particularly self-employment.

For the analysis of progressivity of the PIT structure and the simulation of tax reforms, we complement KRA data with the 2021 Kenyan Continuous Household Survey (KCHS), a household survey collected by the Kenya National Bureau of Statistics (KNBS) that is used as a source for some official statistics, e.g. on labor. The KCHS aims at providing up-to-date information on various socio-economic aspects of Kenyan households, including income, expenditure, employment, health, education, and living conditions. Crucially, it includes information on formality status according to various definitions, including paying taxes. The KCHS uses a nationally representative sample of households, selected through a multi-stage stratified sampling process, and employs a rolling sample design, where data is collected continuously throughout the year. The sample of KCHS 2021 includes 68,677 individuals in 17,042 households.

3. Estimating the elasticity of taxable income

Methodology

The basic setup for elasticity estimation is the following. Let y_{it} be some income concept (e.g. taxable or gross income) of individual i at time t, and $\tau_{it} = 1 - \mathrm{T}_t(y_{it})$ the net-of-tax rate faced by that individual, where $\mathrm{T}_s(y_{it})$ is the MTR corresponding to income y_{it} according to tax rates in period s. We want to know how income responds in relative terms to relative changes in the net-of-tax rate:

$$\Delta \log y_{it} = \theta \Delta \log \tau_{it} + \eta_{it}$$

We are interested in obtaining an unbiased estimate of the elasticity θ. This is a challenging endeavor for several reasons. The primary source of endogeneity is that the tax code determines MTRs as a function of taxable income. Therefore, literature has often exploited the exogenous variation in tax rates introduced by reforms of the tax code, to overcome endogeneity. Furthermore, when taxpayer panel data is available and it is possible to observe pre-reform and post-reform income for a given individual, the predominant approach has been to instrument the change in MTRs faced by an individual by the predicted "mechanical" change $\Delta \log \widetilde{\tau_{it}^{s}} = \log(1 - \mathrm{T}_s(y_{it-1})) - \log\left(1 - \mathrm{T}_{s-1}(y_{it-1)})\right)$ on the basis of pre-reform incomes and post-reform tax rates. In this way, it is avoided that assignment into treatment depends on the outcome variable.

To obtain unbiased estimates of θ, it is further required that the exclusion restriction is met and predicted changes in net-of-tax rates are not correlated to other drivers of differential growth for individuals affected by the tax reform. Since assignment into treatment is fully determined by initial incomes, this assumption essentially requires the independence of income growth rates η_{it} in absence of changes to the tax code from initial income levels y_{it-1}. The literature has referred to mean reversion and secular trends as the main threats to this assumption (Saez, Slemrod and Giertz, 2012). Mean reversion refers to the fact that lower incomes in the initial year might be partly due to negative temporary shocks, so that faster growth can be expected for individuals with lower initial incomes. Secular trends capture the general idea that different segments of the income distribution might be systematically growing at different rates for many reasons other than income taxes.[1]

[1] The terminology adopted in the methodological literature seems heavily influenced by the focus of seminal studies on estimating the effect of marginal top rates in the United States in a

The independence assumption is thus unlikely to be valid unconditionally. Literature has tried to overcome these issues around differential growth trends by flexibly controlling lagged incomes, thus weakening the requirement into a more plausible conditional independence assumption. The standard procedure to do this has been to include a as a set of dummies for different income bins as control, but results have been proved sensitive to the exact specification chosen (Neisser, 2021). This is intuitive because, as pointed out by Jakobsen and Søgaard (2022), with only one pre-reform and one post-reform period, lagged income is the only source of variation in exposure to tax changes and can thus not be controlled for fully non-parametrically without absorbing all variation needed for identification.

Jakobsen and Søgaard (2022) observe that an additional pre-reform period can be used to flexibly control for differences in income growth at different levels of initial income under the assumption of "constant trend differentials". This assumption implies that income growth relative to a common benchmark (which captures changes in the average growth rate, thus not required to be the same) at different points of the distribution must remain constant over time.

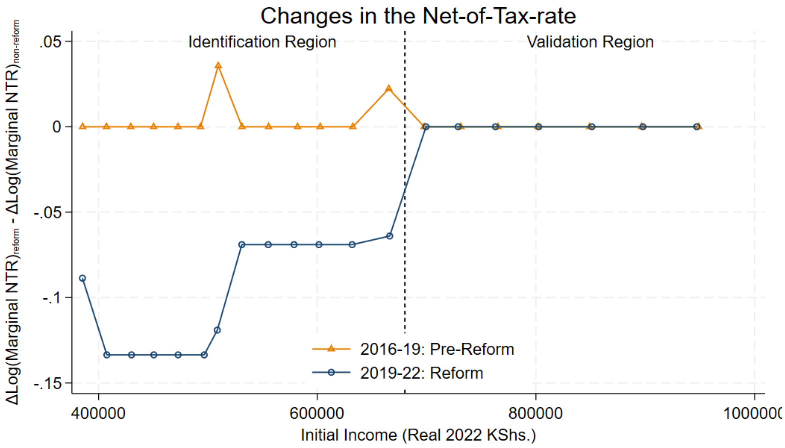
Thus, in our setup we estimate the equation

$$\Delta \log y_{it} = \gamma_0 + \mathrm{f}(y_{it-1}) + \theta \Delta \log \tau_{it} + \gamma_1 R_{it} + n_{it} \qquad (1)$$

with 2SLS, where $R_{it}$is a reform dummy, $\mathrm{f}(y_{it-1})$ a flexible control function based on initial income and $\Delta \log \tau_{it}$ is instrumented with $\Delta \log \widetilde{\tau_{it-1}^{t}}$. Using data for 2016, 2019 and 2022, we exploit the 2020/21 reforms described in Section 2.2 and the fact that MTRs did not change for most individuals between 2016 and 2019 to identify responses to taxation from differential growth in 2019-2022, using changes between 2016 and 2019 to control for trend differentials along the distribution. Figure 5 shows the changes in marginal net-of-tax rates predicted by our instrument for our estimation sample, which fundamentally consists of increases in MTRs to the left of the threshold for the top rate in 2019:

period where a secular increase in inequality was indeed unfolding. More generally, differential growth trends across the income distribution, as routinely found by growth incidence analyses such as e.g. Lakner and Milanovic (2016) for the global income distribution, would suffice to invalidate the unconditional independence assumption without them having to be "secular".

Figure 5. Predicted changes in the Net-of-Tax-Rate



Note: The figure plots "mechanical" change in marginal Net-of-Tax-Rates (NTR) due to reforms in the PIT reform structure, predicted based on initial period income. NTR increases in the pre-reform period are due to inflation indexing of the tax brackets (see Table 1).

In principle, we could exploit both the increase of the tax-exemption threshold and the subsequent increase of MTRs for the first effective taxpayers in 2022. Since being exempt from paying income taxes may plausibly influence reporting behavior, we focus on the latter change, restricting our sample to individuals with initial incomes between 375,000 real 2022 Kshs, thus comfortably above the exemption threshold, and below 975,000 real 2022 Kshs. This corresponds to individuals between the 49th and the 80th percentile of the income distribution for taxpayers in 2022. While in principle all income earners beyond the top MTR threshold in 2019 could serve as a control group, since they faced MTRs of 30% before and after the reform, we decide to include those close enough to the treated groups, as very large incomes are unlikely to be a valid counterfactual for the lower incomes affected by the reform. The assumption of constant trend differentials needs to hold locally for the income range in the estimation sample, as we shall now verify.

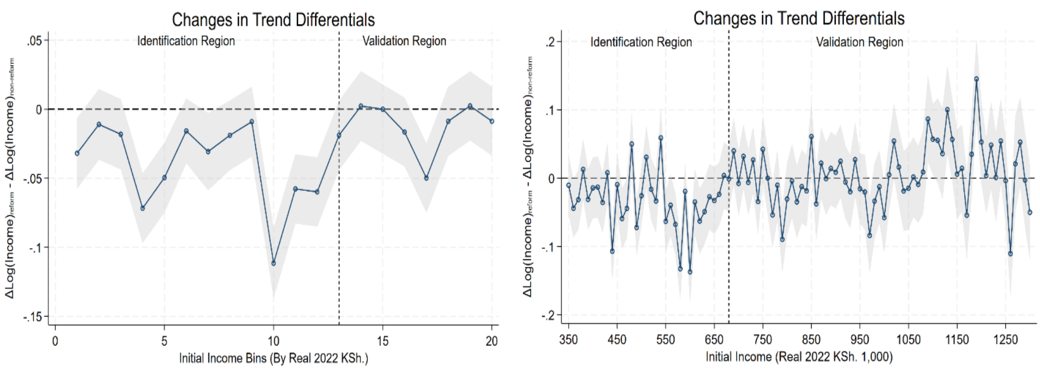
Validity checks

A key advantage of this approach is that the core constant trend differential assumption is readily falsifiable with available data, similarly to the parallel trends' assumption in difference-in-difference studies. This assumption implies that, in absence of a tax reform, relative income growth conditional on initial income in 2016 and 2019 would not be different to that between 2019 and 2022. This can be evaluated by looking at a validation region, comprising taxpayers for which the reform would not be expected to induce any "mechanical" change in MTRs on the basis of their initial incomes. In our case, those are individuals whose MTR was already at 30% before the top marginal tax threshold was lowered. Formally, this is tested estimating the equation

$$\Delta \log y_{it} = \beta_0 + \beta_1 B_{it-1} + \beta_2 R_{it} + \beta_3 R_{it} \times B_{it} + b_{it} , \quad (2)$$

where B_{it} is a vector of income bin dummies and R_{it} a dummy for the reform period. If the coefficients β_3 in the "validation region" are systematically statistically significantly different from 0, that implies that local growth differential trends are different post-reform and pre-reform are different, and the identification assumption is violated. Elasticity estimates will then not be reliable. Figure 6 shows that this is not the case in our sample, and that the constant trend differentials assumption generally holds in the validation region. While the assumption seems to be violated at one point in the left sub-figure, the partition in thinner income bins on the right shows that this violation is not driven by a large income region systematically growing above or below pre-reform trends, but rather by a few particularly noisy thin income bins.[2] Thus, our elasticity estimates are driven by changes in income trends in the identification region, as required by the methodology, and we can confidently interpret them as income responses to changes to tax rates.

Figure 6. Validity checks: Constant trends differential assumption



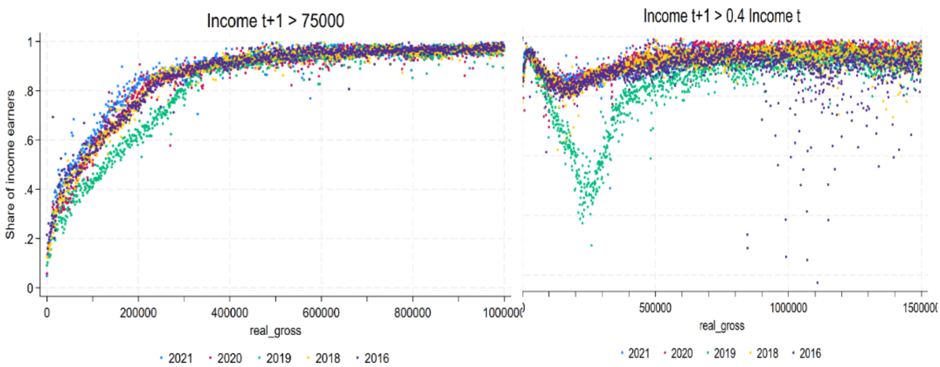
Note: The figures plot the coefficients β_3 estimated for equation 2. If the key validity assumption holds, these should be generally equal to 0. On the left sub-figure, income trends are controlled with 20 income bins B_{it-1}, on the right with equal sized bins that are 10,000 Ksh. broad.

In our application, there is an additional threat to the validity of elasticity estimates. If a shock (such as Covid-19 and the ensuing public health

[2] Those thin bins are not driving the results, as excluding them does virtually not affect the results.

measures) affected the validation region in a markedly different form to the identification region, the constant trend differential might still not hold[3] and trend differences in the identification region would be a combination of the response to changes in tax rates and the differential impact of the shock.

Figure 7. Income dynamics across the distribution



Note: Annual gross income in the x axis expressed in real 2022 KShs.

To evaluate whether such concerns are pressing for our setup, Figure 7 analyzes the distribution of earning losses by plotting the probability that income over the following year dropped substantially at different levels of the income distribution. While the dynamics between 2019 and 2020 are markedly different to other years for lower income earners due to the pandemic shock, this is not the case for incomes above 375,000 real 2022 Kshs., which show no difference to other years if evaluated with respect to an absolute threshold and a very small reduction in the probability to earn at least 40% of last year's income, which is rather constant across all income levels in our sample. This suggests that pre-reform trend differentials are an adequate benchmark to evaluate the effects of the reform for this range of incomes, and it provides further reassurance on the validity of our estimates. The marked differences in income dynamics at lower levels of income further support the notion that this setup seems not to be adequate for estimating the impact of changes to the implicit tax-exemption threshold.

Results

Table 2 summarizes the main results of the estimation using the standard instrumental variable approach in equation 1 above. We present estimates for taxable income, the relevant construct for ascertaining revenue implications, and for gross income prior to applying any tax benefits. Headline estimates are rather moderate, and particularly so for gross income which, as usual, displays lower elasticities. Weighting observations by their initial income leads to larger point estimates, which could be explained by the fact that the largest reactions to taxes in the identification region in Figure 6 take place close to the threshold and hence for higher initial incomes.

Columns 3 and 4 present disaggregated estimates by the sector of employment. Point estimates in the private sector are always higher, statistically undistinguishable from each other and statistically significant from those for public workers. Indeed, the gross income elasticity in the public sector is not statistically different from 0, which suggests that in this sector any response may come from increased reliance on tax benefits. We shall return to the implications of these heterogeneous elasticities when discussing the possibilities for tax reform in Kenya in Sections 6 and 7 below.

Table 2. Income Elasticity Estimates

	(1)	(2)	(3)	(4)
Taxable Income				
$\Delta\log(\tau_{it})$	0.300	0.362	0.305	0.509
	(0.077)	(0.077)	(0.078)	(0.154)
Observations	1,537,949	1,537,949	838,036	622,065
Gross Income $\Delta\log(\tau_{it})$	0.150	0.220	0.060	0.620
	(0.061)	(0.061)	(0.048)	(0.146)
Observations	1,541,515	1,541,515	835,596	630,285
Weights	No	Yes	No	No
Employer	All	All	Public	Private

Note: This table shows estimates of the elasticity of income to net-of-tax rates from an administrative taxpayer panel data from KRA for 2016, 2019 and 2022. These are IV estimates of equation 1 using predicted changes in tax rates from the 2019/20 PIT reform as an instrument.

There are different possible interpretations for these patterns. The common convention for high-income countries is to interpret changes in gross income as real responses in economic activity and explain discrepancies with the responsiveness of taxable income as arising from tax planning. However, in an environment with weaker enforcement possibilities, it is also possible that the higher elasticities in the private sector, which do not vary much across income concepts, are partly explained by tax avoidance, which might be more simple or less costly than engaging in tax planning around legal tax benefits.

5. Tax filers in the income distribution

Merging household surveys and administrative tax records

To properly assess the progressivity of the PIT structure, we need to be able to place incomes of employees reporting PAYE to KRA within the overall national income distribution. For that purpose, following an increasingly common practice in inequality literature (Pikétty, Saez and Zucman, 2018; Blanchet, Flores and Morgan, 2022), we combine tax data with household survey data to obtain a more accurate picture of income distribution. We use data on income from the 2021 Kenya Continuous Household Survey (KCHS), which is better suited to capture the incomes in lower segments of the income distribution and the self-employed, who rarely report their incomes to tax authorities.

The first challenge is to obtain an estimate of the income distribution across all working individuals. Unfortunately, KCHS 2021 only provides reliable data on a subset of them.[4] This is not a rarity in the context of Sub-Saharan Africa, as stronger emphasis has traditionally been placed on the precise measurement of household consumption expenditures, typically the basis for assessments of poverty and inequality in the region. We use an imputation model for income based on consumption and several relevant individual characteristics:

$$\log(\mathrm{y}_i) = \gamma_0^T + \rho_k^T \mathrm{D}_{ik} \log(c_i) + \gamma^T \mathrm{X}_i + \epsilon_i$$

[4] Data on income is collected for employees and the self-employed, with many missing values. In addition, for some observations it is not possible to tell apart whether daily or monthly salaries were recorded, while others provide a range of income instead of an exact value. We carefully clean the data building on the procedures followed by the Kenya National Bureau of Statistics. Sensitivity checks show that variations in defining the set of reliable observations, such as dropping very small income observations instead of treating them as daily incomes, or in the imputation model employed, such as having a joint model for employed and self-employed with dummies for employment type, have a very limited impact on the resulting income distribution.

$\log(\mathrm{y_i})$ is log income, c_i consumption per adult,[5] D_{ik} (with k = 1,…,9) a set of dummies for deciles in the consumption distribution, which allow to capture the different saving rates at different levels of the distribution through ρ_k^T. The independent variables $\mathrm{X_i}$ include sex, age, education, number of other working adults in the household, area of residence (rural or urban) and information on whether the individual works in the agricultural sector. Separate models are estimated for each type T of workers: employees and the self-employed. We estimate these income models with ordinary least squares on the set of observations R with reliable income observations and use them to predict incomes for the rest of the working population (those reporting having worked over the last 7 days, for which the income variable is not directly available NR. Assuming log-normality, we further take a draw from $\mathcal{N}(0, \sigma_\epsilon^{R,T})$, where σ_ϵ^R is the variance estimated for income residuals in R for workers of type T. This last step adds random noise that is uninformative for each household, but it is necessary to account for the variance not explained by observable characteristics and adequately reflect the dispersion of the income distribution.

The validity of this procedure depends on three assumptions:

1. $\mathbb{E}_{R,T}[\log(\mathrm{y_i})|\mathrm{X_i},\ c_i] = \mathbb{E}_{NR,T}[\log(\mathrm{y_i})|\mathrm{X_i},\ c_i]$
2. $Var_{R,T}(\epsilon_\mathrm{i}) = Var_{NR,T}(\epsilon_\mathrm{i})$
3. $\epsilon_i^{NR,T} \backsim \mathcal{N}(0, \sigma_\epsilon^{R,T})$

Essentially, these assumptions require that the set of individuals for which income is reliably captured in KCHS is representative of that type of workers overall both in terms of the conditional correlation between predictors and income, as well as in the dispersion of the unexplained component of income.

These assumptions are still relatively strong and might not be fully satisfied, as workers with a reliable income measure differ in their observable characteristics. They are, for illustration, more likely to be paid monthly rather than daily. It is easy to imagine that for example the association of education with income, or the extent of wage dispersion not explained by observables might differ across these types of workers, and hence between R and NR.[6]

Notwithstanding its limitations, this procedure is likely to provide a more reasonable approximation than the most straightforward alternatives, such as

[5] Since household income is mainly generated by adults, consumption per adult seems intuitively more strongly linked to income than consumption per capita or per equivalent adult.

[6] Assumption 2 could be eventually relaxed to a conditional version by allowing for and modelling heteroskedasticity. Similarly, the normality assumption is taken for simplicity, and other distributions (including the empirical distribution of residuals) could be easily employed. We consider this procedure sufficiently good as a first-order approximation.

direct replacement by per capita consumption (as e.g. Jensen (2022) for the agricultural sector). It is well known that consumption distributions are more compressed than income distributions for various reasons, so that this procedure would notably underestimate income inequality and underestimate the share of workers with incomes above the tax-exemption threshold. Another simple alternative, directly extrapolating the distribution of income within R to the whole workforce, does not seem convincing given the easily verifiable differences in observables between R and NR mentioned above, which our method is able to absorb.

Once income observation is available for all working individuals, we need to combine survey and tax data. The link is given by a variable capturing whether the respondent´s employer deducts income tax from the worker´s salary, which neatly corresponds to participation in the PAYE system. We define individuals for which the answer is affirmative as formal employees and assume that both the distribution of incomes within this group and its size are better captured by the administrative tax data. For all other working individuals, we divide the income distribution into administrative tax data for 2021 in thin bins (centiles for the bottom 90% and increasingly thinner bins in the top of the distribution). We then take those bins to the household survey and, using survey weights, compute the share of the working population within each bin, as well as their average income. While inequality indicators computed from grouped data underestimate income inequality by obliterating disparities within those groups (Jordá, Sarabia and Jäntti, 2021), this is not worrisome for our thin partition.

Finally, these aggregate observations are combined with the individual tax data, after correcting population weights with π_{NF} to account for the fact that formal workers are underrepresented in the survey (see Section 5.2. below). With the combined data, inequality indicators can be readily computed using weights: aggregate observations from the survey are weighted to reflect the population they represent, while all individual observations from tax data have a weight of 1. When computing the impact of PIT on inequality or average incomes, we assume that only the households in formal employment, i.e. those in the administrative tax data, pay taxes.

Table 3. Inequality, Data Combination and PIT: Kenya 2021

	Tax data		**KCHS Survey**		**Combined**	
	Pre-tax	Post-tax	Pre-tax	Post-tax	Pre-tax	Post-tax
Gini	0.612	0.566	0.613	0.591	0.649	0.620
Top 1%	0.184	0.165	0.215	0.196	0.239	0.213
Top 5%	0.372	0.338	0.397	0.367	0.435	0.394
Top 10%	0.492	0.452	0.515	0.484	0.555	0.515
Top 20%	0.640	0.597	0.656	0.634	0.692	0.663

Note: Authors' own elaboration based on KCHS 2021 household survey data and administrative taxpayer data from KRA for 2021. Pre-tax inequality among working individuals assessed based on gross income, post-tax inequality applying 2021 PIT rates. See Section 5.1. for details on data processing and combination.

Table 3 displays the implications of data combination for the measurement of income inequality and the assessment of the role of PIT in reducing disparities. We see that both the Gini coefficient and top income shares are underestimated by each of the two data sources when considered separately – KCHS due to the "missing rich" problem common to household surveys (Lustig, 2019) and the administrative tax data due to the absence of the large informal sector – which implies the inclusion of too few individuals in the top percentiles when computing top income shares. These different sources of error lead to different biases when evaluating the impact of personal income taxes on inequality: while survey data generally underestimates the redistributive potential of personal income taxation, administrative tax data tends to overstate the impact on inequality measures like the Gini or the top 20% share, which are not focused on top earners, by ignoring the large share of population unaffected by changes in the PIT tax structure.

The PIT revenue gap

We also seize the potential of the combination of household survey and administrative tax data to quantify the PIT revenue gap G. This PIT revenue gap provides an estimate of the amount of tax revenue foregone due to non-compliance, assuming current tax rates and no behavioral reactions from improved enforcement.[7] In this case, we do not need to exploit the individual nature of tax data, since our estimates simply rely on carefully triangulating

[7] It is important to note that, if there are any real responses to higher income taxation, this revenue gap is an upper bound of the additional revenue that would be collected under perfect enforcement.

information from the survey with administrative data on total revenue and total number of tax filers.

We define potential revenue P as the tax revenue from PIT if all taxable workers were to pay the statutory tax rates, i.e. the one they should be paying according to income tax laws. If T is the actual tax revenue collected, as reflected in administrative records, we then define the PIT gap G as follows:

$$G = \frac{P - T}{P}$$

We take a microsimulation approach as in Dare et al. (2019). The main data source used for quantifying the revenue gap is household survey data, since administrative data is obviously not informative about incomes in the informal sector. With perfect data on the distribution of income, obtaining an estimate of G through microsimulation is a simple process. It suffices to apply statutory tax rates to all individuals in the survey to obtain P.[8] Then, G can be obtained from a straightforward calculation using $T = T_F + T_{NF}$ from administrative sources , where T_F denotes tax revenue from formal employment through the PAYE system and T_{NF} refers to PIT revenue from other sources, which mainly originates from self-employment. If information on the joint distribution of income and tax compliance or formality is available, then T_F can be recovered from ideal flawless household survey data as potential revenue from the formally employed P_F. When the survey contains data on types of employment, P can be disaggregated across sub-groups g of non-formal workers, such as the self-employed (*S*), informal employees (*I*) and family workers (*W*). We denote the potential revenue that could be obtained from individuals in group g under perfect compliance by P_g.

However, imperfections in available survey data pose certain challenges to this procedure. The first challenge is that the size of the formal sector is underestimated in KCHS 2021. While the survey estimates the number of Kenyan individuals paying taxes on their employment income at $\hat{\phi}$ = 1.77M, official figures data from KRA shows that income was reported for ϕ = 2.2 M individuals through the PAYE system in an average month in 2021,[9] of which

[8] This calculation abstracts from the differences in gross and taxable income since such detailed information is typically not available in household surveys, and also not in KCHS 2021.

[9] Our annual dataset includes a larger number of observations, but PAYE is not filed every month for every individual. We believe that the measure of formality in the survey, which measures employment over the last 7 days, corresponds rather to the monthly number of filers. Using the larger yearly number leads to a stronger correction of the survey's estimate of the size of the informal sector and hence to lower estimates of the revenue gap, see Table 4.

1.63 M reported incomes above the tax-exemption threshold.[10] This implies that the size of the informal sector, and hence the amount of foregone revenue, is overestimated in the survey (see row 7 in Table 4 below). To correct this, we define the following population correction factors:

$$\pi_F = \frac{(1-o_\pi)\Phi}{\widehat{\Phi}} \quad \pi_{NF} = 1 - \frac{(1-o_\pi)\widehat{\Phi}}{\widehat{\Pi} - \widehat{\Phi}},$$

where NF denotes any employment type other than formal workers and $\widehat{\Pi}$ is the size of the workforce as estimated in the household survey. This correction factor is derived analogously to Blanchet et al. (2022). While in their setup the criterion to decide how to combine tax or survey data is given by the level of income, the logic for determining this weight adjustment is nevertheless the same. o_π denotes the share of individuals older than 65 years old among those filing PAYE returns, and it is introduced to account for the fact that KCHS only provides the necessary information for individuals between 18 and 65 years old.

Second, the survey underestimates the amount of income tax revenue obtained from this formal sector P_F even after correcting for the underrepresentation of formal workers, which implies that high incomes in the formal sector are underestimated in KCHS 2021. Therefore, we use average monthly tax revenue as measured from administrative sources as a benchmark against which to compare potential additional revenue from the non-compliant as computed from the survey. The revenue gaps for informal workers and the self-employed, respectively denoted by G_I and G_S, are thus defined as follows:

$$G_I = \frac{P_I \pi_{NF}}{(1-o_T)T + (\sum_{g \neq F} P_g)\pi_{NF}}$$

$$G_S = \frac{P_S \pi_{NF} - T_{NF}(1-o_T)}{(1-o_T)T + (\sum_{g \neq F} P_g)\pi_{NF}},$$

where o_T is the share of PIT tax revenue collected from individuals older than 65 years. We can obtain the overall PIT revenue gap G by adding both gaps. Estimates are presented in the first row of Table 4. The baseline estimates in the first row show that the PIT revenue gap from informally employed workers is at 4.6% of potential revenue, while that of the self-employed is around 19%. When employers are added to the self-employed category, the PIT gap

[10] A substantial share of the individuals claiming to pay income tax in the household survey earn incomes below the tax-exemption threshold (see Figure 7). Therefore, we interpret that the number of individuals filing taxes is the appropriate benchmark, rather than those above the threshold.

increases by around 2 percentage points.[11] When adding family workers, estimates of the revenue gap would increase by 8 percentage points. However, these are excluded from the main calculation because it is unrealistic to expect tax authorities to be able to make tax retributions within households.

Our adjustment procedure takes some implicit assumptions on how the "missing formal workers" and the "missing PIT revenue" in KCHS are related to each other. First, the proportional population adjustment assumes that errors in the formality variable are distributed at random across the population, and orthogonally to income. In the diametrically opposed case, all "missing PIT revenue" would be attributed to errors in recording the formality of high earners and the revenue gap would virtually vanish. While this extreme case is not plausible, it is not unlikely that the likelihood of being misclassified as informal is positively correlated to income, which would lead to smaller estimates of the revenue gap than those presented below.

Table 4. PIT Gap (as a share over potential revenue P)

	Informal Employees P_I	Self-Employed P_S	All Taxable Workers $(P_I + P_S)$
Baseline Estimates	0.046	0.188	0.234
Employers as Self-Employed	0.052	0.205	0.257
ϕ measured yearly	0.045	0.181	0.226
Ignore non-PAYE PIT revenue T_{NF}	0.062	0.276	0.338
Common Income Model	0.049	0.185	0.234
Tax revenue P_F from KCHS '21	0.057	0.235	0.293
KCHS '21 (no pop. adj.)	0.068	0.302	0.371

Note: This Table presents estimates of the PIT revenue gap under various assumptions. Row 1 presents baseline estimates under the methodological choices to combine survey and tax data described in Section 5.2. Row 2 assumes that all employers in the survey are liable to pay PIT. Row 3 measures the size of the formal sector based on the number of PAYE taxfilers in a year rather than per average month. Row 4 takes PAYE revenue as total PIT revenue. Row 5 predicts income for missing observations based on the same income model for employees and non-employees (see Section 5.1). Row 6 estimates PAYE revenue from survey data instead of from administrative sources. Row 7

[11] The taxation of small business owners differs depending on the turnover from their businesses, so that only some of them would be expected to fulfill their obligations under PIT. Conversely, by assuming that all self-employed should file taxes under PIT, we interpret that anybody required to file taxes on income generated by business activities under a different regime would be classified as employer in KCHS.

is directly estimated from KCHS survey data and hence does not adjust for the underestimation of formality nor tax revenue in KCHS.

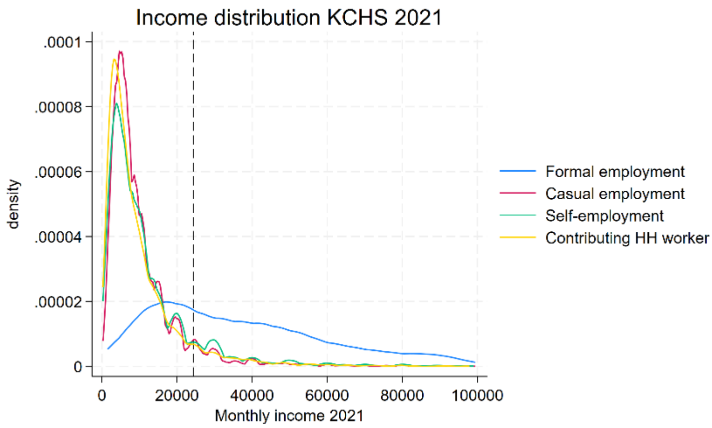
The second assumption, implicitly taken by using T from administrative sources without adjusting potential revenues from informal and self-employed workers is that the underreporting of incomes revealed by the gap between P_F and T_F affects only formal workers. One argument that supports this assumption is that household surveys are widely known to underestimate incomes at the top of the distribution (Lustig, 2019), where the share of formality is much higher, so that the missing revenue in the survey is likely to be due to underreported high incomes from individuals paying tax. Relaxing this assumption would lead to higher estimates of the revenue gap, bounded by the above by the case where P_F from the household survey is employed in the calculation instead of T (see row 6 in Table 4). We believe that the combination of our two baseline assumptions provides a reasonable estimate.

Kenya's limited tax base is often attributed to compliance issues. While a substantial revenue gap exists, a simple extrapolation from the large number of non-registered working individuals will vastly overestimate its value. Most informal workers earning low incomes are exempted from paying PIT not by lacking implementation, but by the progressive design of this tax (see Figure 8). The share of employees in informal employment or self-employment that would need to pay taxes is around 13%, as the large bulk of those groups is located well below the exemption threshold. Therefore, targeted efforts towards those in the shadow economy with sufficiently high incomes to be tax liable are much more likely to be cost-effective than broad registration initiatives harvesting large numbers of unproductive taxpayers (Mascagni et al., 2022; Moore, 2023). In fact, perfect enforcement would be an equalizing force, as the post-tax Gini coefficient in 2021 would have been further reduced (assuming no behavioural reactions) by 0.9%.

It is often argued that broad tax bases are essential for efficient tax systems, so that it might thus seem puzzling at first sight that the Kenyan implicit tax-exemption threshold is not set at lower levels. Yet, the comparatively high share of informal workers at low incomes in the tax base may lead to a high ratio of administrative costs to tax collection for the marginally included payers, thus reducing the overall efficiency of the tax system. Additionally, a smaller share of formal workers in the tax base will give rise to larger horizontal inequities de facto between the formally and informally employed low-income earners, which may in turn lower tax morale. Lastly, having a low exemption threshold risk eliciting a participation response moving workers from the formal to the informal sector, which could in turn have adverse long-run productivity effects. These arguments may explain why, as observed by

Jensen (2022), a large majority of countries place their income tax exemption threshold close to the value that maximizes the share of formal employment in the tax base, which in Africa lies at a relatively high point of the income distribution. In fact, Kenya already attempts to tax a large share of its population in comparison to most other EAC countries (see Figure A.1.2).

Figure 8: The formally employed in the income distribution



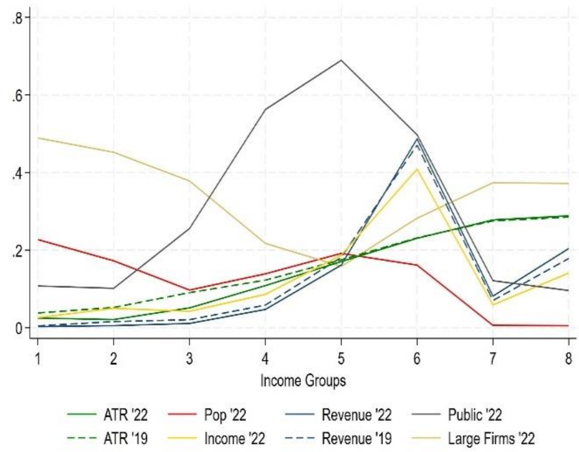
Source: Authors' own elaboration based on KCHS 2021 household survey data. Formal employment defined as employer filing income taxes on behalf of the employee

6. The broader picture: Personal income taxation in Kenya

In this section, we briefly show how our findings can be helpfully incorporated into the ex-ante assessment of possible reforms of the PIT tax schedule. We analyze alternatives by means of simulating their effects using administrative tax data for 2022. For each reform under consideration, we predict how the taxable income of each taxpayer would respond to a change in the tax rates for the bracket using relevant estimates on the ETI. We use our baseline estimates from Table 2 for individuals with incomes within or near the sample's income range. For higher-income individuals, we rely on estimates from the literature, while for those in intermediate income regions, we take an average of both sources. We then apply the reformed tax scheme to the resulting distribution of taxable income and compute aggregate tax revenue, the Gini coefficient of net incomes (a proxy for the tax schedule's impact on inequality and progressivity), and average gross income (a measure of efficiency). We compare this to the benchmark values that result from applying the 2022 PIT rates and bands and present the results as relative changes for ease of interpretation.[12]

Figure 9 provides an overview of how population, income and revenue are distributed across various income groups that are defined by how they have been affected by recent reforms. It stands out that both the most recent reform and the rate progression in the Kenyan PIT system have been focused on a segment of the income distribution that concentrates a large share of taxpayers, but account for a much lower share of income and tax revenue.

Figure 9. Reforms, taxpayers and income



Income Groups (nominal KShs.):

1. < 160k (exempt '19)
2. 160k – 288k (exempt '22)
3. 288k – 388k (Band 2 ´22)
4. 388k – 565k (top ´22, not ´19)
5. 565k – 1M (top ´19)
6. 1M – 6M
7. 6M – 9.6M (32.5% '23)
8. > 9.6M (35% ´23)

Source: Own elaboration using administrative tax data from KRA

When looking at Figure 9, an option that immediately comes to mind for raising revenues and reducing inequality is raising top MTRs. This is the path the Kenyan government followed in July 2023, when new MTRs of 32.5% and 35% were introduced for incomes beyond 6 and 9.6 Mn Kshs., respectively (see Table 1). In 2022, these rates would have affected the top 1.2% of taxpayers, who capture a disproportionate share of resources and generate a remarkable share of revenue.

Unsurprisingly, the impact of further increases depends heavily on the value of the ETI for the wealthy, around which there is considerable uncertainty. While low ETIs such as those we found above for lower income levels or some estimates in Jouste et al. (2023) leave ample space for revenue-enhancing and inequality-reducing tax hikes, Figure 10 (upper-left) shows that for higher

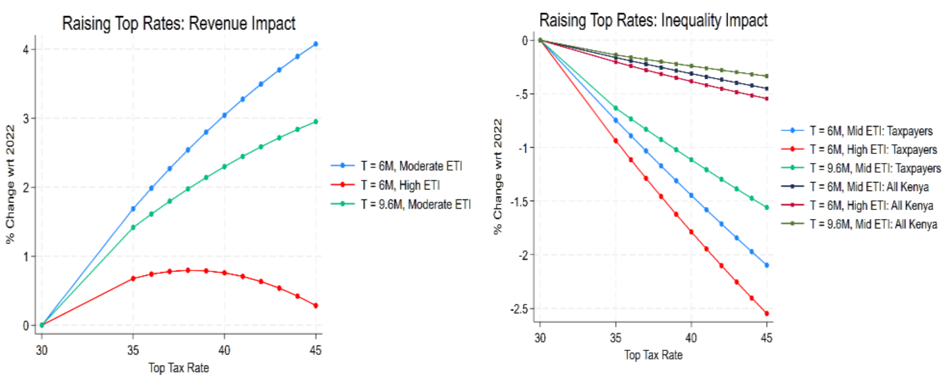
[12] For reference, a 1% increase in tax revenue represents additional Ksh 4.4 Bn, a 1% decrease in average taxpayer income implies a loss of Ksh 3,900 yearly, and a 1% decline in taxpayer inequality is around 0.57 Gini points – the effect of PIT in 2022 being a reduction by 4.7 Gini points.

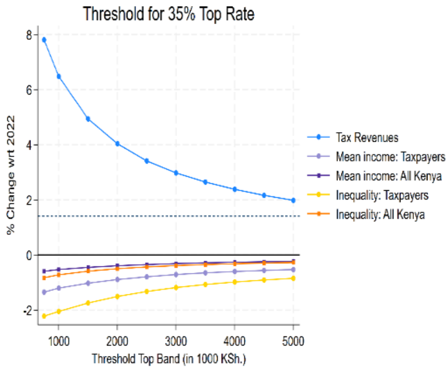
values of the elasticity, the current tax rate of 35% may not be far from the revenue-maximizing tax rates, so that large raises may lead to the right side of the Laffer curve. Such higher estimates close to or even above 1 are sometimes found in the literature (Neisser, 2021; Axelson et al. 2024; some specifications in Jouste et al., 2023), and it is plausible that the rich have more opportunities to engage in tax planning. The inequality reducing impact of higher top MTRs (upper-right panel in Figure 10) is much smaller when the full income distribution is taken into consideration.

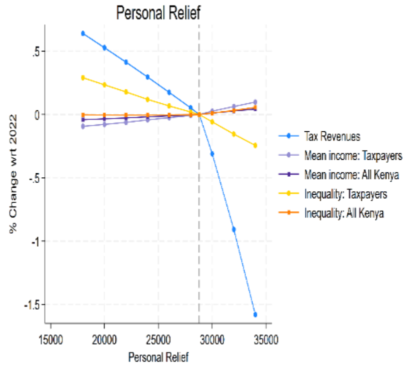
The limited progression of tax bands is a commonly criticized feature of the Kenyan PIT structure. In this line, Kenya's Medium Tax Revenue Strategy notes that Kenya's PIT structure is not sufficiently progressive since tax bands are not wide enough to cushion low-income earners (Republic of Kenya, 2023). We consider two ways to achieve a more gradual progression of tax rates within the large group of taxpayers currently facing MTRs of 25% or 30% – increasing tax rates for the richer among them and reducing them for the lower income earners in this group.

Figure 10 (bottom-left) shows the impact of the first option, modeled as a reduction of the threshold for the top MTR. Public employees, who have been seen reacting less swiftly to tax increases, represent a larger share of the taxpayers in these intermediate groups of the distribution (see Figure 9). Thus, we would expect moderate elasticities (except maybe closer to the upper incomes in this group, where possibilities for tax planning might resemble those of top income earners) and hence large revenue potential from this group. This change in tax rates would be inequality reducing.

Figure 10. Simulating tax reforms at different levels of distribution







Note: Estimates based on KRA data on PAYE and individual tax returns.

Changes are presented as a share of total 2022 PIT revenue. The figure reports relative changes with respect to the 2022 PIT structure. The upper subfigures model an increase of the top MTRs beyond 6M/9.6M Ksh. Under the moderate (high) ETI scenario, the elasticity is 0.475 (0.875) above 6M, 0.385 between 1M and 6M and 0.3 below 1M. The bottom left figure models the impact of lowering the threshold for the 35% top tax rate. The bottom right subfigure models the impact of modifying the amount of personal tax relief, with current levels indicated by the vertical dotted line. Each inequality estimates for post-tax income and mean income estimates for pre-tax gross income assume that 30% of behavioural responses are in form of non-compliance.

The effects are notably amplified for lower values of the threshold. It should be noted that, in the standard framework, raising marginal taxes at these income levels somewhat below the top, has the additional benefit of raising the average tax rate on the very rich without altering their marginal tax rate and hence inducing no behavioral reactions. This relies heavily on the standard assumption that individuals react to marginal rather than average tax rates, inherited from the modelling of labor supply decisions on the intensive margin. If responses at the top are primarily driven by tax avoidance and evasion, it is plausible that they are also influenced by average tax rates—for example, if tax planning decisions depend on a large fixed cost or the expected fine. In this case, these tax increases could create additional distortions at the top that are not captured by our estimates.

Table 5. Effects of tax cuts in bottom brackets

A) Revenue Effects (in % over total PIT revenue)

		Highest income with MTR = 25% (in 1000 KShs.)					
		438	488	538	588	688	864
Highest income with MTR = 20% (in 1000 KShs.)	338	-1.57	-2.19	-2.77	-3.27	-3.72	
	388	-2.36	-2.98	-3.55	-4.05	-4.50	
	438	-3.08	-3.71	-4.28	-4.78	-5.23	
	488		-4.35	-4.93	-5.43	-5.88	
	576						-8.51

B) Post-Tax Income Inequality Effects (in %)

		Highest income with MTR = 25% (in 1000 KShs.)					
		438	488	538	588	688	864
Highest income with MTR = 20% (in 1000 KShs.)	338	-0.13	-0.16	-0.17	-0.17	-0.16	
	388	-0.19	-0.22	-0.23	-0.23	-0.22	
	438	-0.23	-0.26	-0.27	-0.27	-0.26	
	488		-0.30	-0.31	-0.31	-0.30	
	576						-0.20

C) Average Pre-Tax Income (Change in %)

		Highest income with MTR = 25% (in 1000 KShs.)					
		438	488	538	588	688	864
Highest income with MTR = 20% (in 1000 KShs.)	338	0.06	0.11	0.14	0.18	0.22	
	388	0.09	0.14	0.17	0.21	0.25	
	438	0.12	0.17	0.20	0.24	0.28	
	488	0.21	0.21	0.24	0.29	0.32	
	576						0.53

Note: Estimates based on KRA data on PAYE and individual tax returns for 2022. Changes are computed with respect to the 2022 tax structure but are virtually equivalent when evaluated with respect to (simulated) 2023 PIT. Changes in inequality in Panel B reflect percentage changes in the post-tax Gini for taxpayers. Panel C reports changes in average incomes of taxpayers. Based on empirically estimated ETI of 0.3 (see Table 2), with 30% of behavioural responses assumed to be in form of non-compliance.

Alternatively, Table 5 shows the impact of lowering MTRs for the first effective taxpayers, which would imply revenue losses but increase pre-tax incomes for those individuals. Inequality among taxpayers, as measured by the Gini, is reduced by these tax cuts if they affect individuals earning below 550,000 Kshs. An alternative set of options combining both forms of progressivity enhancing reform can be found in Table A.1.2.

Finally, Figure 10 (bottom right) shows the effects of modifying the amount of personal relief. We find that effects on average income are indeed minimal, but at current tax rates, the revenue gains from reducing tax relief would be substantially smaller than those of previously considered measures. Revenue losses from raising personal relief increased more steeply due to the 25% MTR. While inequality impacts are minimal, it is remarkable that reducing personal relief may seem a regressive measure when considering only formal workers but becomes a progressive reform when taking into consideration the full income distribution.

Other considerations around the determination of the income tax concerning inflation adjustments and tax benefits are discussed in Appendix A.2.

7. Discussion

Our credible moderate elasticity estimates and detailed distributional analysis for the case of Kenya show some possibilities for enhancing the inequality-reducing impact of personal income taxes through modifications in the tax band structure. Depending on the preferences and needs of policymakers, these progressive reforms can take the form of economic stimulus measures in the form of tax cuts for the first effective taxpayers, or, alternatively, consist of revenue-enhancing tax raises on the top 15% of taxpayers.

This finding nuances the rather pessimistic outlook in Bachas, Jensen and Gadenne (2024) concerning the possibilities for enhancing the inequality-reducing effects of PIT in developing countries. As much of the recent literature that they review, these authors focus almost exclusively on the taxation of top income earners, finding very likely that they are rather elastic, possibly even enough to render tax increases counterproductive in terms of revenue collection. While efforts to reduce the avoidance and evasion possibilities of the very rich can certainly pay off, as suggested by certain encouraging experiences in East Africa (Kangave et al., 2016; Santoro et al., 2024) specifically focusing on the taxation of High Net Worth Individuals, our findings suggest that there might be some room for enhancing both revenue and the progressivity of income taxes through reforms in the PIT schedule that do not require massive improvements in compliance as implied by the standard recommendations of “taxing the ultra-rich” or “tackling informality”.

However, when taking a step back and focusing on revenue generation, it seems essential to reflect on the important role that public employees play in bringing about these results. A large share of taxpayers at intermediate ranges of income distribution work for the public sector. Thus, increased revenue from those income levels only partially reflects the fundamental principle of taxation, namely mobilizing resources from the private sector to fund public spending deemed necessary. The rest of the additional revenue collected should rather be interpreted as a reallocation of resources from some public employees to other forms of public expenditure. Should policymakers really wish to undertake such a reallocation, then public sector wage containment policies could in principle achieve this more efficiently, without introducing tax distortions in the private sector.[13] While tax raises heavily affecting public workers might be a viable short-term solution to meet urgent needs for additional revenue or in presence of institutional or political constraints to public wage determination, it seems obvious that this is not a sensible domestic revenue mobilization strategy in the long-term.

Public sector workers also lead to moderate aggregate elasticity even though the elasticity for private workers is relatively high. A priority for future research should lie in understanding whether these responses in the private sector correspond to ‘real’ labor supply responses or rather to changes in compliance. The implications for economic policy would be radically different (Chetty, 2009), especially if non-compliance with tax authorities is not associated with other forms of informality detrimental for productivity and human capital accumulation. This is also important to assess the impact of PIT reforms on inequality, which is overstated when looking at reported incomes if large part of taxpayers’ reactions is explained by tax avoidance.

Pressures to increase revenues and static comparisons with higher income countries might create a sense of urgency to set ambitious goals for revenue mobilization, such as the target of reaching overall tax revenue at 25% set by the East African Community. However, both the cross-country (Figure 3) and historical evidence[14] (Besley and Persson, 2014; Jensen, 2022) remind us that

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[13] An advantage of tax increases is that they are rank-preserving between public and (compliant) private employees, a relevant concern in case that status concerns or making public jobs appealing with respect to private jobs to attract high-skill workers are amongf the reasons for the determination of public wages.

[14] Besley and Persson (2014) show that the tax revenue share in higher income countries only peaked up after First World War, when higher income levels substantially higher of those enjoyed by Sub-Saharan countries like Kenya today

a substantial expansion of PIT simply requires a larger, formally employed middle class that can sustain large tax rates that raise and redistribute income at large. This will only come along with economic growth. While our insights rely on an exhaustive static analysis of the Kenyan income distribution and tax structure, it is thus essential to keep in mind the dynamic implications of taxation when taking decisions about the PIT structure.

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9. APPENDICES

Appendix A.1. Additional tables and figures

Table A.1.1.: Personal Income Tax Brackets and applicable tax rates

Country	Annual Taxable Income (Ksh)	Rate	Country	Annual Taxable Income (Ksh)	Rate
Kenya GDP p.c: 2099 US$ PIT/GDP: 4.1%	First 288,000 Next 100,000 Next 5,612,000 Next 3,600,000 Over 9,600,000	10% 25% 30% 32.5% 35%	South Africa GDP p.c: 6777 US$ PIT/GDP: 8.9%	First 1,975,833 Next 1,111,667 Next 1,185,833 Next 1,335,000 Next 1,540,833 Next 7,992,500 Over 15,141,667	18% 26% 31% 36% 39% 41% 45%
Rwanda GDP p.c: 966 US$ PIT/GDP: 3.7%	First 88,889 Next 59,259 Next 148,148 Over 296,296	0% 10% 20% 30%	Seychelles GDP p.c: 15875 US$ PIT/GDP: 4.5%	First 1,140,733 Next 192,600 Next 9,777,733 Over 11,111,067	0% 15% 20% 30%
Uganda GDP p.c: 964 US$ PIT/GDP: 2.9%	First 113,435 Next 48,270 Next 36,203 Next 4,629,123 Over 4,827,031	0% 10% 20% 30% 40%	Namibia GDP p.c: 4911 US$ PIT/GDP: 7.8%	First 416,667 Next 416,667 Next 1,666,667 Next 1,666,667 Next 2,500,000 Next 5,833,333 Over 12,500,000	0% 18% 25% 28% 30% 32% 37%
Tunisia GDP p.c: 3777 US$ PIT/GDP: 6.4%	First 250,000 Next 750,000 Next 500,000 Next 1,000,000 Over 2,500,000	0% 26% 28% 32% 35%	Morocco GDP p.c: 3528 US$ PIT/GDP: 3.7%	First 428,571 Next 285,714 Next 142,857 Next 285,714 Next 1,428,571 Over 2,571,429	0% 10% 20% 30% 34% 38%

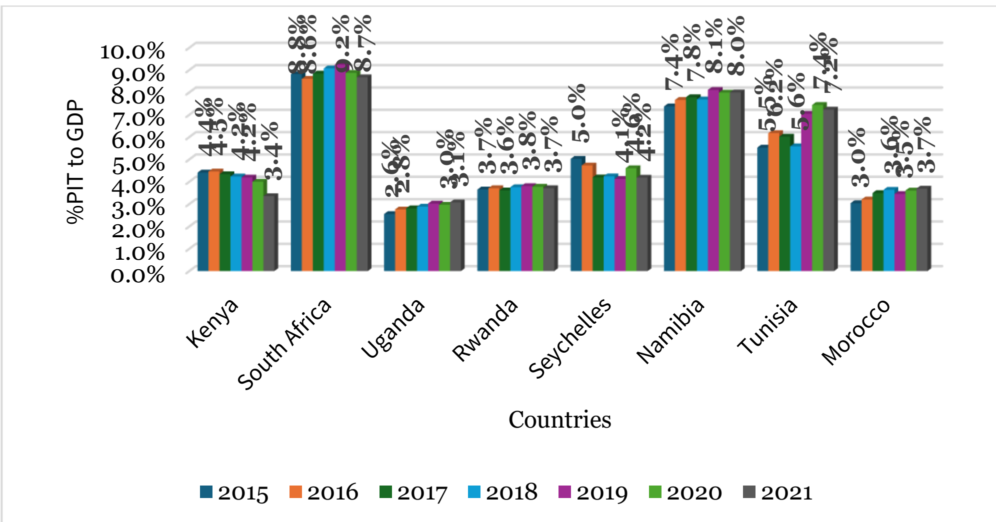
Source: Compilation by the authors. PIT to GDP data from OECD. Conversion from local currencies to Ksh. using market exchange rates.

Table A.1.2.: Combined PIT reforms to increase progressivity. Revenue implications

	Rate between T and KShs. 9.6M			
	32.50%		35%	
Reforms	Rev. Change at T = 1M	Rev. neutral T	Rev. Change at T = 1M	Rev. neutral T
288k - 425k: MTR = 22.5%	0.82%	1.55 M	3.40%	2.93 M
425k - 600k: MTR = 27.5%	0.93%	1.65 M	3.50%	3.08 M
Both reforms	-0.14%	950,000	2.43%	2M

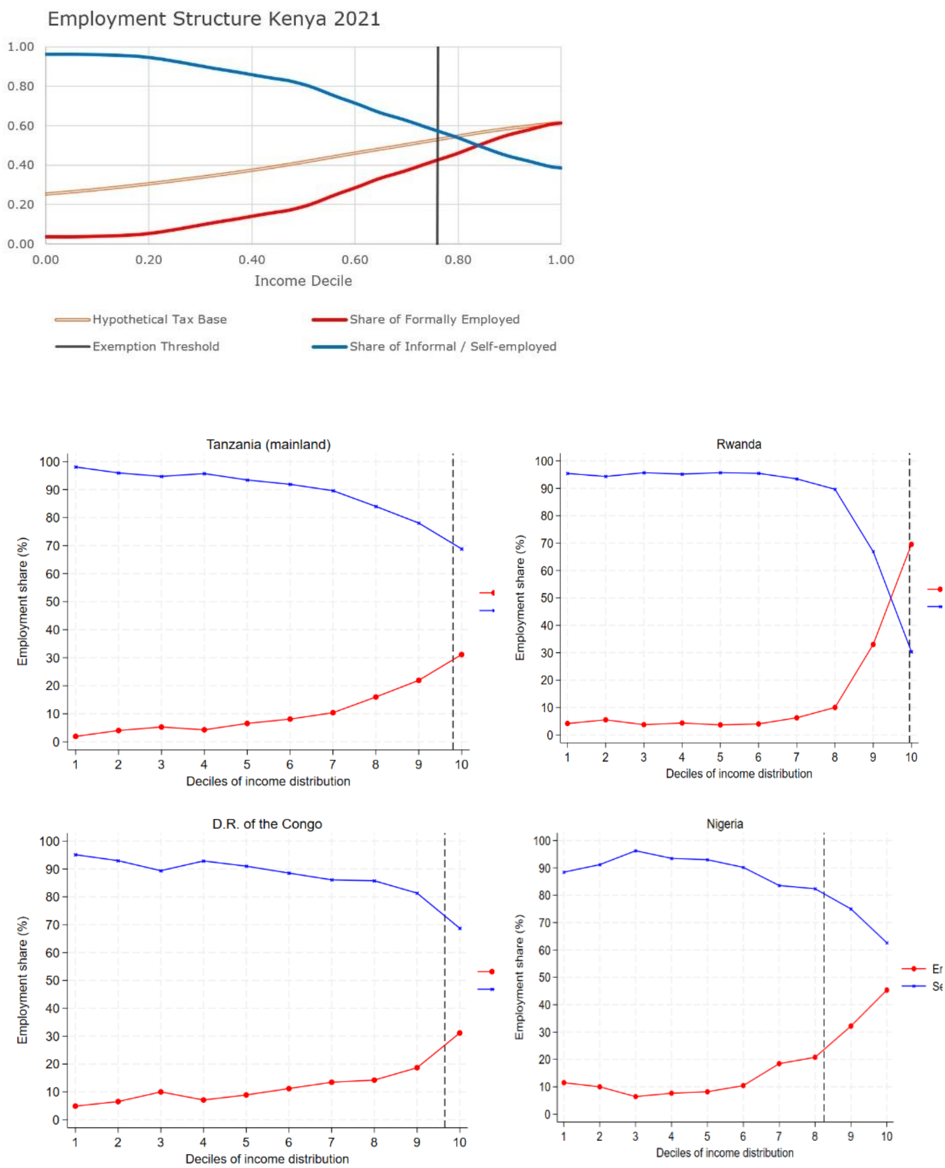
Note: Revenue increases (as a percentage of total PIT revenue) and revenue-neutral T shown with respect to projections for 2022 data under the 2023 PIT schedule, based on an income elasticity to net of tax rates of 0.475 for top incomes. To approximate revenue changes wrt 2022, add the effect of the 2023 reforms (≈1.45%)

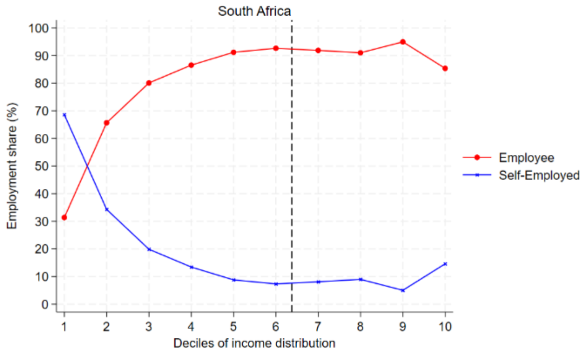
Figure A.1.1: PIT to GDP Ratios across Africa

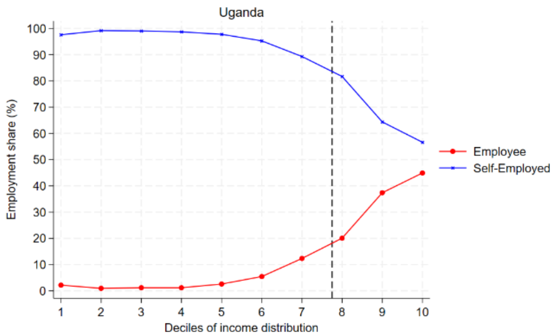


Source: OECD data

Figure A.1.2 Employment structure and tax exemption thresholds across Africa







Note: We thank Magnus Eldrup for providing this figure. The figure shows the placement of the tax exemption threshold in the income distribution. Formal employees are those with a written contract or paying taxes. The "hypothetical tax base" is the share of formal employees above that point of the distribution. The figure for Kenya relies on KCHS 2021 data. For all other countries we use the replication package and database of Jensen (2022).

Appendix A.2 Inflation adjustment and tax benefits

Inflation increases the tax bill of citizens with the same purchasing power and hence reduces the real value of their take-home pay. Bracket creep occurs when inflation pushes taxpayers into higher tax brackets without any corresponding increase in their real earnings. Tax indexation, on the other hand, involves adjusting tax brackets and other tax parameters to accommodate changes in the cost of living caused by inflation. Indexes may include prevailing statutory minimum wages, and yearly average earnings of the contributors. This approach is designed to be transparent and easy to comprehend for both taxpayers and the government.

It may thus seem surprising that, according to Beer et al. (2023), only 9 of 160 countries explicit an adjustment process, and over 80% of countries do not adjust thresholds regularly. An advantage for tax authorities of avoiding adjustments is that inflation represents an automatic, hidden tax increase that will not perfectly align with the policymaker's priorities but is much less salient than explicitly lowering tax brackets or raising tax rates, minimizing not only political costs but also behavioral reactions to higher taxes. Under the assumption of no behavioral reactions (or 0 elasticity), we quantify the real revenue increase from 7.7% inflation in 2023 to 1.7%, with negligible effects on inequality. These effects compound quickly to 8.3%, after 5 years leading to a substantial erosion of households' real disposable income. Therefore, if they are not tying their hands to automatic indexing, policymakers should at least commit to updating brackets for inflation every few years.

Tax benefits serve various purposes. Pension contributions aim to reduce post-retirement poverty, while meal benefits enhance employee satisfaction levels and productivity. Non-cash benefits are designed for employers to compensate employees for the use of their personal devices or other resources, such as data or airtime, or for work-related expenses. Reliefs encourage home ownership, the uptake of insurance policies for education or life, and reduce the tax burden. Exemptions, on the other hand, ensure higher take-home income to cater to the special needs of individuals living with disabilities.

Extending these benefits entails the government forgoing the amount of the benefit that would otherwise be considered taxable income, leading to an increase in tax expenditure. In 2022, the tax expenditure related to personal income tax was estimated to be Kshs. 5.2 billion (RoK, 2023b), based on averages, but we find that revenue losses from benefits excluding personal and insurance relief are above twice that figure, based on the analysis of individual tax records that allow us to observe the distribution of benefits across taxpayers. Such benefits seem as well to have a slight inequalizing impact.

Table A.2.1 includes a detailed overview of the various benefits studied. A particularly popular benefit is tax-free pension contributions, as the total membership covered by pension schemes has shown a notable increase, rising from 1.7 M members in 2011 to 7.1 M in 2021 (RBA, 2021). It is crucial to acknowledge that the value of these benefits naturally erode over time due to inflation, necessitating adjustments to maintain their real value. However, some of them benefits have not been reviewed for up to 18 years,. On the other hand, benefits extended to persons with disabilities are already substantial and account for 3.83 times more than the other tax expenditure on PIT combined (RoK, 2023b) and might hence not need review.

Table A.2.1 Allowable benefits while computing PIT

Allowable Benefits while computing PIT.	**Amount Allowable in Kshs. per year**	**Year last reviewed**	**Intended Purpose**
Pension contribution	20,000.00	2005	Reduce post –retirement poverty
Meal Benefits	48,000.00	2006	Productivity of staff
Non-cash benefits	36,000.00	2004	Compensation for the use of personal resources for business purposes
Reliefs :			
Personal	28,800.00	2020	Reduce tax burden
Post-retirement medical fund	15% of premium to a maximum of 60,000	2024	Encourage savings for post-retirement medical scheeme
Insurance	15% of premium to a maximum of 60,000	2002	Cushion families in case of loss of the bread winner Encourage take up of insurance products
Mortgage	amount of interest not exceeding 300,000.00		Encourage home ownership
Exemptions income for Persons with Disability	1,800,000.00	2011	Increase the disposable income of Persons with Disability
Deductions for Medi and other care for Persons With Disability	600,000.00	2011	Ensure necessary costs of a Persons with Disability are taken care of

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