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Taxpayer response to greater progressivity

Evidence from personal income tax reform in Uganda

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Abstract: We evaluate a major personal income tax reform in Uganda that came into effect in 2012–13, contributing to the scarce literature on the effects of personal income tax reform on employees' income in a low-income country in Africa. The reform increased the tax-free lower threshold, increased tax rates for higher incomes, and introduced an additional highest tax band for top 1% of income earners. Using the universe of pay-as-you-earn (PAYE) administrative data from the Uganda Tax Authority, we analyse the impact of the reform on reported labour incomes. In the preferred specification, we find very limited support for behavioural reactions. However, heterogeneity analysis reveals that top-income workers in firms handled by ordinary (as opposed to medium or large taxpayer) offices report lower incomes after the reform. We also find suggestive evidence that part of the response may arise from income shifting. The reform managed to raise more revenue and it also led to a limited reduction in after-tax income inequality.

Key words: personal income tax, Uganda, administrative data, tax reform

JEL classification: C31, H24, O23

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1   Introduction

While developing countries have strived to raise their tax take, the revenue raised by the personal income tax is still very low (Figure 1). In low-income economies, revenues from the personal income tax have only amounted to approximately 2.5 per cent of GDP in recent years. One reason is, of course, the widespread informality in these countries, but the personal income tax rates in developing countries are also low in comparison to OECD countries (see Figure 2 which offers a comparison of tax rates in Africa versus those in the OECD).

At the same time, incomes are very unequally distributed in lower-income sub-Saharan African countries. Bargain et al. (2021) calculate Gini indices for five different countries[1] in Africa and find that the market income Gini is on average close to 80, and the reduction in the Gini due to tax and transfer policies is only 0.2, implying that the disposable income Gini is almost as high as that of market incomes.

Figure 1: Tax revenues in low- and lower-middle income countries (% of GDP)
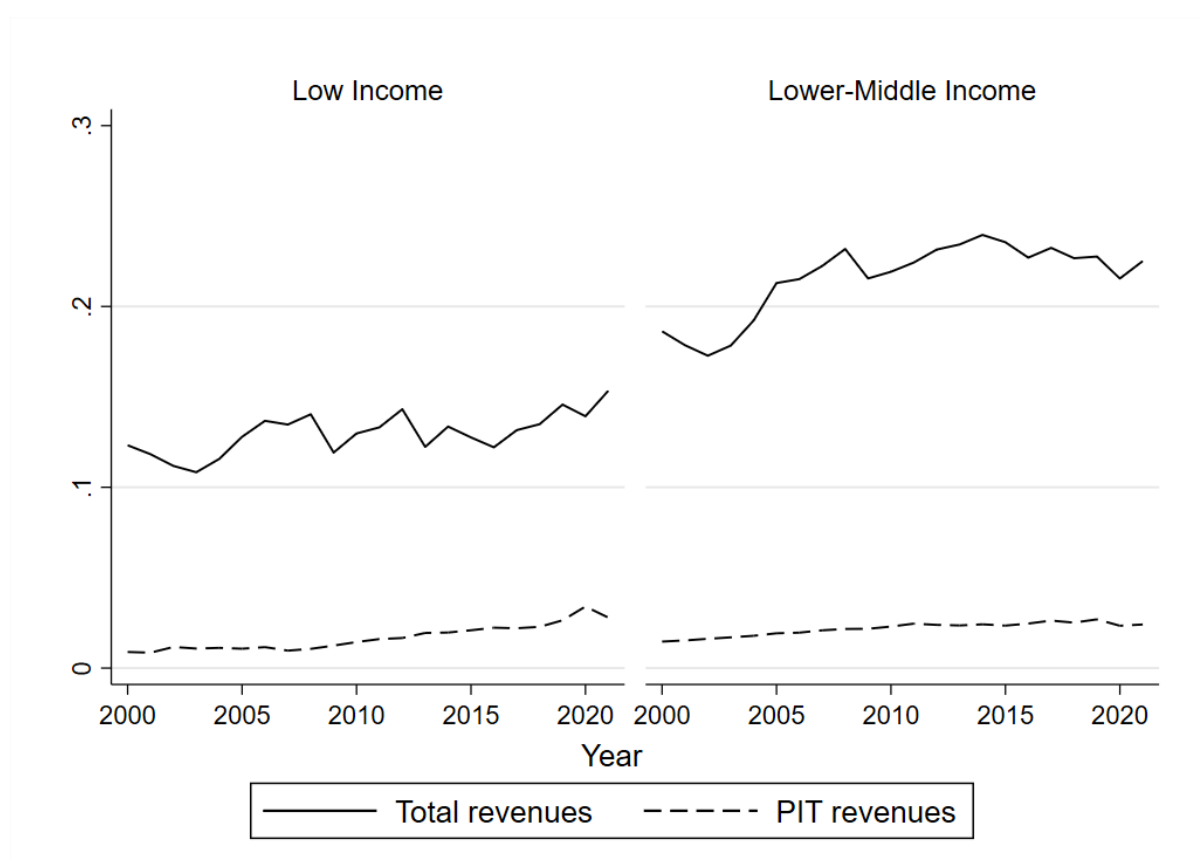
Source: authors' illustration based on UNU-WIDER Government Revenue Dataset (UNU-WIDER 2022).

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[1] Ethiopia, Ghana, Mozambique, Tanzania, and Zambia.

Figure 2: Tax rates for personal income tax in Africa and the OECD countries with and without mandatory social security contributions (SSC)

Figure 2 Top marginal PIT and employee SSC rates, 2000–2019, African and OECD countries

Sources: EITD (forthcoming) and OECD (2021)

Source: Figure 2 in McNabb and Granger (2022: 14), reproduced under the Creative Commons license CC BY-NC-ND 4.0.

This raises the question whether the tax rates on personal income tax could and should be raised, especially at the top, to alleviate inequalities and to help in revenue raising. In public economics theory, the Mirrlees (1971) optimal tax framework suggests that one needs reliable information on the tax response of reported incomes among the affected taxpayers to m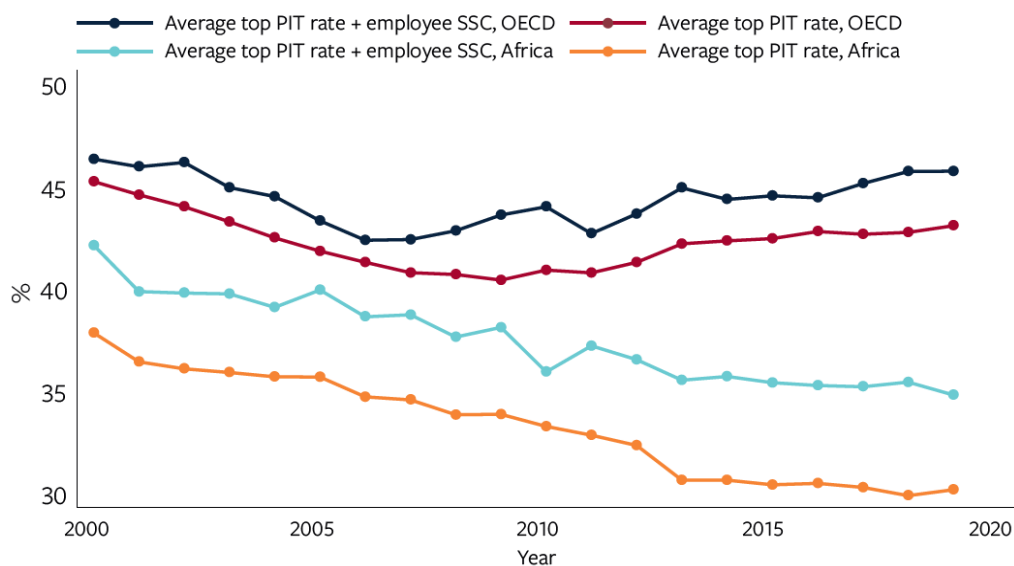ake informed decisions on setting the top tax rate (Brewer et al. 2010). This elasticity of taxable income is, therefore, one of the sufficient statistics for well-planned redistributive tax policy.

There is, of course, a vast empirical literature on elasticity of taxable incomes, which has been surveyed by Saez et al. (2012) and Neisser (2021). However, almost all of this work is based on data from developed economies. Because of differences in the administrative capacity to enforce taxation, differences in the economic structure and the large extent of informality,[2] the responsiveness of reported incomes to changes in tax rates may be very different in developing economies. Especially—and we review the literature below—there is almost no evidence on tax responsiveness for low-income economies.

Our paper aims to fill this gap by providing evidence on the response of reported taxable employment income[3] to a personal income tax reform in Uganda. The reform, which took effect in 2012, lowered the tax rates on low to middle incomes by pushing the tax bracket threshold values up. In order to recoup the revenue loss, the government also increased the highest marginal

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[2] In Uganda, 91.7% of employment was informal in all sectors in 2012 (International Labour Organization 2023). The informality is higher for agriculture than for non-agriculture (96% vs 83.2%).

[3] Taxable income in Uganda's pay-as-you-earn (PAYE) records is roughly comparable to broad income in the elasticity of taxable income literature. Employees' taxable income consists of basic salary plus e.g., allowances and bonuses paid by the employer minus applicable deductions. In Uganda there is only one deduction, the local service tax, which has not changed since 2008.

tax rate from 30 to 40 per cent. This tax increase affected the top 1 per cent of income earners. We examine the responses of taxpayers along the entire distribution of incomes, utilizing the fact that upper-middle-income groups' marginal tax rate did not change, and hence these taxpayers are used as a control group. However, our main focus is on the top taxpayers, who face the large salient increase in their tax treatment. Employed with the universe of administrative pay-as-you-earn (PAYE) tax data from Uganda Revenue Authority, we estimate the responses to the reform using a difference-in-differences estimations strategy. When exploring the anatomy of the behavioural response we further match the PAYE data to tax records of corporate firms, allowing us to analyse how sales, dividends and other firm-level outcomes vary at the employer level. We further compare revenue outcomes simulating pre-reform and post-reform revenues to pin down the overall consequences of the reform on tax revenue from PAYE, and how much behavioural responses contributed to it.

We estimate these responses using a simple, and transparent, repeated cross-section approach. Saez et al. (2012) note that a panel approach, often used in the elasticity of taxable income work, is ill suited for a setting such as ours, where a single tax reform affects a particular group of taxpayers. This is because the panel approach will suffer from mean reversion (some individuals having high incomes before the reform temporarily and reverting to lower income levels in after-reform periods), leading to a spurious correlation between tax rate changes and income changes. Another concern is that income trends may differ for different income groups irrespective of tax changes. Therefore, they conclude that the benefits of the panel approach have been exaggerated in the literature. The repeated cross-section approach, in turn, may suffer from changes in group composition: the individuals in the treated group may differ in characteristics across time, leading to changes in their income-earning processes. Since poor countries, such as Uganda, do not necessarily have individual identifiers for all taxpayers, the full panel approach would not even be feasible for us. What we do is to follow the repeated cross-section approach suggested in Saez et al. (2012) and limit the analysis in our main approach to individuals in a balanced panel of employers. This implies that there have been no compositional changes arising from the industry and region people work for. We admit having access to employee panels would be a useful alternative approach, but we would also argue that the main approach would have to be the repeated cross-section one, and obtaining evidence on the basis of this approach is valuable.[4] We also examine the sensitivity of the results for choosing the control group and illustrate how the results are affected by working with a relatively broad (next 9 per cent of income earners) versus narrow (next 4 per cent of income earners).

Our results indicate that the reported incomes of the top 1 per cent group of taxpayers, who faced a ten-percentage point increase in the marginal tax rate, declined substantially after the reform. While this reduction is statistically significant and quantitatively large when using the broad comparison group, its size and significance drops in our preferred specification, which uses the rest of the top 5 per cent (the next 4 per cent) as the control group. This implies that there is only weak evidence that the top incomes would have declined as a consequence of the reform. The reason is that at the same time than the reform, there was a contemporaneous reduction in income differences among top earners, which also affected the control group (next 4 per cent) relative to those below them. A caveat to the insignificant response is that the response appears to be greater three years after the reform in comparison to immediate reaction one year after. There is very limited evidence that the incomes of any of the other income groups, which faced a reduction in their marginal or average tax burden, would have reacted to the reform.

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[4] The new approach in Jakobsen and Søgaard (2022) would in principle be used to validate whether the assumptions required for the panel estimator hold, but its use would require longer pre-period data than we have.

However, when examining heterogeneous responses, we find that top-income employees working for firms which are not handled by the large- or medium-taxpayer offices, report lower incomes after the reform. We dig deeper into the potential mechanisms and find that firms where the earned income for the top-income earners dropped the most also increased their dividend payments more than other firms of similar size. While not causal, this finding could indicate that a part of the income reduction among the top earners stemmed from income shifting between earner income and capital income. We also gauge the revenue and inequality impacts of the reform. The revenue impacts were clearly positive, and they would remain so with plausible behavioural reactions among the top earners. The reform also led to a mild reduction in after-tax income inequality.

Our work contributes in several ways to the literature. To our knowledge this is one of the first studies to evaluate the effects of personal income tax reform on employee income in a low-income country in Africa, using the universe of thoroughly cleaned and checked administrative data on employees in the formal sector. Recent years have witnessed a rapid increase in tax studies that utilize administrative data from developing countries (for a recent survey, see Pomeranz and Vila-Belda 2019) due to increasing data availability. Yet most of this literature up to date examines tax policies influencing firm decisions. Studies examining the taxation of individuals in low- and middle-income countries are not common.

One of the first studies to examine personal income taxation in a low-income country is Kleven and Waseem (2013), using administrative data from Pakistan, a lower-middle income country. The authors analyse the elasticity of taxable income for wage earners and the self-employed, detecting substantial bunching at notch points. Several other papers use personal income tax records in the setting of upper-middle-income countries, but with a different focus of analysis. Kemp (2019) uses the bracket creep approach in the South African context, and his preferred elasticity is approximately 0.3. For Ecuador, Bohne and Nimczik (2018) illustrate how taxpayers learn to optimize taxes when entering the formal economy; and Lopez-Luzuriaga (2021) analyses how reporting requirements may weaken tax compliance. Tortarolo et al. (2020) in turn examine intertemporal labour supply elasticity using Argentinian administrative data.

We further contribute to the literature by exploring how taxpayer behaviour differs along different margins of response. Our analysis shows that basic salaries react less than the combination of deductions and other incomes such as bonuses. This finding for top wage earners in the setting of a low-income country such as Uganda relates to the work by Lopez-Luzuriaga (2021) on the use of deductions in a middle-income country, Ecuador, and equally to Bergolo et al. (2021) who show that taxpayers in Uruguay, a high-income country, use deductions more intensively at kink points.

Finally, since arguably the most interesting aspect of the reform was the sizeable increase in the top marginal tax rate, our work speaks to the feasibility of increasing income tax progressivity in a low-income economy. Our analysis shows that in the case of Uganda, the reform's stated intention to alleviate the burden on the bottom of the formal wage distribution without loss of revenue, seems to have been successfully delivered, even when taking into account the behavioural response by top taxpayers that our analysis identified. The reform also led to a reduction in after-tax income dispersion, albeit at a moderate scale.

The paper is structured as follows. Section 2 explains the institutional background of income tax in Uganda. In Section 3 we describe the empirical approach. Section 4 turns to the data and descriptive evidence. Section 5 presents the regression results and robustness checks and explores potential other channels of behavioural response. Section 6 discusses the revenue and inequality implications of the reform. Section 7 concludes.

2 Institutional background

Since the 2010s, Uganda has consistently increased its tax take, and the share of revenues from personal income tax rose from approximately 23 per cent in 2010 to about 25 per cent in 2018 (see Figures 3 and 4). The contribution of PAYE alone was UGX2.4 trillion[5] of total tax revenue collected, constituting about 16.6 per cent of total tax revenue in the 2017–18 fiscal year. For comparison, the value-added tax contributed similarly to gross revenues at 15.1 per cent; corporate and withholding taxes, the other main contributors to direct taxes, constituted 6.9 per cent and 5.0 per cent, respectively. Overall, domestic tax (direct and indirect taxes) makes up 55.3 per cent of revenues, with taxes on international trade contributing the rest (URA 2018; Waiswa et al. 2020).

Figure 3: Total tax revenue as a share of GDP
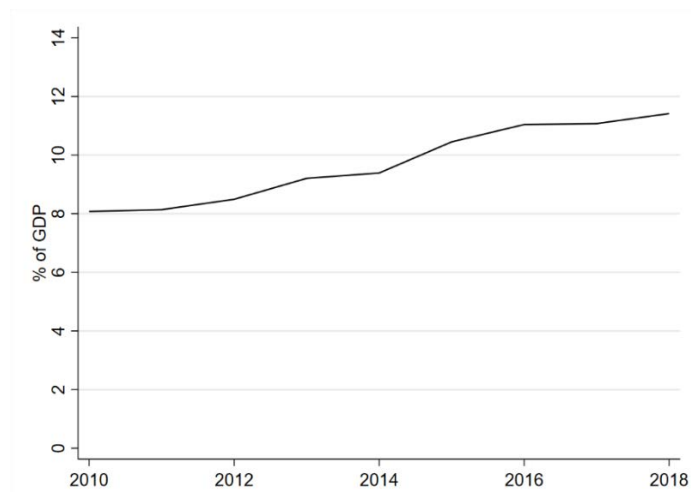
Source: authors' visualization based on data from UNU-WIDER (2022).

Figure 4: Contribution of different tax instruments: share of total tax revenue
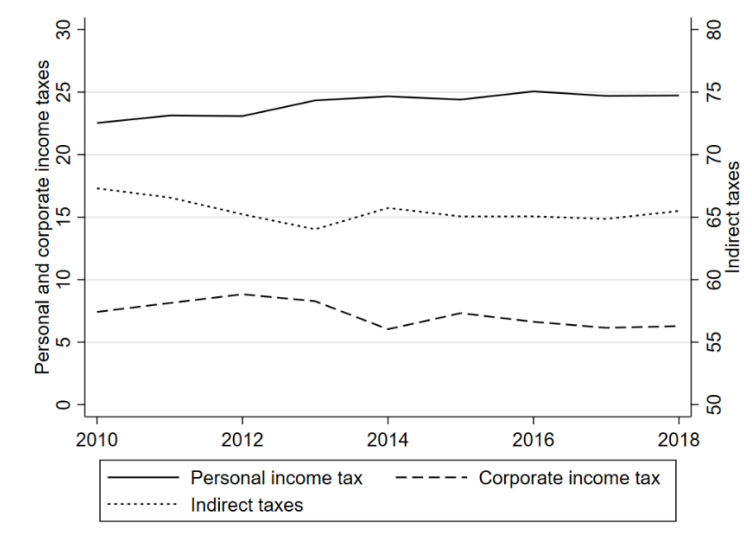
Source: authors' visualization based on data from OECD (2020).

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[5] In 2023, US$1 = UGX3,700.

2.1 Taxation of individual income in Uganda

The design of individual income taxation in Uganda is largely similar to other countries. By law it is the duty of every Ugandan who earns income to pay an annual tax on his or her income for each year, and the fiscal year runs from 1 July to 30 June. Income tax is defined as a tax charged on the income of any person who has taxable income for each year of income.[6] The term 'income' includes any gains, profits, interest, and dividends, and also any non-monetary benefit, advantage, or facility obtained by a person through employment. The Income Tax Act defines a 'person' to include an individual, partnership, trust, company, retirement fund, government, political subdivision of a government, or institution. Each of these persons may be assessed for income tax if he, she, or it earns taxable income. Uganda Revenue Authority, URA, is responsible for the enforcement and implementation of the income tax.

PAYE is a form of individual tax charged on employment income[7] in the scope of income taxation. PAYE is deducted from employees' salaries before the last payment for the period (normally a month) is made by the employer to the employee. PAYE is therefore a source (withholding) tax, because the tax is collected before it reaches the employee. The employer remits the total tax deducted directly to URA, accounting to the employee how much tax has actually been paid to government.

Individual income tax is also levied on income earned by individuals such as 'sole traders' or self-employed in business, but we focus our analysis on salaried workers. While the response of the self-employed to tax reform is an equally important topic of study, the self-employed generate a negligible share of tax revenue in the Ugandan case, and we found only a too small number of observations in the top tax band, the main focus of this study.[8]

Individual income tax is not limited to employment and business income. It includes all income earned by an individual from all sources, except that income which is assessable separately.[9] Individual income tax rates furthermore differ between resident and non-resident taxpayers. Anyone residing for less than a period of 183 days of a year in Uganda is considered a non-resident and is subject to the higher, non-resident tax schedule. If an employee holds a second job, one employer withholds PAYE at the normal progressive individual income tax schedule, and the other employer withholds a flat rate 30 per cent of earnings. Non-resident taxpayers and flat-rate incomes are dropped from the analysis, since these taxpayers represent only around 2 per cent of taxpayers. Also, the flat-rate payers tax treatment remained the same over the reform.

Tax collection underwent a major reform with the adoption of an electronic filing system for PAYE (e-tax system) that substantially simplified the filing procedure. Before the roll-out of the e-tax system starting in September 2009, there was a highly manual tax assessment and payment process in place. The e-tax system automated the registration, filing, payment, and further

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[6] Income Tax Act, Cap 340 of the Laws of Uganda 2000, Section 5(1).

[7] Employment income includes wages, salary, leave pay, payment in lieu of leave, overtime pay, fees, commission, gratuities, bonuses, and allowances (entertainment, duty, utility, welfare, housing, medical, or any other allowance) (Income Tax Act, of 1 July 1997, Cap 340 of the Laws of Uganda 2000, Section 19(1)).

[8] Specifically, the share of all individual income tax revenue generated by the self-employed is just 1.2 per cent on average during our period of analysis, with PAYE revenue generating all other revenue. Furthermore, there is only around 50 self-employed individuals facing the top tax rate, and identification of a stable parallel pre-trend is challenging.

[9] See Part I of Schedule 3 of the Income Tax Act (of 1 July 1997, Cap 340 of the Laws of Uganda 2000) on how the assessment is done.

processing with the aim of easing transactions so as to ultimately enhance revenue collection, among other goals. The e-tax system was fully operating in all tax offices across Uganda from February 2012 onwards.

In general, all employers have been required to obtain tax identification numbers (TINs) since the introduction of the e-tax system (although this also pre-dated e-tax). While all employees should also have TINs, in practice, however, employers are currently not required to report TINs for all their employees, and employers cannot force their employees to acquire a TIN. Employers are therefore not held to report all employees' TINs by URA, to avoid them not reporting PAYE at all for employees without TINs.

Apart from income tax, any employed or self-employed Ugandan is subject to the local service tax (LST), which is levied on wealth and income. Whether one is held to pay the LST, and the amount of LST ultimately levied, depends on the type of (self-)employment and income earned (for an overview and recent reforms to the LST, see Waiswa et al. 2020). For employees, the LST on wages is also deducted by the employer, and the LST is a tax-deductible payment for employees. The rates of the LST have been unchanged since 2008.

2.2   The income tax reform of 2012

With the fiscal year 2012–13, a major income tax reform came into effect. The government's stated motivation for the reform was to take into account inflationary effects. The tax schedule had been the same for over ten years, and due to bracket creep an increasing number of low-income earners, such as teachers, had become subject to tax. To counteract the significant revenue loss such reform would obviously entail, the government decided to generate additional revenue by increasing taxes on high incomes.

Table 1: Individual income taxation in Uganda since fiscal year 1997–98

	Monthly taxable income	Tax rate
Pre-reform: 1997–98 to 2011–12	Not exceeding 130,000	0%
	Over 130,000, but not exceeding 235,000	10% of the amount exceeding 130,000
	Over 235,000, but not exceeding 410,000	10,500 plus 20% of the amount exceeding 235,000
	Over 410,000	45,500 plus 30% of the amount exceeding 410,000
Post-reform: 2012–13 and onwards	Not exceeding 235,000	0%
	Over 235,000, but not exceeding 335,000	10% of the amount exceeding 235,000
	Over 335,000, but not exceeding 410,000	10,000 plus 20% of the amount exceeding 335,000
	Over 410,000, but not exceeding 10,000,000	25,000 plus 30% of the amount exceeding 410,000
	Over 10,000,000	2,902,000 plus 40% of the amount exceeding 10,000,000

Note: all monetary values are in UGX.

Source: author's compilation based on the Income Tax Act.

The reform consisted of two major changes. First, the whole tax schedule was shifted to the right. That is, the threshold of the tax-free lowest band increased from UGX130,000 (or US$57) per month to UGX235,000 per month, thus pushing it up by nearly 80 per cent. The third tax bracket, ranging initially from UGX235,00 to UGX410,000, was split into two tax brackets taxed at 10 per cent and 20 per cent, respectively. Second, the reform introduced an additional top tax bracket

with a marginal tax rate of 40 per cent for incomes exceeding UGX10,000,000 per month. Until then the top marginal tax rate had been 30 per cent.[10]

Table 1 and Figure 5 illustrate the PAYE rates applicable to resident individuals before and after the reform. In terms of changes to average and marginal tax rates, the reform reduced marginal and average tax rates for low- to middle-income taxpayers, and it increased the marginal and average tax rates for those in the newly introduced top tax band. The reform did not affect marginal taxes for incomes sitting in the tax bracket just below the newly introduced top tax bracket. The reform only marginally increased average tax rates for those sitting at the top of the second highest tax bracket compared with those sitting in the top tax bracket post reform.

Below we refer to the following five groups of taxpayers, based on how the reform affected their marginal and average tax rates:

1. 'To zero' taxpayers are the group of taxpayers with monthly taxable income in the range of UGX0 to UGX235,000. Those in the group with monthly taxable incomes between UGX130,000 to UGX235,000 experienced a reduction of tax rates to zero due to the reform.
2. 'MTR down' taxpayers are the group of taxpayers with monthly taxable income in the range of UGX235,001 to UGX335,000, whose marginal tax rate went from 20 per cent to 10 per cent, while average tax rates also fell.
3. 'ATR down, lower income' taxpayers are the group of taxpayers with monthly taxable income in the range of UGX335,001 to UGX410,000, whose average tax rate fell while the marginal tax rate remained stable at 20 per cent.
4. 'ATR down, higher income' taxpayers are the group of taxpayers with monthly taxable income in the range of UGX410,001 to UGX10,000,000, whose average tax rate fell while the marginal tax rate remained at 30 per cent. As taxable income approaches UGX10,000,000, the difference in average tax rates between pre- and post-reform becomes marginal.
5. 'Top taxpayers' are the group of taxpayers with monthly taxable income in the range of UGX10,000,001 or higher.

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[10] Tax rules are defined in the Income Tax Act (of 1 July 1997, Cap 340 of the Laws of Uganda 2000) and the Income Tax (Amendment) Act 2012 (of 1 July).

Figure 5: Marginal and average tax rates of individual income tax by monthly taxable income
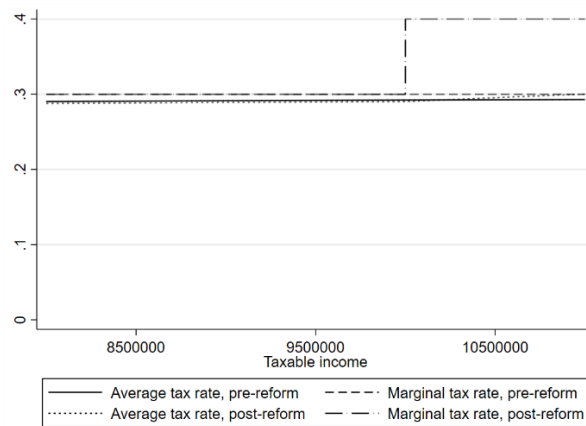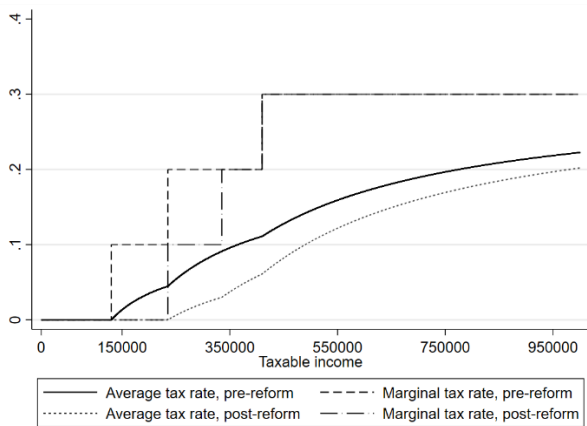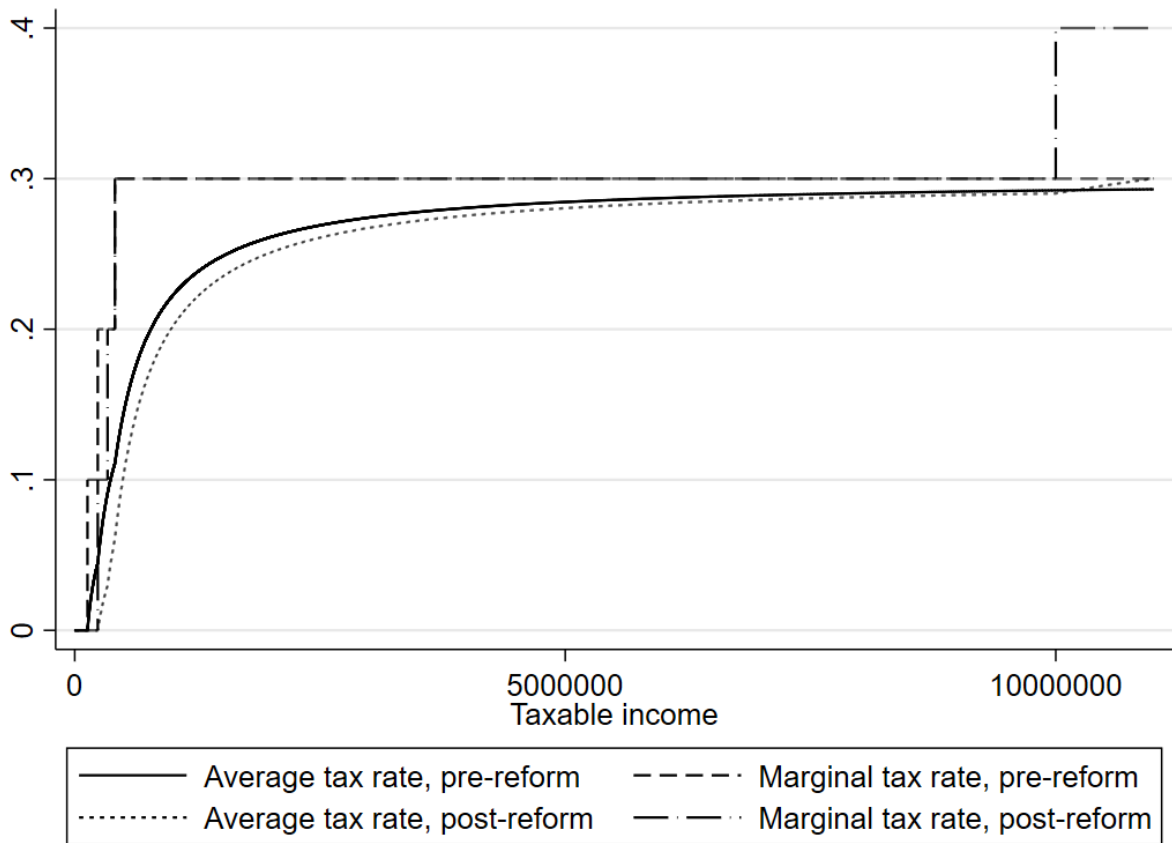
Note: the upper panel shows tax rates from UGX0 to UGX11 million of taxable income. The lower two panels concentrate on the tax rates at the bottom and the top, where the most pronounced changes in tax rates took place. The lower left panel shows tax rates for taxable incomes less than UGX1 million, and the lower right panel shows tax rates for taxable incomes more than UGX8 million. 'Pre-reform' refers to fiscal years before the 2012–13 fiscal year. 'Post-reform' refers to the fiscal year 2012–13 and onwards. All monetary values are in UGX.

Source: authors' schematic representation based on the Income Tax Act (of 1 July 1997, Cap 340 of the Laws of Uganda 2000) and the Income Tax (Amendment) Act 2012 (of 1 July).

9

3 Methodology

In this section, we first discuss our empirical approach related to examining the responses to the top tax increase—our main interest—and finally we briefly explain how the approach is adjusted for the other income groups.

We aim to examine whether, and if so by how much, taxpayers reacted to the increase in the top marginal tax rate. It might be that high-income individuals put in less work, or that employees and employers colluded to report lower incomes than they would have done in the absence of the reform. Such responses are captured by the elasticity of taxable income, i.e. the percentage change of taxable income with respect to a percentage change in the net-of-tax rate. The net-of-tax rate is defined as one minus τ, where τ represents the marginal tax rate.

We employ difference-in-differences (DiD) analysis to estimate top taxpayers' response in terms of changes to their taxable income in response to the increase in the marginal tax rate they faced due to the reform. Specifically, we consider the taxpayers subject to the tax increase (that is, people with monthly taxable income exceeding UGX10,000,000) as the treated group, and those just below that threshold as the control group. If the next 4 per cent is used as a control, control group incomes are between UGX3,515,553 and UGX10,000,000. In other words, the control group in the descriptive and econometric analysis below includes people from the 95th to the 99th percentiles, unless indicated otherwise.

We opt to use a smaller set of the 'ATR down, higher incomes' taxpayer group as the control group, as the full 'ATR down, higher incomes' group is very large and thus likely heterogeneous, as observations are located further away from the threshold of the top taxpayer group. As discussed in Section 2.2, individuals in the control group experienced no changes in the marginal tax rate and only a minor reduction in the average tax rate.

In the DiD analysis we then basically compare the mean taxable income across these two otherwise similar groups before and after the reform. We thus estimate, in a balanced firm panel, the basic DiD regression equation:

$$lnY_{ijtm} = \alpha_j + \sum \beta_{1,t} Year_t + \sum \beta_{2,m} Month_m + \beta_3(Treat_i x After_t) + \varepsilon_{ijtm} \qquad (1)$$

where lnY_{ijtm} is the outcome variable log taxable income for observation i, firm j, year t, and month m. The firm fixed effect is represented by α_j. $Treat_i$ is a dummy variable that takes value one when the individual belongs to the treatment group, $Year_t$ refers to dummies for each tax year, and $Month_m$ refers to month dummies. The variable of interest is the coefficient β_3, which is our DiD estimate for the interaction term $(Treat_i x After_t)$, which takes value one when an observation is treated and observed post-reform. Equation (1) is our main approach.

In alternative specifications, we (1) widen the control group to include individuals from the 90th percentile, and (2) work with unbalanced panel of employers, to increase the sample size and possibly precision. As different parts of the country introduced the e-tax system at different points in time, we also add fixed effects for tax office, $Tax\ office_k$, interacted with year. The estimation equation is then written as follows:

$$lnY_{iktm} = \alpha + \sum \beta_{1,t} Year_t + \sum \beta_{2,m} Month_m + \beta_3(Treat_i x After_t) +$$
$$\beta_4(Tax\ office_k x Year_t) + \varepsilon_{ijtm}. \qquad (2)$$

In addition, we examine heterogeneous responses by splitting the treatment group into two: the top one to 0.5 per cent, and the top 0.5 per cent. We also study response heterogeneity by size of employer and tax office.

We use the DiD estimate β_3 to calculate the elasticity of taxable earnings using the following equation:

$$e = \frac{DiD\ estimate}{\frac{d(1-\tau)}{1-\tau}} \tag{3}$$

This taxable income elasticity is a sufficient statistic for measuring the welfare costs of taxes under certain assumptions (Chetty 2009). These assumptions include the absence of income shifting between the labour income tax base and alternative tax bases. We will revert to this in Section 5.3 when examining the anatomy of taxpayer response.

The elasticity may also be estimated directly (as in Saez et al. 2012) using a two-stage least squares (2SLS) approach of the following type

$$lnY_{ijtm} = \alpha_j + \sum \beta_{1,t}\text{Year}_t + \sum \beta_{2,m}\text{Month}_m + \beta_3 ln(\widehat{1-\tau})_{1,t} + \varepsilon_{ijtm} \tag{4}$$

where $(\text{Treat}_i x \text{After}_t)$ is used as an instrument for the log retention rate, $\ln(1-\tau)$. This approach yields very similar estimates than the response calculated from eq. (1), normalized with the net-of-tax rate change.

Complementary to the above, we explore how the behavioural response unfolds across time using event-study methods. Specifically, in our econometric specification, we replace the interaction term between the treatment indicator and after-dummy (the DiD estimate) with interactions of the treatment group indicator with dummies for all years. This also serves to validate the identifying assumption behind the approach, the usual parallel trends assumption.

The repeated cross-section approach would underestimate the actual response if there were significant movement away from the treatment group due to the reform. Individuals could choose to locate instead in the area just below the threshold income level for the top tax rate. We therefore also investigate if there is bunching at the top tax rate kink, i.e. at income level 10 million after the reform. Kleven (2016) suggests that bunching is not the favoured method to estimate taxable income elasticities, because individuals may fail to optimize locally around kink points. Even if there is no bunching, taxpayers (clearly) above the kink may start to report lower incomes because of the reform.

Finally, we examine the response of the other income groups using eq. (1), where the treated individuals are either those in groups 'To zero', 'MTR down', or 'ATR down, lower income', and the comparison group consists of individuals earning UGX410,000– 704,447 (the 70th percentile) a month.

4   Data and descriptive evidence

We use the universe of PAYE data extracted from URA databases for our analysis. The monthly payroll tax data includes information submitted by the employer through the e-filing system, such as basic salary, allowable deductions, taxable income, and payable tax for each employee. It also includes indicators of whether the taxpayer is subject to the resident tax schedule, and whether taxable income is subject to the flat-rate tax for income from a second job. The data ranges from fiscal year 2010–11 to fiscal year 2014–15 and is available on a monthly basis. Earlier data is not of sufficient in terms of quality and coverage due to the roll-out of the e-tax system. Having three years of post-reform data enables examining short- and medium-run responses, a time span common in the literature (see e.g. Gruber and Saez 2002). For some employees falling into the lowest tax-free tax band, data is available if the employer shared the information with URA. Employees' TINs are largely not known for the reasons provided above, and we cannot create a panel of taxpayers. Therefore, we use the data as cross-sectional data for income earners.

Linking employers' TINs across time is nevertheless possible, as employers' TINs are consistently recorded in the data. The data also allows us to identify the taxpayer office responsible for an employer filing PAYE which is important information given the staggered implementation of the e-tax system. Including tax region fixed effects or restricting the analysis to the same employers allows us to control for the e-tax roll-out. We further can link the PAYE data with corporate income tax (CIT) returns containing information such as sales, costs, profits, proposed dividends, and benefits paid to employees which allows us to investigate potential avoidance behaviour beyond responses of taxable income.

Non-resident taxpayers represent a negligible share of observations at fewer than 0.2 per cent, and we therefore drop them from our analysis. We also exclude records of employees taxed at the flat rate of 30 per cent for their second job subject to PAYE. This group represents only around 2 per cent of observations and is not our main interest of analysis.

Table 2: Summary statistics of employees subject to PAYE

		2010–11	2011–12	2012–13	2013–14	2014–15
Taxable income	Mean	1,027,101	1,031,467	1,169,879	1,169,773	1,088,942
	Median	354,750	350,000	400,000	400,000	440,000
	St dev.	14,339,589	5,512,124	4,135,703	4,362,415	4,576,946
Basic salary	Mean	901,016	910,407	1,048,436	1,051,102	981,635
	Median	300,000	300,000	350,000	359,700	408,135
	St dev.	12,884,193	5,057,097	3,650,625	3,520,560	4,032,016
Payable tax	Mean	246,028	247,136	287,143	285,476	256,371
	Median	34,455	33,500	23,000	23,000	34,000
	St dev.	4,301,466	1,651,306	1,556,276	1,653,639	1,754,052
Total payable taxes (in billions)		528.44	731.30	1,024.77	1,193.45	1,379.61
Number of taxpayers	Total	2,147,903	2,959,084	3,568,851	4,180,571	5,381,323

Note: all monetary values are in UGX and refer to monthly incomes. Non-resident employees and records of employees taxed at the flat rate of 30 per cent for a second job subject to PAYE excluded.

Source: authors' calculations based on URA PAYE administrative tax records.

Figure 6: Distribution of taxpayers by taxable income pre-reform and post-reform
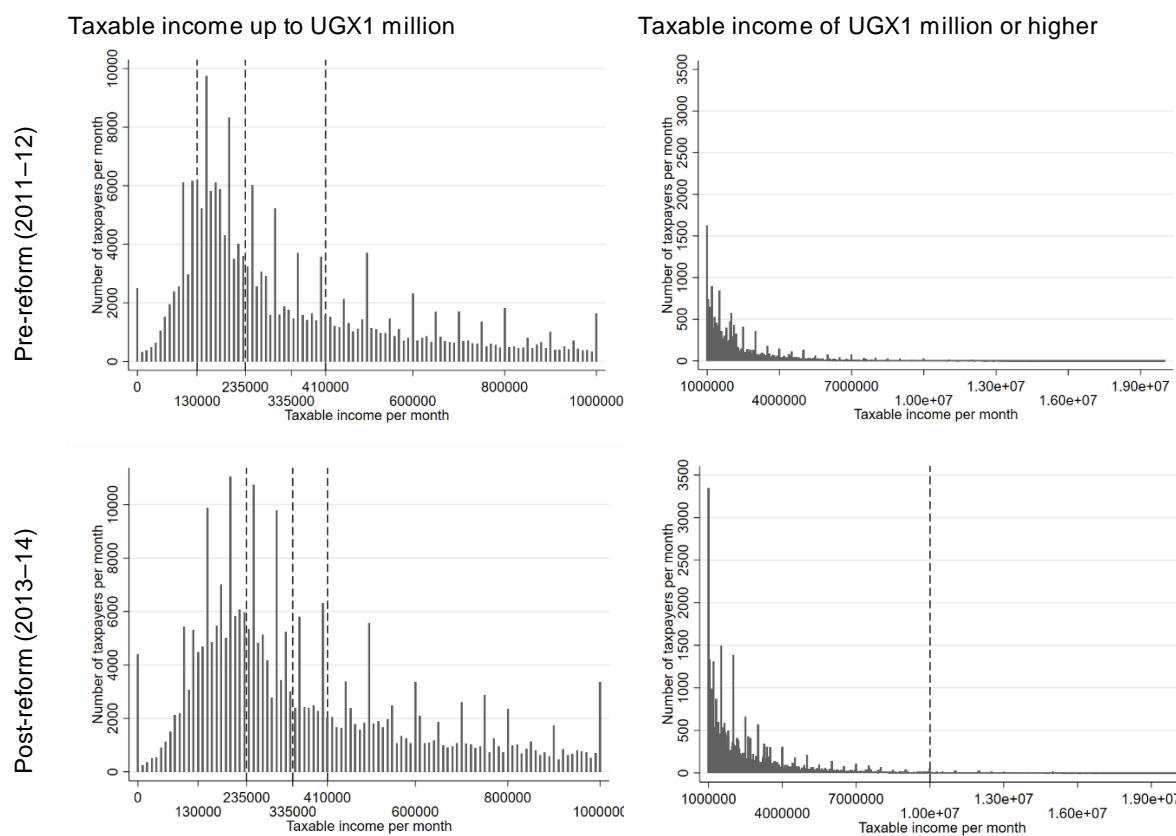
Note: in the pre-reform panels, dashed lines are the thresholds in the pre-reform tax schedule: (1) 130,000, (2) 235,000, (3) 410,000. In the post-reform panels, dashed lines are the thresholds in the post-reform tax schedule: (1) 235,000, (2) 335,000, (3) 410,000, (4) 10,000,000. The size of a bin in the graph is UGX10,000. Incomes exceeding UGX20 million are excluded from the figure.

Source: authors' calculations based on URA PAYE administrative tax records.

The overall number of employees subject to PAYE more than doubled between 2010–11 and 2014–15 (see Table 2). The median of basic salaries and taxable income (i.e. a basic salary plus any applicable allowances, bonuses, etc.) steadily increased, although it moved sideways in 2013–14. The mean of taxable income and basic salary also increased year on year, except for the last year analysed. Payable tax accordingly shows a similar pattern across time. While the mean taxable income goes down in 2014–15, total payable taxes from PAYE records increase alongside the increasing number of taxpayers.

The distribution of taxable income changed between the pre-reform and post-reform fiscal years (Figure 6), with less heaping to the left of the distribution. The graphs reveal a clear pattern of round number bunching, with incomes clustering around multiples of 100,000 and similar round values. Visually, no obvious bunching around the tax thresholds can be identified. There is also no excess bunching around to 10 million threshold after the reform, which indicates that the repeated cross-section approach remains feasible.

Before and after the reform, the largest share of taxpayers falls consistently into the 'ATR down, higher incomes' group, with around half of all observations (upper panel of Table 3). This share further increases with the onset of the reform, from 44 per cent to 48 per cent. The second largest group of taxpayers are those in the 'to zero' group, who pay no tax (or before the reform, little tax). This share—consistent with the reform's stated intention to alleviate the tax burden at the

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lower end of the wage distribution—decreased from 37 per cent pre-reform to 29 per cent. The share of 'top taxpayers' did not change to a large extent.

The lower panel of Table 3 shows for each taxpayer group how the average taxable income of that group relates to the average taxable income of the universe of PAYE taxpayers. Around the reform, the average taxable income of the 'ATR down, higher incomes' taxpayers group goes from 151 per cent times the average taxable income to 139 per cent, thus clearly declining by 8.6 per cent. For top taxpayers we find an even more sizable decline of nearly 20 per cent in declared average taxable income, from 2,357 per cent to 1,977 per cent. The latter group thus on average has a taxable income roughly 20 times that of the average taxable income.

Table 3: Shares of taxpayers and mean taxable income by taxpayer group

	Fiscal year	'To zero' taxpayers	'MTR down' taxpayers	'ATR down, lower income' taxpayers	'ATR down, higher income' taxpayers	'Top taxpayers'
Share of taxpayers	2010–11	37%	11%	6%	45%	0.9%
	2011–12	37%	12%	6%	44%	1.0%
	2012–13	29%	15%	7%	48%	1.2%
	2013–14	28%	16%	7%	48%	1.2%
	2014–15	23%	15%	10%	51%	1.2%
Mean taxable income (as a share of average income)	2010–11	14%	27%	36%	152%	2428%
	2011–12	14%	27%	36%	151%	2357%
	2012–13	13%	24%	32%	139%	1977%
	2013–14	13%	24%	32%	139%	1913%
	2014–15	14%	26%	35%	131%	1924%

Note: monthly taxable income for 'to zero' taxpayers: UGX0–235,000; 'MTR down' taxpayers: UGX235,001–335,000; 'ATR down, lower income' taxpayers: UGX335,001–410,000; 'ATR down, higher income' taxpayers: UGX410,001–10,000,000; 'top taxpayers': UGX10,000,001 or higher. Grey-shaded cells are for post-reform time points.

Source: authors' calculations based on URA PAYE administrative tax records.

In the following we concentrate on the treatment group of 'top taxpayers' and the control group, ranging from the 95th percentile to the threshold of the 'top taxpayers' (roughly to the 99th percentile) composed out of highest earning employees in the 'ATR down, higher incomes' taxpayer group.

Figure 7 plots the mean log taxable incomes for the treatment and the control group. The parallel trends assumption appears to hold for the two-year period before the reform. After the reform, the log income drops noticeably for treated individuals. The figure also suggests that the income drop among the treated group could continue. If this were the case, cutting the analysis period to three years would imply that our estimates mark the lower bound of the long-run response. On the other hand, extending the analysis further in time would require strong identifying assumptions; one would have to assume the absence of other confounding factors with different impacts on different parts of the distribution.

Table 4 shows the mean monthly taxable income for the treatment and control groups. Between fiscal years 2011–12 and 2014–15, mean monthly taxable income declines by 16 per cent for the treatment group; it also declines consistently in a year-on-year perspective, and decreases by 10 per cent when we lump together all pre- and all post-reform observations. By contrast, mean monthly taxable income increases quite consistently for the control group, increasing by about 1 per cent between fiscal years 2011–12 and 2014–15.

Figure 7: Parallel trends for treatment group ('top taxpayers') and control group ('next 4%')
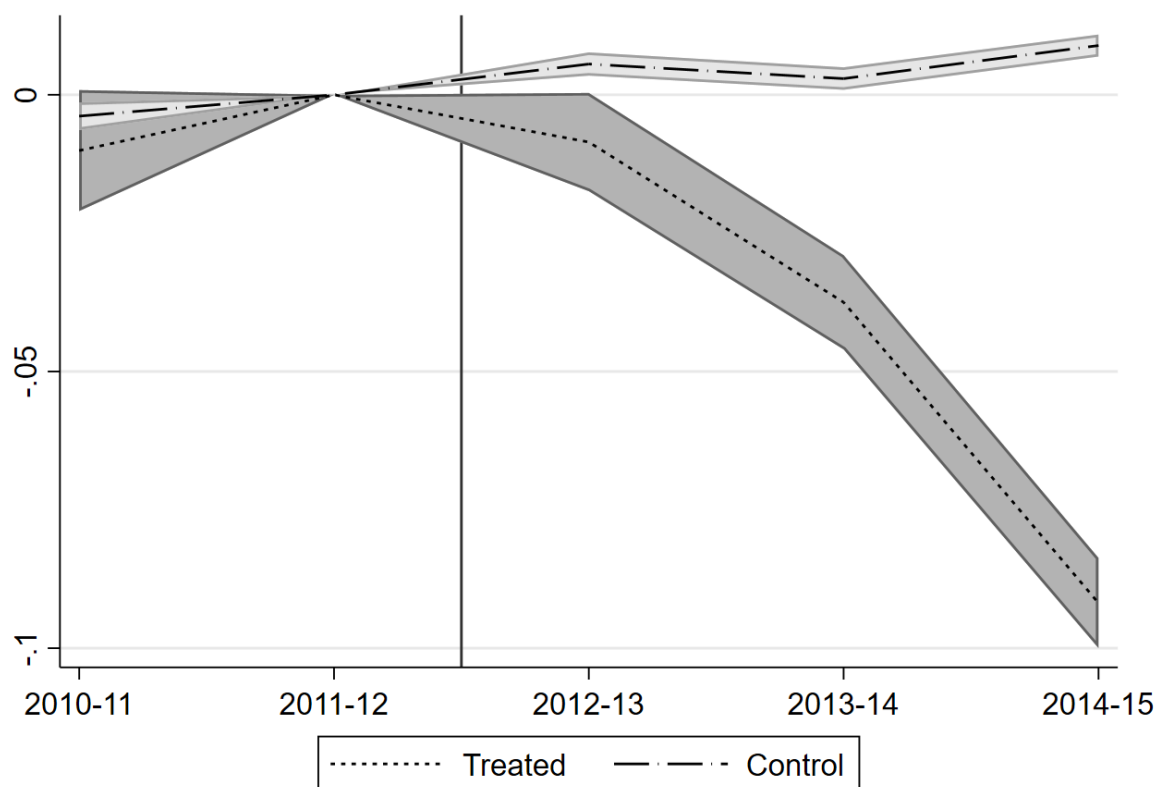
Note: incomes are normalized for both groups in 2011–12. The vertical line indicates the reform time in July 2012.

Source: authors' calculations based on URA PAYE administrative tax records.

Table 4: Mean monthly incomes (in millions) for the 'top taxpayers' treatment and control group in the balanced firm panel data

Fiscal year	Treatment group ('top taxpayers')	Control group ('next 4%')
2010–11	25.104	5.481
2011–12	24.747	5.499
2012–13	24.129	5.496
2013–14	23.798	5.523
2014–15	22.895	5.549
Pre-reform	24.890	5.491
Post-reform	23.558	5.524

Note: treatment group ('top taxpayers'): monthly taxable income UGX10,000,001 or higher. Control group ('next 4 per cent' = p95 up to the 'top taxpayers' group threshold): monthly taxable income UGX3,515,553–10,000,000. 'Pre-reform' refers to the mean monthly taxable income for fiscal years 2010–11 and 2011–12. 'Post-reform' refers to the following three fiscal years. Grey-shaded cells are for post-reform time points. All monetary values are in UGX.

Source: authors' calculations based on URA PAYE administrative tax records.

5   Results

In this section we start by discussing results for top taxpayers in Section 5.1. Possibly heterogeneous responses are investigated in Section 5.2, whereas margins of taxpayer response

beyond taxable income are examined in Section 5.3. In Section 5.4 we show how the rest of PAYE employees with taxable income responded to the reform in the middle and lower parts of the distribution.

5.1   Responses among the top taxpayers

Tables 5 and 6 present DiD estimation results using different specifications. Models (2) and (4) are weighted using income weights to reflect relative contribution to total revenues, as is commonly done in the literature on the elasticity of taxable income. In Table 5, a broad control group consisting of the rest of the taxpayers in the top ten group is used, whereas Table 6 shows the results for our preferred, narrower, control group (the percentiles 95–99).

Table 5: DiD results for treatment group 'top taxpayers' using a balanced firm panel: control next 9%

	'Top taxpayers'		'Top taxpayers', censored		Top 1–0.5%		Top 0.5%, censored	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Simple	Weighted	Simple	Weighted	Simple	Weighted	Simple	Weighted
$Treat_i$*$After_t$	-0.050**	-0.164*	-0.048**	-0.068**	-0.050***	-0.047***	-0.057***	-0.068***
	(0.023)	(0.093)	(0.023)	(0.029)	(0.002)	(0.002)	(0.004)	(0.013)
Year and month dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.609	0.713	0.611	0.768	0.396	0.509	0.599	0.837
Implied elasticity	0.347**	1.148*	0.339*	0.475**	0.353***	0.327***	0.401***	0.477***
	(0.160)	(0.652)	(0.161)	(0.206)	(0.011)	(0.011)	(0.029)	(0.094)
Observations	1,681,849		1,681,849		1,601,130		1,601,127	
No. of firms	2,294		2,294		2,292		2,289	

Note: columns (2), (4), (6), and (8) present weighted least squares estimates with income used as weights. In columns (3–4) and (7–8), incomes exceeding the top 1 per cent threshold among the treated group (that is, income above 0.01 per cent of all income earners) are censored to the threshold value. 1,613 observations are censored. The estimated models include firm fixed effects. Standard errors clustered at the firm level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Source: authors' calculations based on URA PAYE administrative tax records.

Concentrating first on the results in Table 5, the basic specification in column (1) shows a highly significant DiD estimate with the expected sign: taxable incomes in the treated group, i.e. 'top taxpayers', have decreased in response to the reform. The corresponding elasticity is 0.35, which is well in line with the evidence from earlier studies (see e.g., Neisser 2021), although the literature as discussed concentrates mainly on developed countries. When we use income weights (column 2), the elasticity increases further to around one.

As large outliers at the top of the distribution might be driving the results, we further estimate the same equation censoring the taxable incomes of the top of the treatment group (models 3 and 4 in Table 5). Specifically, we censor taxable incomes at the 99.99[th] percentile for each year.[11] Capping taxable incomes at the top makes a large difference: the income-weighted elasticity is halved, dropping it to approximately 0.5. This suggests that the very high elasticity found in the basic specification with weights is driven by a few large observations.

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[11] The censoring applies to just over 1,600 observations, i.e. around 27 taxpayers annually if they have taxable income in every month of the year.

To further study this matter, we split the treatment group into two halves: a lower half with employees with monthly taxable incomes between the 99th and 99.5th percentiles, and an upper half with those in the top 0.5 per cent of the distribution, censored at the 99.99th percentile. Estimates for both groups are presented in columns 5-8. The response among the lower half of the 'top taxpayers' is more muted, with an elasticity of 0.33 (income-weighted results). By contrast, the explanation for the high elasticity found in the basic regression above seems to stem from the response of the very top taxpayers. For the top half of the treatment group, we find an elasticity of 0.48.

The results change, however, quite drastically when the control group is made narrower (Table 6). Now the point estimates of the treatment*after dummy decline from around -0.05 to -0.01 (column 1), and the estimate becomes insignificant. In the split-sample analysis, only the lower income group among the treated individuals shows a negative and significant coefficient, with an elasticity of approximately 0.1. The comparison group in these regressions is arguable more similar, and hence we would argue that these results represent our preferred specifications.

Table 6: DiD results for treatment group 'top taxpayers' using a balanced firm panel: control next 4%

	'Top taxpayers'		'Top taxpayers', censored		Top 1–0.5%		Top 0.5%, censored	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Simple	Weighted	Simple	Weighted	Simple	Weighted	Simple	Weighted
$Treat_i*After_t$	-0.014	-0.125	-0.013	-0.031	-0.017**	-0.015**	-0.025	-0.034
	(0.024)	(0.092)	(0.024)	(0.029)	(0.007)	(0.007)	(0.028)	(0.029)
Year and month dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.680	0.667	0.687	0.738	0.516	0.600	0.745	0.838
Implied elasticity	0.098	0.875	0.090	0.219	0.118**	0.104**	0.174	0.235
	(0.169)	(0.643)	(0.170)	(0.204)	(0.046)	(0.048)	(0.019)	(0.201)
Observations	856,085		856,085		775,366		775,363	
No. of firms	1,800		1,800		1,795		1,791	

Note: columns (2), (4), (6), and (8) present weighted least squares estimates with income used as weights. In columns (3–4) and (7–8), incomes exceeding the top 1 per cent threshold among the treated group (that is, income above 0.01 per cent of all income earners) are censored to the threshold value. 1,613 observations are censored. The estimated models include firm fixed effects. Standard errors clustered at the firm level in parentheses *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Source: authors' calculations based on URA PAYE administrative tax records.

Why are the results so different when a different choice for the control group is used? To investigate this, we ran placebo regressions where the 'treated' are those in percentiles 95-99 and the controls are the rest in the top 10 group, i.e. percentiles 90-94. The results for the placebo treatment are displayed in Table 7. While the estimates are not significant, they suggest that income growth in the 95-99 group is slower than in the group below. Thus, there seems to be a declining trend in top incomes more broadly, not only among the top 1 group. Hence, we would overestimate the reduction in incomes for the treated group with the broader comparison group.

As discussed in the theory section, a 2SLS approach can also be used in this context, where the interaction term between the treated group and the after dummy is used as an instrument for the net-of-tax rate (Equation 4). These results are available in Table 8. Not surprisingly, the estimates for the log of the net-of-tax rate term are not significant with the usual confidence levels.

Table 7: DiD results for a placebo treatment using a balanced firm panel

	'Treated Top 5 – Top 2 %'	
	(1)	(2)
	Simple	Weighted
$Treat_i*After_t$	-0.019	-0.016
	(0.017)	(0.017)
Year and month dummies	Yes	Yes
R-squared	0.746	0.750
Observations	1,345,421	
No. of firms	2,269	

Note: column (2) present weighted least squares estimates with income used as weights. Treatment group is Top 5 – Top 2 % i.e., percentiles 95-98. Control group is Top 10 – Top 6 % i.e., percentiles 90-94. The estimated models include firm fixed effects. Standard errors clustered at the firm level in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Source: authors' calculations based on URA PAYE administrative tax records.

Table 8: IV results for treatment group 'top taxpayers' using a balanced firm panel: control next 4%

	'Top taxpayers'		'Top taxpayers', censored	
	(1)	(2)	(3)	(4)
	Simple	Weighted	Simple	Weighted
log net-of-tax rate	0.091	1.606*	0.083	0.538
	(0.157)	(0.943)	(0.157)	(0.344)
Year and month dummies	Yes	Yes	Yes	Yes
R-squared	0.607	0.469	0.614	0.587
Observations	856,000		856,000	
No. of firms	1,715		1,715	

Note: columns (2) and (4) present weighted least squares estimates with income used as weights. In columns (3–4), incomes exceeding the top 1 per cent threshold among the treated group (that is, income above 0.01 per cent of all income earners) are censored to the threshold value. 1,631 observations are censored. The estimated models include firm fixed effects. Standard errors clustered at the firm level in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Source: authors' calculations based on URA PAYE administrative tax records.

Finally, we study how taxable income responds across time using event study methods. Estimation results (with corresponding confidence intervals) are plotted in Figure 8. The graph indicates that before the reform (2011–12), there is no difference between treatment and control groups, as should be the case. After the reform, a difference starts to emerge, and the response seems to unfold gradually, with the latest year showing the largest drop in treatment group incomes. However, also all these year-specific treatment impacts are not statistically significant. This may be an indication that taxpayers cannot adjust their earnings immediately but do so slowly over time. However, extending the period of analysis further entails the risk that other factors that may cause different trends between the treatment and the control group become stronger.

Figure 8: Event study plots for the treatment group 'top taxpayers', censored: control next 4%
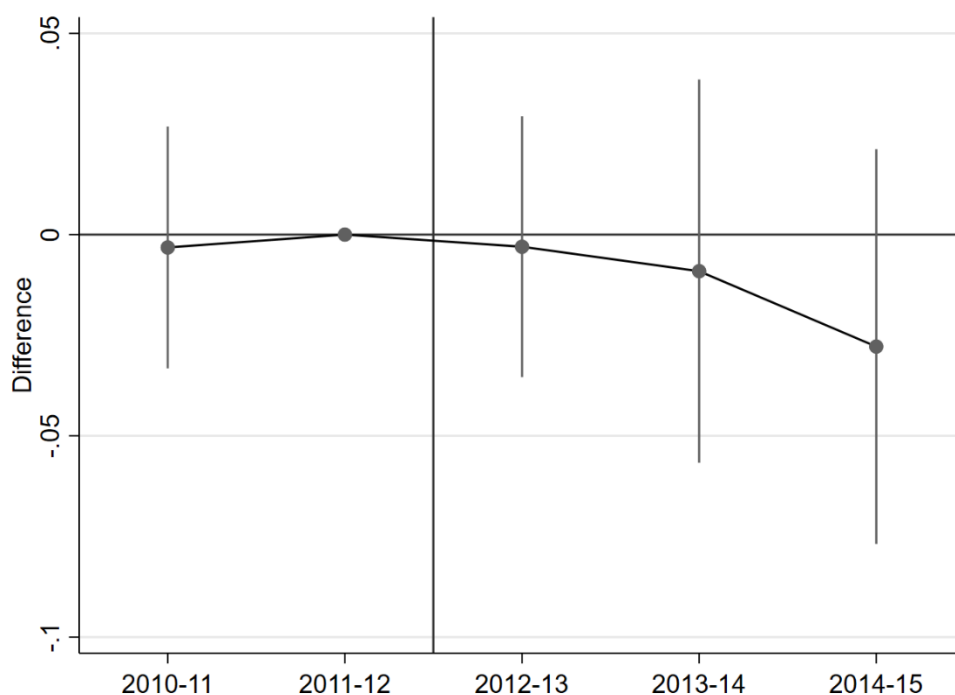
Note: difference estimated using the DiD regression model. The vertical line indicates the time of the reform in July 2012. Analysis using firm fixed effects in a balanced sample of employers.

Source: authors' calculations based on URA PAYE administrative tax records.

5.2 Heterogeneous responses and robustness

Next, we provide further evidence of how the response to the tax reform might be driven by different factors, and perform various robustness checks. First, Table 9 reports results by firm size (measured as number of employees either below or above the median). Firm size might be considered a proxy for how skilled firms and employees are in colluding to report lower incomes in the face of higher tax rates. The results in this table indicate that the response is similar across firms of different size.

Second, the type of tax office overseeing an employer's tax matters might create another dimension of response heterogeneity. Specifically, URA has a dedicated department specializing in large taxpayers, the Large Taxpayer Office (LTO). Large taxpayers are defined as those with turnover of UGX15 billion and above or average annual tax contributions exceeding UGX4 billion, an indicator that is likely correlated with the firm's number of employees but not forcingly so.[12] If a firm is not overseen by the LTO, it will fall under the Medium Taxpayer Office (MTO) if its turnover is UGX2–15 billion or its average annual tax falls in the range of UGX1–4 billion.[13] Otherwise, a firm is monitored by a standard tax office. Firms under the remit of the LTO might thus be or perceive themselves as more strongly monitored.

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[12] The LTO criteria also include other indicators besides the value of turnover or taxes such as whether they have business activities in extractive industries, banking institutions, insurance companies and pension funds, high net-worth individuals, the top 50 individuals based on tax contributions, and mobile telephone companies.

[13] The MTO criteria also include other indicators besides the value of turnover or taxes: for example, all businesses in gaming and pool betting activities, and the top 51–100 individuals based on tax contributions.

Table 10 shows that employers not handled by the LTO or the MTO react far more strongly to the reform. This is an interesting finding and calls for further analysis. It could be that income shifting – employees benefitting from other forms of compensation instead of earner income – could be behind the differences in the reactions, since such behaviour can be expected to be more common in smaller firms. This is studied in more detail in Section 5.3.

Table 9: Heterogeneity analysis for the treatment group 'top taxpayers' using a balanced firm panel, censored: Top taxpayers in small and large firms

	'Top taxpayers', censored = Baseline		Small firms		Large firms	
	(3)	(4)	(5)	(6)	(7)	(8)
	Simple	Weighted	Simple	Weighted	Simple	Weighted
Basic:						
Treat$_i$*After$_t$	-0.013	-0.031	-0.022	-0.066*	-0.042	-0.082
	(0.024)	(0.029)	(0.015)	(0.035)	(0.084)	(0.056)
Year and month dummies	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.687	0.738	0.694	0.751	0.681	0.732
Implied elasticity	0.090	0.219	0.154	0.463*	0.293	0.572
	(0.170)	(0.204)	(0.107)	(0.245)	(0.588)	(0.393)
Observations	856,085		563,755		292,330	
No. of firms	1,800		1,795		78	

Note: we use a median number of employees by firm from the full data to define large and small firms (98.7 employees). The control group is next 4%. 1,613 observations are censored. The estimated models include firm fixed effects. Standard errors clustered at the firm level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Source: authors' calculations based on URA PAYE administrative tax records.

Table 10: Heterogeneity analysis for treatment group 'top taxpayers' using a balanced firm panel, censored: Top taxpayers in MTO, LTO and all other tax offices

	LTO firms		MTO firms		All other tax offices	
	(1)	(2)	(3)	(4)	(5)	(6)
	Simple	Weighted	Simple	Weighted	Simple	Weighted
Basic:						
Treat$_i$*After$_t$	-0.002	-0.035	-0.014	0.011	-0.073***	-0.108**
	(0.032)	(0.035)	(0.018)	(0.033)	0.025	(0.051)
Year and month dummies	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.691	0.727	0.677	0.747	0.685	0.758
Implied elasticity	0.013	0.242	0.099	-0.076	0.508***	0.756**
	(0.227)	(0.248)	(0.129)	(0.232)	(0.172)	(0.358)
Observations	552,611		159,576		143,898	
No. of firms	576		754		1,475	

Note: columns (1) and (2) show estimates for firms that fall under the LTO. Columns (3) and (4) present estimates for firms that fall under the MTO. Columns (5) and (6) includes all other tax offices. The control group is next 4%. All specifications include firm fixed effects. 1,613 observations are censored. Standard errors clustered at the firm level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Source: authors' calculations based on URA PAYE administrative tax records.

Finally, turning to robustness analysis, we first examine responses in a sample consisting all taxpayers in the treated and control groups, not just those employed by the same firms. In these regressions, corresponding to Eq. (2), we add tax office*year fixed effects to account for the expansion of e-filing. Now the weighted results (presented in Table A.1 in the Appendix) are more significant, suggesting large elasticities. However, in these results the worry that the group of

taxpayers is more heterogenous after the reform is greater, and hence we favour the results based on the balanced sample of employers.

The potential issue of bunching biasing our results downwards is examined in the analysis reported in Table A.2, where incomes of those locating above the 98.5 percentile but below 10 million are dropped. The results for the treatment impact of the reform are not significant, thus reinforcing the results in the main analysis.

5.3 Anatomy of top taxpayer response

The response of the 'top taxpayers' group to the marginal tax rate increase presented above has focused exclusively on taxable income. Yet, taxpayers might respond (differently) along different margins of response, and in this section, we investigate the potential underlying mechanisms further. First, we investigate the response of other outcome variables and specifically basic salary to the reform. Second, we take a closer look at employers that record overall the largest drops in incomes for top earners in response to the reform.

Table 11: Summary statistics of basic salary and other income

	Obs	Mean	St dev.	Min	Max
Control group, before the treatment					
Basic salary	190,919	4.932	1.834	0.000	17.590
Other income	190,919	0.559	1.120	-10.653	9.956
Taxable income	190,919	5.491	1.658	3.516	10.000
Control group, after the reform					
Basic salary	503,725	5.027	1.838	0.000	23.003
Other income	503,725	0.497	1.062	-15.336	10.000
Taxable income	503,725	5.524	1.676	3.516	10.000
Treatment group, before the treatment					
Basic salary	44,359	20.334	95.749	0.000	15417.000
Other income	44,359	4.557	20.189	-8.852	2326.000
Taxable income	44,359	24.890	105.723	10.000	17743.000
Treatment group, after the reform					
Basic salary	117,082	19.684	31.216	0.000	4741.141
Other income	117,082	3.873	16.242	-15.487	1927.756
Taxable income	117,082	23.558	36.005	10.000	4741.141

Note: Summary statistics before and after the reform for the uncensored balanced firm panel data in millions of UGX, by treatment status. The control group is next 4%.

Source: authors' calculations based on URA PAYE administrative tax records.

In addition to the basic salary, responsible for the main share of taxable income, taxpayers report other benefits (in cash or the monetary value of in-kind benefits) and they may also claim deductions. Table 11 provides summary statistics information about basic salary and all other income (which may be negative due to deductions) as well as taxable income. For the treatment group, other income constitutes a greater share (exceeding 15 per cent) of taxable income than for the control group (for whom it stays below 10 per cent). For the treatment group, other income also declined more (22 per cent) than their basic salary did (where the reduction was 8 per cent). This suggests that the response for the basic salary may have been more muted.

To examine this further, Table 12 contains DiD results for the same specifications as Table 6, but with basic salary as the outcome variable. All these results are not significant, and the magnitudes typically decline. This conforms with the general perception that basic salary is more rigid and less under taxpayers' control than the items collected under other income.

Next, we examine whether income shifting could be driving the results in Table 10, where a significant reduction in incomes reported by firms not handled by the LTO or the MTO was detected. We study more closely those firms whose PAYE taxable incomes for the top group employees drop the most (more than 10 per cent) around the reform; this corresponds to around 100 firms. For that purpose, we first identify these firms in the PAYE balanced firm panel. Second, we merge additional information on these firms from the corporate income tax (CIT) returns records.

Table 12: DiD results for treatment group 'top taxpayers' using a balanced firm panel: dependent variable is basic salary

	'Top taxpayers'		'Top taxpayers', censored	
	(1)	(2)	(3)	(4)
	Simple	Weighted	Simple	Weighted
Basic:				
Treat$_i$*After$_t$	0.005	-0.091	-0.006	-0.022
	(0.035)	(0.102)	(0.035)	(0.046)
Year and month dummies	Yes	Yes	Yes	Yes
R-squared	0.604	0.644	0.609	0.735
Implied elasticity	-0.036	0.636	0.043	0.152
	(0.228)	(0.714)	(0.244)	(0.320)
Observations	852,589		852,589	
No. of firms	1,795		1,795	

Note: columns (2) and (4) present weighted least squares estimates with income used as weights. In columns (3) and (4), incomes exceeding the top one per cent threshold among the treated group (that is, income above 0.01 per cent of all income earners) are censored to the threshold value. The control group is next 4%. 1,609 observations are censored. The estimated models include tax office fixed effects. Standard errors clustered at the firm level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Source: authors' calculations based on URA PAYE administrative tax records.

We then create a comparison group of firms. We do so by first checking the sales figures of the firms that experience the largest drop in PAYE taxable incomes identified in step one. Second, we identify other firms subject to CIT with similar sales figures but not belonging to the group with a large drop as defined in step one. This leaves us with around 3,500 firms for the comparison group. Third, we identify the firms defined for the comparison group in the PAYE balanced panel records, and further restrict the comparison group to firms that record employees with taxable income in the highest tax bracket.

Table 13 presents the means of various firm-level variables, such as log sales, costs, profits, proposed dividends, [14] and their differences between before and after the tax reform, for firms with the largest drop in PAYE incomes and our choice of comparable firms. We find that firms with the largest drop in PAYE incomes decrease their sales and costs after the reform, but log profits and proposed dividends increase. Leave and travel benefits also increase, but certain other line items (such as bonuses) actually decline. By contrast, among firms in the comparison group, sales, costs, and profits are larger after the reform.

This points to lower economic activity for the firms with the largest drop in PAYE incomes compared with otherwise similar firms. Nevertheless, these firms at the same time propose to pay larger dividends to shareholders (see differences as calculated in Table 13). To put it simply, firms whose employees' taxable incomes (i.e. PAYE taxable incomes) fall, report an increase in profits and dividends. Firms with no such change in PAYE taxable incomes see higher economic activity after the reform, but they increase dividends to a smaller extent.

While the above analysis cannot be interpreted as causal evidence, the descriptive evidence is clearly suggestive of a certain degree of income shifting taking place between PAYE taxable incomes and dividends. Firms recording the largest drop in taxable income to their top earning employees seem to increase proposed dividends more than other, rather similar, firms. Assuming that companies' top earners often own shares of the companies they work for, and taxation of these did not change over the period of analysis, this points to firms and employees using proposed dividends as a channel of adjustment to lower overall tax on incomes received by the employee, thus income from wages and dividends.

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[14] In the Ugandan context, proposed dividends refer to expected provisional dividends declared by the firm at the beginning of its income year on the CIT tax form. If the firm pays the dividends proposed in its provisional returns at the end of the fiscal year, the proposed dividends are considered final; otherwise the dividends are amended in the final return.

Table 13: Descriptive evidence of firm-level variables for largest-drop and other firms

		Log sales	Log costs	Log profit before tax	Log proposed dividends	Log management fees	Log contribute to other funds	Log leave and travel benefits	Log bonuses	Log total administrative expenses	Log basic salary	No. of firms
Other firms	Before	21.111	20.787	17.746	18.436	16.695	16.441	16.054	16.127	18.071	17.573	3 367
	After	21.236	20.873	17.899	18.601	17.071	16.694	16.190	16.233	18.294	17.880	3 694
	Difference	0.124	0.086	0.153	0.165	0.376	0.253	0.136	0.106	0.223	0.307	
Largest-drop firms	Before	22.751	22.346	19.987	21.341	19.348	17.126	15.231	18.438	20.534	20.238	98
	After	22.527	22.207	20.208	22.510	18.607	17.642	16.832	17.730	20.507	20.345	111
	Difference	-0.224	-0.139	0.221	1.169	-0.740	0.516	1.601	-0.707	-0.027	0.107	
	DiD	-0.348	-0.225	0.068	1.004	-1.116	0.262	1.465	-0.813	-0.250	-0.200	

Note: largest-drop firms are firms that have the largest drop in PAYE incomes (= log PAYE income) from the 'top taxpayers' group after the reform. Other firms are firms that have similar log sales to largest drop firms and have employees in the 'top taxpayers' group in the PAYE balanced panel data. The numbers in the row entitled 'DiD' indicate the difference between the change for the treatment group and the corresponding change for the control group. The variables described in this table are calculated from CIT returns data, with the exception of log basic salary which is from PAYE balanced panel records.

Source: authors' calculations based on URA PAYE and CIT administrative tax records

5.4 Responses to the reform along in the middle and bottom of the distribution of taxable income

Finally, we turn to discuss results for the other taxpayer groups who experience a decline in tax rates (Table 14). These include those in the two groups at the bottom of the income distribution, whose marginal tax rate declines by ten percentage points ('to zero' taxpayers and 'MTR down' taxpayers in Table 3), and the group whose average tax rate drops significantly ('ATR down, lower incomes'). The taxable income developments for these groups are compared with those in a control group that consists of individuals earning UGX410,000– 704,447 (the 70th percentile) a month.

The results for the estimated effects are insignificant for all other groups, apart from the 'To zero' group. At face value, the results for the 'To zero' group would indicate an increase in reported incomes because of the reform. However, after the reform reporting incomes in this bracket was not mandatory anymore, and hence there is a selection bias in those firms choosing to report these earnings. If the smallest incomes are not reported, this would lead to an upward bias in the estimates, and hence these results are not very credible.

Table14: Balanced firm panel: DiD results for treatment groups 'to zero', 'MTR down', and 'ATR down, lower incomes'

	'To zero'		'MTR down'		'ATR down, lower incomes'	
	(1)	(2)	(3)	(4)	(5)	(6)
	Simple	Weighted	Simple	Weighted	Simple	Weighted
Basic:						
$Treat_i*After_t$	0.039***	0.033***	-0.004	-0.006*	-0.003	-0.002
	(0.010)	(0.010)	(0.003)	(0.003)	(0.003)	(0.003)
Year and month dummies	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.934	0.926	0.881	0.857	0.661	0.633
Implied elasticity	0.355***	0.299***	0.033	0.044*		
	(0.085)	(0.086)	(0.026)	(0.027)		
	(0.086)	(0.086)	(0.026)	(0.027)		
Observations	4,761,395		3,818,374		2,895,986	

Note: columns (1) and (2) present estimates for the treatment group 'to zero', and columns (3) and (4) for the treatment group 'MTR down'. Columns (5) and (6) are DiD estimates for the treatment group 'ATR down, lower incomes', which does not face any marginal tax rate change. The control group consists of taxpayers who have income of UGX410,001–704,447. Income of UGX704,447 is the threshold for 70th percentile. The estimated models include firm fixed effects. Standard errors clustered at the firm level in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The elasticity cannot be calculated for the ATR down group (division by zero).

Source: authors' calculations based on URA PAYE administrative tax records.

6 Revenue and inequality implications

Based on the above findings on the elasticity of taxable income, we now turn to the question of how revenue is affected. The main takeaway from the analysis above is that the actual behavioural response to the tax changes was not significant. Hence, the actual revenue after the reform also captures the non-existent behavioural responses, strictly speaking.

However, there are reasons to be more cautious, for example, because of a declining trend in incomes, depicted in Figures 7 and 8, and therefore the long-run behavioural responses could be

stronger. That is why we also consider revenue implications with a plausible behavioural reduction in incomes. Such an estimate could be based on the results in Table 5 where the broader control group is used. The preferred estimate, we would argue, for the behavioural reactions would be an income-weighted one, but probably without the large outliers. Hence, the estimate of column 4 in Table 5 (about -0.07) could be used.

To demonstrate what the revenue impacts would then be, we first calculate the actual tax revenues recorded by URA for all fiscal years. In the presence of behavioural reactions in the period after the reform, this number is affected by the behavioural reaction in incomes. To obtain a counterfactual revenue estimate, we apply the post-reform tax schedule to the uprated pre-reform taxable incomes. The uprating factor for incomes is given by the estimates of Section 5. Finally, comparing the actual revenue with the simulated revenue reveals how much revenue the behavioural responses would cost.

We first perform this exercise for the 'top taxpayers' group before turning to the other groups. Then, we summarize the overall implications for PAYE revenues. Finally, we close this Section with the inequality implications.

6.1 Revenue implications for the top group

We first calculate actual revenues gathered from the control and treatment groups, as defined for the analysis of top taxpayers in Section 5, for the different fiscal years. Columns 1 and 2 of Table 14 show that the actual revenues from PAYE increase over the time span analysed for both groups, but more so for the treated group, which faces an increase in the marginal tax rate. The revenue gain in both groups also represents an increase in the number of taxpayers.

For the counterfactual scenario of the 'top taxpayers' treatment group, uprated incomes are 7 per cent higher (column (4), Table 5) than actual incomes in the post-reform period. To sum up, simulated revenues are obtained by first uprating employees' taxable incomes in the treatment group by 7 per cent for the post-reform period; second, we use the post-reform tax rules to calculate the hypothetical payable taxes by employee; then we sum every employee's taxes together for each year, which is finally our hypothetical revenue. This simulated revenue represents how much revenue would be collected if there were no behavioural responses to the reform.

The results suggest that the mean annual revenue loss due to behavioural reactions amounts to approximately UGX48 billion (Table 14, columns (2) and (3), mean post-reform UGX455 minus UGX407 billion), or 12 per cent of actual revenues from employees in the treated group. The reason why the relative revenue loss (12 per cent) is greater than the percentage change in taxable income (7 per cent) is because the average tax rate increases when incomes increase.

If some part of the behavioural response stems from income shifting between different tax bases rather than from a real behavioural reduction, our revenue loss calculations are upwardly biased. This is likely the case here, since those at the very top of the income distribution appear to react to the reform more. If these individuals include corporation owners, they might react to the reform by lowering the salaries their corporations pay to themselves and using other forms of compensation (such as dividend income) instead (see also the discussion in Section 5.3). To the extent that these other payouts are within the tax net, the overall revenue consequences would be smaller.

Table 14: PAYE actual revenues and counterfactual simulated revenues for 'top taxpayers' and the control group

Fiscal year	Actual revenue, control group	Actual revenue, treatment group 'top taxpayers'	Simulated revenue, treatment group 'top taxpayers'
	(1)	(2)	(3)
2010–11	234	154	
2011–12	395	230	
2012–13	466	371	411
2013–14	528	411	457
2014–15	549	439	495
Mean, pre-reform	314	192	
Mean, post-reform	514	407	455

Note: all monetary values are in UGX billions. Values are adjusted for inflation. Column (1) reports the actual revenues from the control group (the next nine per cent), while column (2) does the same for the treatment group 'top taxpayers'. 'Simulated revenue, treatment group' reflects revenues generated by the treatment group for the post-reform years if there are no behavioural responses to the reform. Grey-shaded cells are for post-reform time points.

Source: authors' calculations based on URA PAYE administrative tax records. CPI index: https://data.worldbank.org/indicator/FP.CPI.TOTL?locations=UG (accessed 9 May 2023).

The above back-of-the envelope calculation raises the question of what the revenue-maximizing top tax rate would be in the Ugandan context. Theory has shown (e.g., Piketty and Saez 2013) that the revenue-maximizing top tax rate in a non-linear income tax system is:

$$\tau^* = \frac{1}{1 + a * e} \tag{5}$$

where a is the Pareto parameter estimated from fitting a Pareto distribution using income data, and e is the elasticity of taxable income. It is worth noting that this tax rate is defined to also include the tax burden stemming from indirect taxes.

We have estimated the Pareto parameter on the basis of the Ugandan PAYE data for incomes exceeding the threshold value of the highest marginal tax bracket. The estimates are in the range of 1.7 to 1.9 for the different years, with a smaller value reflecting a larger share of total income captured by top income earners. These estimates suggest that the Ugandan earnings distribution is quite uneven with the Pareto parameter measures indicating a fairly thick upper tail of the Pareto distribution. Other things being equal, this rather low Pareto parameter then raises the revenue-maximizing top tax rate as defined in equation (5).

With an elasticity of taxable income equal to, say, 0.5, and a Pareto parameter of 1.7 the revenue-maximizing top tax rate would amount to around 54 per cent. Currently, when taking indirect taxes into account, the Ugandan top tax rate is approximately 50 per cent. [15] Thus, the elasticity of taxable income would have to be much larger than our preferred estimates are for the country to locate on the wrong side of the Laffer curve.

It is though worth bearing in mind that the above calculation disregards various considerations, including possible income shifting and the impacts of taxes on the extensive margin (the share of formal sector employment in the economy).

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[15] Calculated as $1 - \frac{1 - t_y}{1 + t_x}$, where $t_y = 0.4$ refers to the top marginal income tax rate and $t_x = 0.2$ to the approximate effective consumption tax rate, which includes value-added tax and excises.

6.2 Revenue implications for other tax brackets

For the other taxpayers, we only calculate the actual revenue, since the evidence of any behavioural reactions for these groups was very weak. Table 15 collects these actual revenues for the various groups.

Table 15: PAYE actual revenues for other treatment groups

Fiscal year	To zero	MTR down		ATR down	Control
	(1)	(2)	(3)	(4)	
	Actual revenue	Actual revenue		Actual revenue	Actual revenue
2010–11	5.5	5.2		6.0	29.5
2011–12	6.0	7.9		8.0	40.9
2012–13	0	2.9		4.9	39.2
2013–14	0	3.5		5.9	52.8
2014–15	0	4.1		10.7	71.7
Mean, pre-reform		5.7	6.6	7.0	35.2
Mean, post-reform	0	3.5	7.1		54.6

Note: all monetary values are in UGX billions. Values are adjusted for inflation. Column (1) presents the actual revenue for the treatment group 'to zero' (incomes UGX130,000–235,000). Column (2) does the same for the treatment group 'MTR down' (incomes UGX235,001–335,000). The numbers in column (3) are the actual revenue for the treatment group 'ATR down' (incomes UGX335,001–410,000). Column (4) reports the revenues from the control group, which has incomes UGX410,000–704,447 (the 70th percentile). Grey-shaded cells are for post-reform time points.

Source: authors' calculations based on URA PAYE administrative tax records. CPI index: https://data.worldbank.org/indicator/FP.CPI.TOTL?locations=UG (accessed 9 May 2023).

As anticipated, the actual revenues of all treatment groups decrease when marginal and average tax rates fall after the income tax reform of 2012. However, actual revenues increase steadily every year after the drop in 2012, because the number of PAYE taxpayers hikes up remarkably between 2012 and 2014–15 (see Table 2).

6.3 Overall revenue implications

The actual annual revenues from the 'top taxpayers' group increased by UGX215 billion (Table 14, column (2), mean pre-reform versus mean post-reform) and declined by UGX8.7 billion[16] from groups that experience a tax rate decrease. Taken together, the increase in revenues dominates, leaving overall revenue of UGX206 billion.

If there had been behavioural impacts among the top group, the actual realized revenue would fall short of the counterfactual revenue, as discussed above related to the results of Table 14. Even then, however, the mechanical revenue impacts would dominate.

In a nutshell, this means that regardless of whether one considers behavioural responses, the overall revenue implications are dominated by the developments in the 'top taxpayers' group. As the tax rates at the top increases, the overall revenue consequences of the reform are positive.

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[16] The value UGX5.8 billion is calculated from Table 15. Summing all mean pre-reform actual revenues from columns (1), (2), and (3), we then subtract the sum of all mean post-reform, which results in (5.7+6.6+7.0) - (3.5+7.1) = 8.7.

Note that in this analysis, we have omitted the revenues from the control group (whose average tax rate drops, but not significantly so).

6.4   Impacts on earnings inequality

Because of the reduction of the tax burden at lower income levels and the increase in the taxation of top incomes, the mechanical impact—with fixed before-tax incomes—of the reform must be towards lower after-tax income inequality. In the pre-reform years in our data set, the Gini coefficient for after-tax income was on average 0.635, whereas it was 0.606 after the reform.

Again, one can consider what would have happened if there had been behavioural responses among the top-income earners. With these effects, the counterfactual incomes would be higher, and using the same uprating factor as above, 7 per cent, the Gini would have then been 0.611 in the period after the reform. Hence with behavioural reactions, the actual reduction in Gini would stem from greater progressivity and behavioural declines in top incomes. The overall reduction in the Gini coefficient, approximately 5 per cent, may be regarded as modest.

7   Conclusion

Personal income tax has not often been the prime focus of tax analysis in developing countries. The main reasons for this have been the challenges of accessing high-quality data and the fact that indirect taxes have made up the bulk of government revenue in developing countries. Yet in the age of domestic revenue mobilization, and with the onset of electronic tax-filing systems, coupled with an increasing concern for inequality, the design and evaluation of personal income tax schedules is due to receive more scrutiny by policy makers and researchers alike.

In this study we analyse the impact of a major tax reform in Uganda that took place in 2012–13. The reform shifted the lower threshold of the tax schedule and subsequent thresholds upwards and introduced an additional top tax rate to the tax schedule. We use the universe of Ugandan administrative tax data from the PAYE system from 2010 to 2015 to assess the impacts of this reform on employee wage and/or taxable income, using difference-in-differences and event-study methods. We also provide back-of-the-envelope calculations simulating the reform's impact on revenue performance.

Our results indicate that the top taxpayers' incomes declined substantially after the reform, but in our preferred specification, where we compare these top 1 per cent of income earners to the next 4 per cent in a balanced panel of employers, the reduction is not statistically significant. The result turned out to be sensitive to the choice of the comparison group: if a broader comparison group were used, the reform impact would be significant. This suggests that top incomes more broadly have risen less than incomes of those just below, and all this income reduction is unlikely to be due to the reform. A caveat that needs to be kept in mind is that the negative impacts on incomes seem to be somewhat larger in the final year of the data.

However, we also find that top-income employees working for firms whose employers are not handled by large- or medium-taxpayer offices report lower incomes after the reform. Part of the response may reflect income shifting between earned vs. capital income, since dividends were found to increase more in firms where employment incomes for the top-income taxpayers declined the most.

Perhaps still more important from the policy point of view are the revenue implications of the reform. Our estimates suggest that the Ugandan government has been able to raise more revenues thanks to the introduction of an additional top tax band. Had there been behavioural responses, the revenue increase would have still most likely been positive, indicating that Ugandan tax rate after the reform is not yet on the decreasing side of the Laffer curve. The revenue implications of the entire reform—taking into account the revenue loss in taxes paid by those whose tax rates were reduced—appear to be positive. The reform also helped reduce after-tax earnings inequality with the Gini index dropping by approximately 5 per cent. Given that the Ugandan income tax system is very similar to other low- or lower-middle-income African countries, our results will also be useful when considering income tax reforms elsewhere.

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Appendix

Table A1: DiD results for the treatment group 'top taxpayers' using all observations: control 'next 4%'

	Top taxpayers		Top taxpayers, censored	
	(1)	(2)	(3)	(4)
	Simple	Weighted	Simple	Weighted
Basic:				
$Treat_i*After_t$	-0.054	-0.279**	-0.052	-0.147***
	(0.033)	(0.117)	(0.033)	(0.055)
Year and month dummies	Yes	Yes	Yes	Yes
R-squared	0.642	0.550	0.649	0.652
Implied elasticity	0.375	1.953**	0.365	1.029***
	(0.229)	(0.819)	(0.228)	(0.388)
Observations	1,029,046		1,029,046	

Note: columns (2) and (4) present weighted least squares estimates with income used as weights. In columns (3) and (4), incomes exceeding the top one per cent threshold among the treated group (that is, income above 0.01 per cent of all income earners) are censored to the threshold value. 2,039 observations are censored. The estimated models include tax office*year controls. Standard errors clustered at the firm level in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Source: authors' calculations based on URA PAYE administrative tax records.

Table A2: Event study results for the treatment group 'top taxpayers' using a balanced firm panel: control next 4% without potential bunchers

	'Top taxpayers'		'Top taxpayers', censored	
	(1)	(2)	(3)	(4)
	Simple	Weighted	Simple	Weighted
Basic:				
$Treat_i*2011-12$	0.004	-0.161	0.005	-0.004
	(0.015)	(0.132)	(0.015)	(0.031)
$Treat_i*2012-13$	0.002	-0.236	0.004	-0.039
	(0.026)	(0.159)	(0.026)	(0.038)
$Treat_i*2013-14$	-0.0001	-0.207	0.001	-0.020
	(0.033)	(0.164)	(0.033)	(0.039)
$Treat_i*2014-15$	-0.014	-0.181	-0.012	-0.015
	(0.032)	(0.168)	(0.032)	(0.047)
Year and month dummies	Yes	Yes	Yes	Yes
R-squared	0.752	0.684	0.760	0.758
Observations	765,788		765,788	
No. of firms	1,800		1,800	

Note: columns (2) and (4) present weighted least squares estimates with income used as weights. In columns (3–4), incomes exceeding the top one per cent threshold among the treated group (that is, income above 0.01 per cent of all income earners) are censored to the threshold value. 1,613 observations are censored. We drop observations from percentile 98.5 to the threshold of UGX 10 million to exclude the potential bunchers. The estimated models include firm fixed effects. Standard errors clustered at the firm level in parentheses *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Source: authors' calculations based on URA PAYE administrative tax records.