Taxpayer response to greater progressivity: Evidence from personal income tax reform in Uganda*

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May 2022

Acknowledgements: This study has been prepared within the UNU-WIDER project Building up efficient and fair tax systems—lessons based on administrative tax data, which is part of the Domestic Revenue Mobilization programme. The programme is financed through specific contributions by the Norwegian Agency for Development Cooperation (Norad). Financing by the Finnish Ministry of Foreign Affairs is gratefully acknowledged, as well as support to Jouste by the Kone Foundation (grant no. 80-42327). This work is part of a larger research and capacity-building initiative between the Uganda Revenue Authority (URA) and UNU-WIDER. We thank colleagues at URA, specifically Milly Nalukwago, Nicholas Musoke, Dorothy Nakyambadde, and Ronald Waiswa, for their comments and ongoing support of this work. Colleagues at URA, as co-authors or when commenting our work, have provided invaluable information on the institutional background and processes governing personal income taxation in Uganda. For their comments, we thank Ohto Kanninen, Janne Tukiainen, Mazhar Waseem and Kyle McNabb, as well as participants at the following: Journées Louis-André Gérard-Varet 2019 in Aix-en-Provence; the International Institute of Public Finance Congress 2019 at the University of Glasgow; the Virtual North East Universities Development Consortium 2020 at Dartmouth College; the 'Use of Administrative and Longitudinal Data for Distributional Analysis' workshop at the University of Essex; the Aboa Centre for Economics and the Turku School of Economics Research Seminar at the University of Turku. The results and their interpretation presented here are solely the authors' responsibility.

* The previous version of this paper is published as Wider Working Paper 2021/11, Helsinki: UNU-WIDER, https://doi.org/10.35188/UNU-WIDER/2021/945-7.

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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. Using the universe of pay-as-you-earn (PAYE) administrative data submitted by employers in the formal sector to the Uganda Tax Authority, we analyse the impact of the introduction of the additional top tax band on taxable income. Our results indicate that the elasticity of taxable income in Uganda is somewhat larger than in developed countries, a result particularly driven by income earners at the very top. We find suggestive evidence of income shifting between wages and dividends. Taxpayers in the lower part of the wage distribution also responded to the reform but to lesser extent. Despite the large elasticity of taxable income at the top, the additional revenue generated from the introduction of the additional top tax band by far offset the revenue losses triggered by the more generous tax-free threshold for low taxable incomes and the behavioural response along the distribution. The behavioural reactions reinforced the inequality reduction implied by the reform.

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

JEL classification: C31, H24, O23

1 Introduction

Developing countries are increasingly aiming to raise their own revenues. Apart from decreasing developing countries' dependency on foreign aid, improved domestic revenue mobilization (DRM) is also key to finance and improve domestically owned social protection programmes and avoid increasing inequality. The expansion of DRM and social protection are also clearly connected to reducing poverty and inequality, two key elements of the Sustainable Development Goals.

Traditionally developing countries' tax receipts have relied mainly on taxes on (multinational) firms, trade taxes, and more recently on value added tax and other consumption taxes. Personal income tax has often received less attention. Yet not only does personal income tax hold potential to boost DRM, personal income tax policy can also be a highly equitable tax tool, addressing inequality concerns and social protection goals simultaneously. The increasing use of digital technologies by revenue authorities, together with taxpayer awareness campaigns, has further improved the potential for boosting personal income revenues.

For the design of an equitable personal income tax policy understanding taxpayer behaviour in response to tax reform is indispensable. In this paper we analyse a major personal income tax reform in Uganda that came into effect in 2012 to understand these questions better in a low-income country setting. The reform consisted of two major changes. First, it hiked up the threshold of the tax-free tax band at the bottom of the schedule by 80 per cent, and of the second tax band by nearly 40 per cent; second, it introduced an additional top tax bracket with a marginal tax rate of 40 per cent, which used to be 30 per cent.

In this paper we evaluate the impact of the reform on employees' taxable incomes.[1] Our main emphasis is on the impact of the new top tax bracket, influencing approximately the top one per cent of taxpayers, but we also examine taxpayer responses to the tax schedule changes elsewhere in the income distribution. Methodologically, we follow the elasticity of taxable income literature surveyed by Saez et al. (2012) and Neisser (2018). We use administrative income tax data collected by the Uganda Revenue Authority (URA) through URA's pay-as-you-earn (PAYE) system for the fiscal years before and after the reform took place. 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.

Our results indicate that the reported incomes of the top one per cent group of taxpayers, who faced a ten percentage point increase in the marginal tax rate, declined substantially after the reform relative to individuals in the control group, i.e. those in a lower tax band. Our preferred estimates of the elasticity of taxable income with respect to the change in the net-of-tax rate lie between 0.33 to 0.48. These estimates suggest a substantial response to the reform, especially compared with results from developed countries. In alternative specifications we estimate elasticities as large as up to 2. However, these large elasticities are highly sensitive to the removal of a few outliers.

[1] Taxable income in Uganda's 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.

Elasticities are also sensitive to whether income weighting is used or not, and whether or not we restrict our sample to the same firms across time. Closer scrutiny of the parallel trends assumptions confirms that differences in taxable income between the treatment and control groups emerge after the reform and continue well beyond the first year after the reform. The above results are also robust to the choice of the control group. We find small effects of the reform for the middle and bottom of the taxpayer distribution.

In terms of heterogeneity of effect, the response to the tax reform is strongest for the wage earners at the very top of the distribution. It is also stronger for individuals employed at large firms, with size either defined in terms of number of PAYE employees but also in terms of turnover and the firm being monitored by a dedicated department of URA specialized in large firms.

Furthermore, deductions and benefits, including bonuses, seem to have played a larger role in shaping the response of taxable income to the reform than basic salary alone. The response of basic salary income (which constitutes the bulk of taxable income) to the reform is more muted than that of other income (the total of (non-monetary) benefits including bonuses and deductions). Descriptive evidence comparing firms whose PAYE salaries paid to the top taxpayer group decreased the most with other similar firms indicates that dividends increased more among the former set of firms. This suggests that the reform probably led to income shifting between different tax bases; the decrease in wage incomes was likely at least (partly) offset by higher incomes from dividends.

Based on a simple simulation exercise our estimates imply that while adding a top tax band increased revenue, the revenue impacts turned out to be more muted than they would have been without behavioural impacts. A back-of-the envelope calculation suggests that the current Ugandan top tax rate (personal income tax rate plus indirect tax rate) is quite close to the theoretically revenue maximizing tax rate à la Piketty and Saez (2013). Overall, our simple calculations suggest that the reform led as intended to lower tax loads and thus revenue losses in the lower half of the distribution. But these losses were more than recouped by the additional revenue generated at the top, a result that also holds when taking into account behavioural responses. Finally, we examine the consequences of the reform on after-tax income inequality. The mechanical reduction due to greater progressivity was amplified by the drop in top incomes stemming from the behavioural reaction.

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. A vast literature estimating elasticities of taxable income, or in other words on tax responsiveness exists for developed, high-income countries, where access to administrative tax data has largely become possible already several years ago. By contrast, this has not been the case for developing countries, or such data simply does not exist. Recent years, however, 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 were Kleven and Waseem (2013), using administrative data from Pakistan, a lower-middle income country. They 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 strong 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.

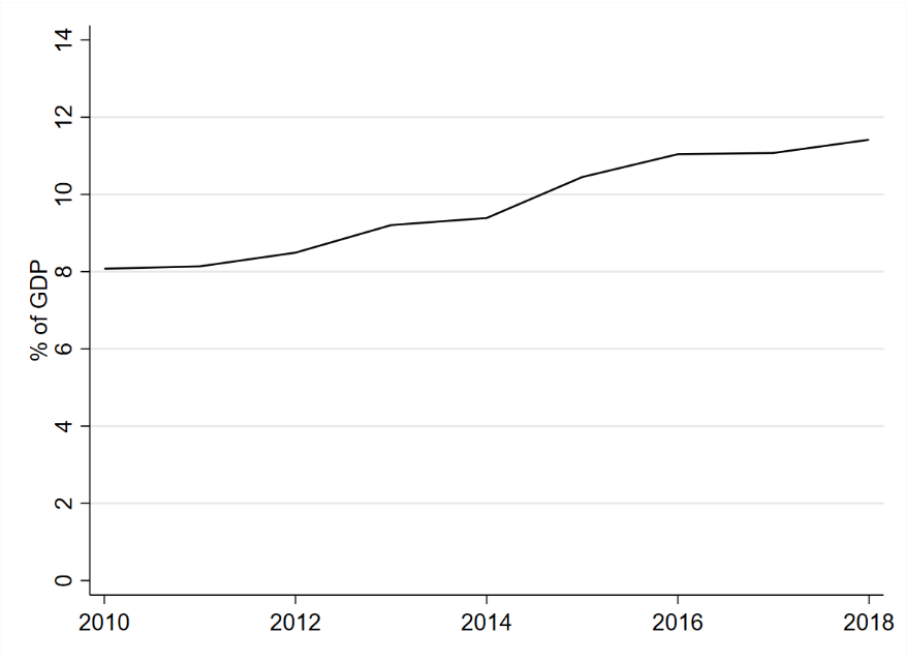
The paper is structured as follows. Section 2 explains the institutional background of income tax in Uganda. In Section 3 we describe the empirical approach. Section 4 turns to the data and descriptive evidence. Section 5 presents the regression results and robustness checks, and explores potential other 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 1 and 2). The contribution of PAYE alone was UGX2.4 trillion[2] of total tax revenue collected, constituting about 16.6 per cent of total tax revenue in the 2017–18 fiscal year. For comparison, value added taxes 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).

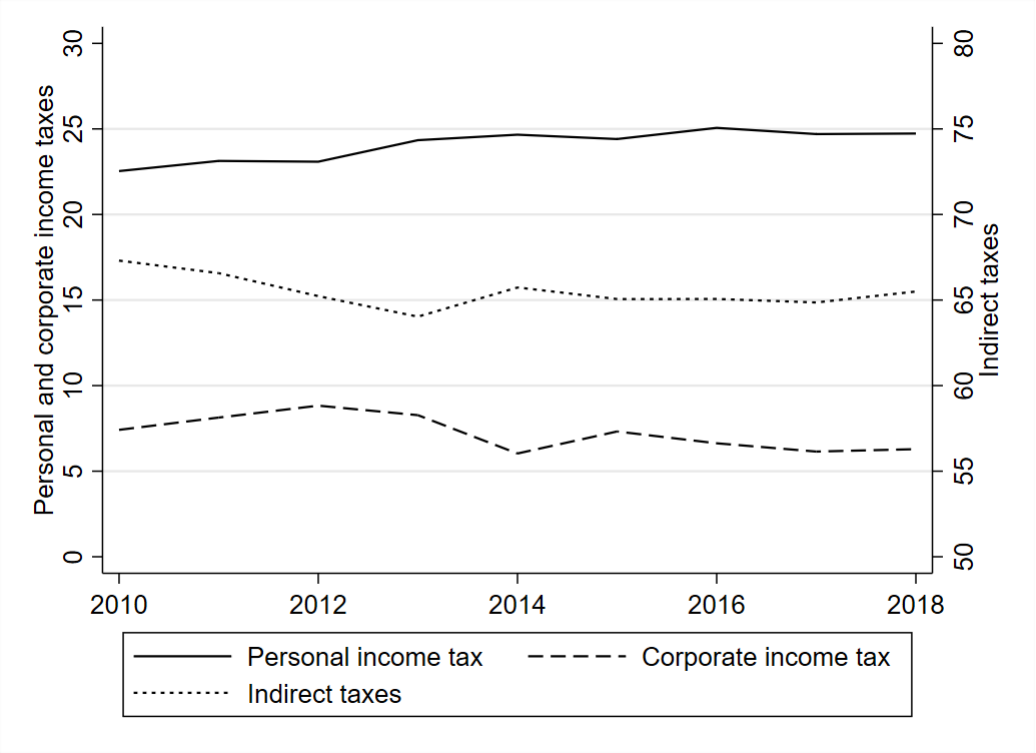
[2] In 2020, US$1 = UGX3,700.

Figure 1: Total tax revenue as a share of GDP



Source: authors' visualization based on data from UNU-WIDER (2020).

Figure 2: Contribution of different tax instruments: share of total tax revenue



Source: authors' visualization based on data from OECD (2020).

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.[3] 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[4] 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.[5]

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.[6] 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 their 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 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.

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

[4] 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)).

[5] 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 stable a parallel pre-trend is challenging.

[6] 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.

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 ten 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.[7]

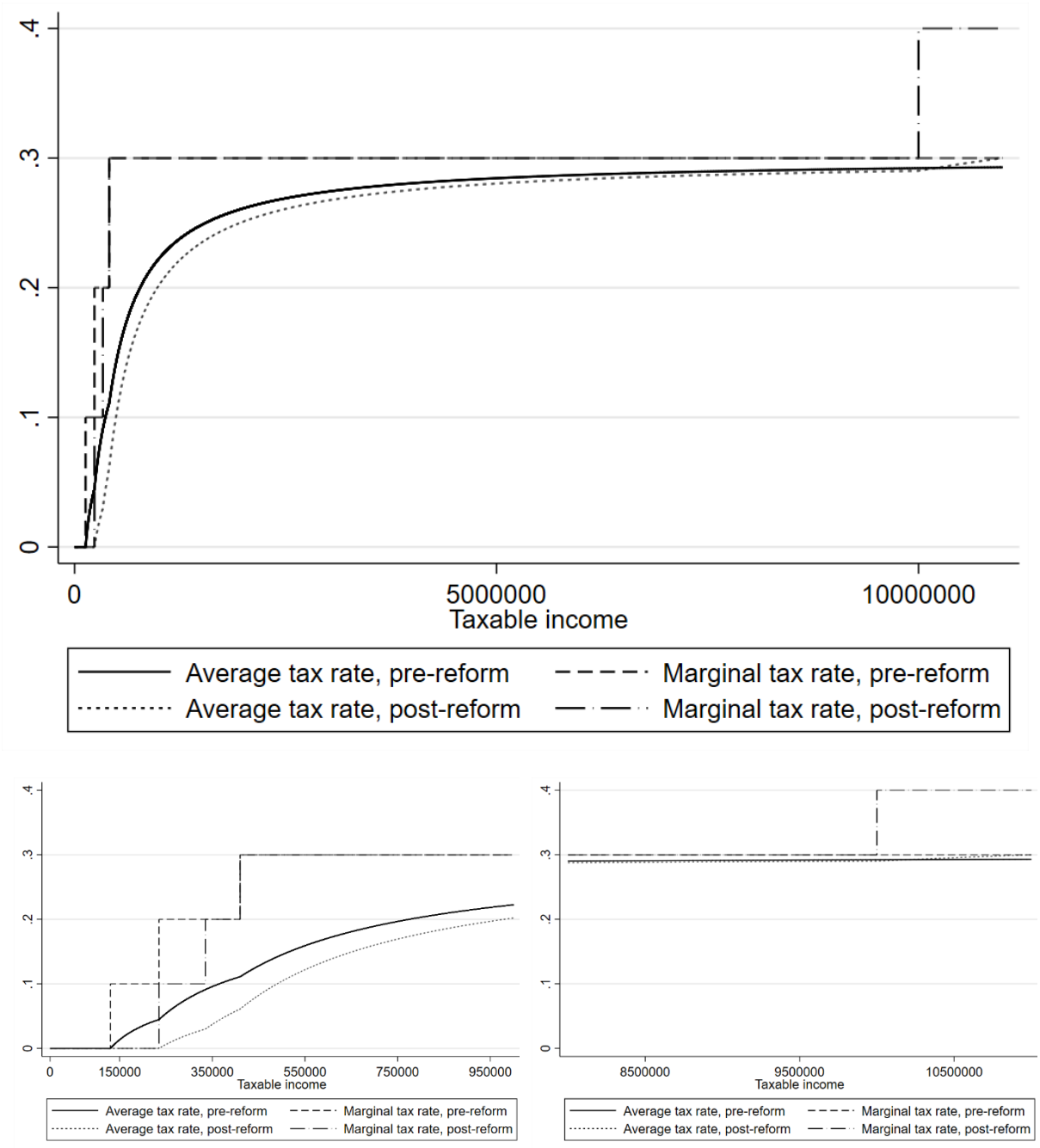
Table 1 and Figure 3 illustrate the PAYE rates applicable to resident individuals before and after the reform. In terms of changes to average and marginal tax rates, the reform reduced marginal and average tax rates for low- to middle-income taxpayers, and it increased the marginal and average tax rates 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 ten 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.

[7] 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 3: 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).

3 Methodology

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 (that is, the 'next nine per cent', situated between UGX2,117,900 and UGX10,000,000 monthly taxable income). In other words, the control group in the descriptive and econometric analysis below includes people from the 90th 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 the basic DiD regression equation:

$$Y_{ijtm} = \beta_0 + \beta_1 \text{Treat}_i + \sum \beta_{2,t} \text{Year}_t + \sum \beta_{3,m} \text{Month}_m + \beta_4 (\text{Treat}_i x \text{After}_t) + \beta_5 \text{Tax office}_j + \varepsilon_{ijtm} \quad [1]$$

where Y_{ijtm} is the outcome variable log taxable income for observation i, tax office j, year t, and month m, 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_4, which is our DiD estimate for the interaction term $(\text{Treat}_i x \text{After}_t)$, which takes value one when an observation is treated and observed post-reform. 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_j, when estimating equation [1][8].

We add group-specific linear trends based on the pre-treatment period in some specifications, to account for group-wise trend heterogeneity. For example, in this way we allow a different trend in taxable incomes for the treatment group than for the control group. 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. As further robustness checks, we vary the lower cut-off point for the control group and study response heterogeneity by size of employer and tax office.

[8] The models estimated for the benchmark results in Table 5 have also been run with tax office * year fixed effects. The magnitude and statistical significance of the results remain very similar with these specifications.

We use the DiD estimate β_4 to calculate the elasticity of taxable earnings using the following equation:

$$e = \frac{DiD\ estimate}{\frac{d(1-\tau)}{1-\tau}} \quad [2]$$

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 5.2 when examining the anatomy of taxpayer response.

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.

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.

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 two per cent of observations and is not our main interest of analysis.

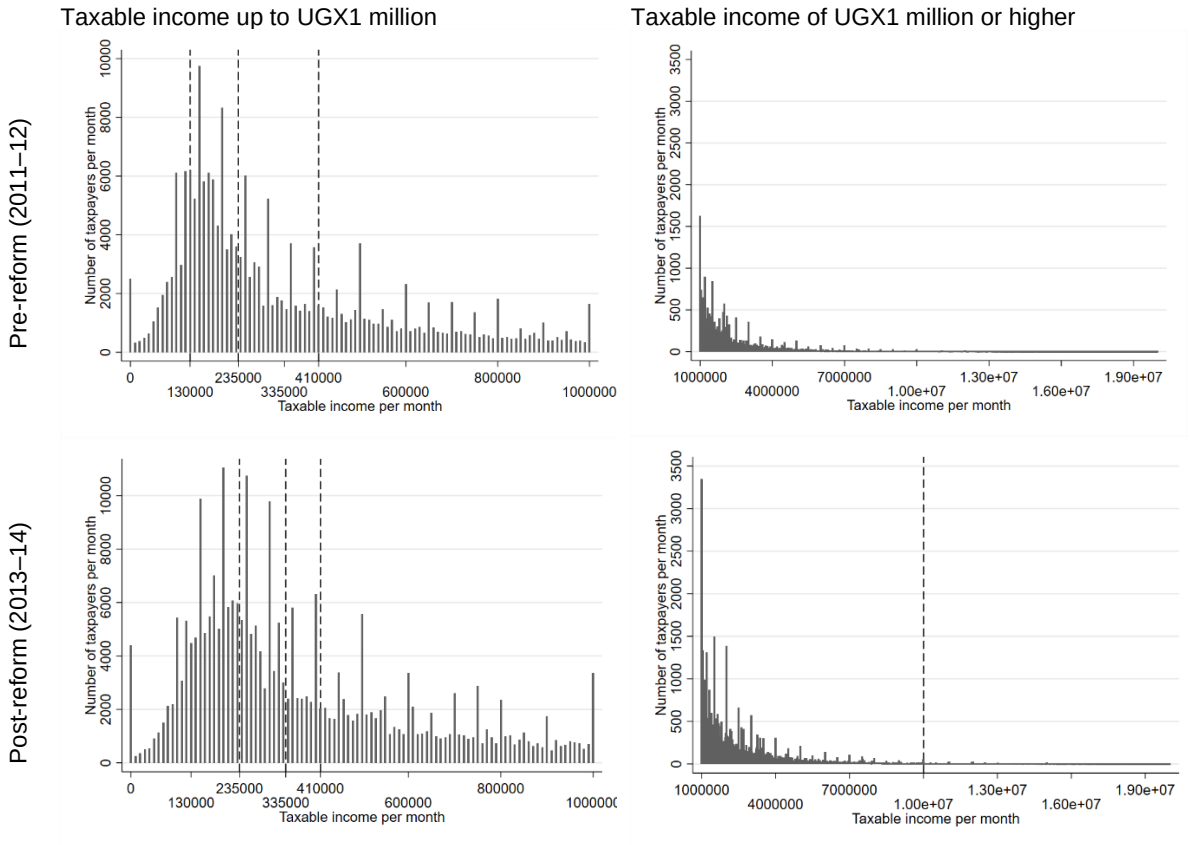
Table 2: Summary statistics of employees subject to PAYE

		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 4: 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 4), 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.

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 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.

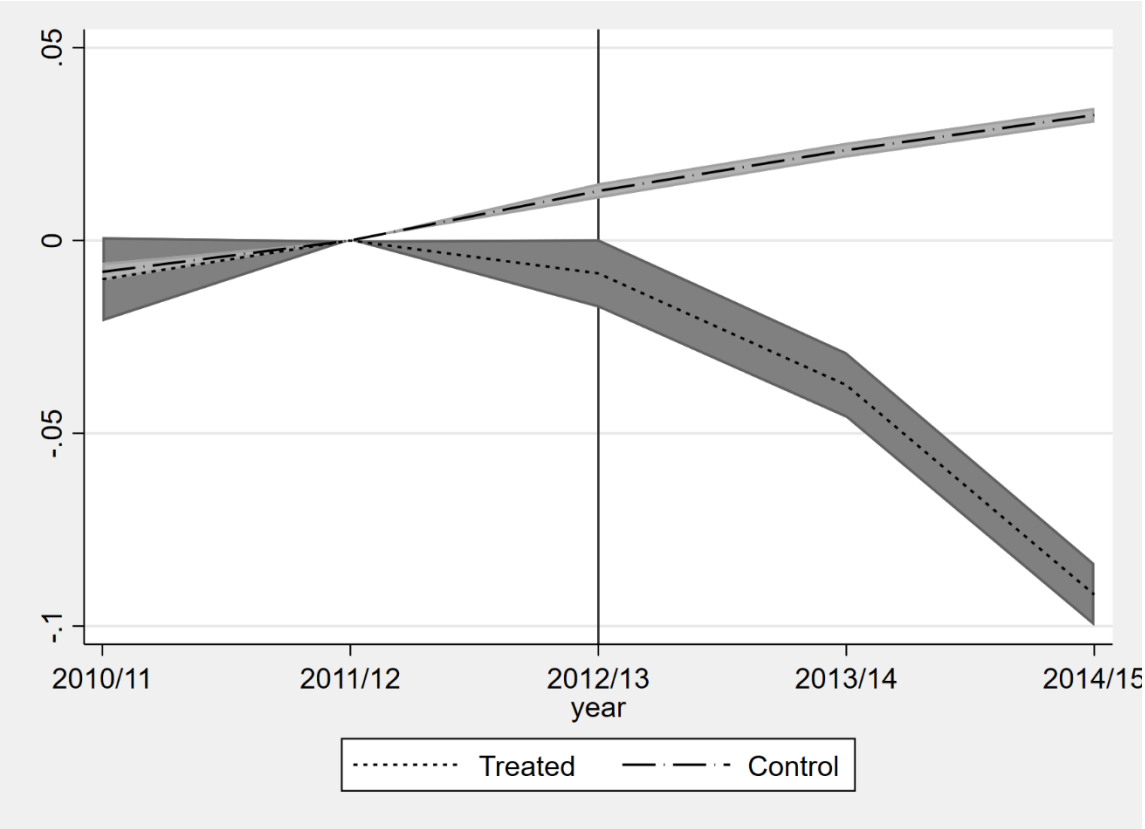
Table 4: Mean monthly incomes (in millions) for the 'top taxpayers' treatment and control groups

Fiscal year	Treatment group ('top taxpayers')	Control group ('next 9%')
2010–11	24.937	3.901
2011–12	24.309	3.949
2012–13	23.128	3.993
2013–14	22.386	4.035
2014–15	20.946	4.075
Pre-reform	24.623	3.925
Post-reform	22.153	4.034

Note: treatment group ('top taxpayers'): monthly taxable income UGX10,000,001 or higher. Control group ('next 9 per cent' = p90 up to the 'top taxpayers' group threshold): monthly taxable income UGX2,117,900–10,000,000. '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.

Figure 5: Parallel trends for treatment group ('top taxpayers') and control group ('next 9 per cent')



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.

In the following we concentrate on the treatment group of 'top taxpayers' and the control group, ranging from the 90th 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.

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 ten

per cent when we lump together all pre- and all post-reform observations. By contrast, mean monthly taxable income increases consistently for the control group, increasing by 4.5 per cent between fiscal years 2011–12 and 2014–15, and by 2.78 per cent when we compare pre- and post-reform data.

Figure 5 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.

5 Results

In this Section we start by discussing results for top taxpayers in Section 5.1, including sensitivity analysis, before investigating margins of taxpayer response beyond taxable income in Section 5.2. In Section 5.3 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 Strong response by top taxpayers

Table 5 presents 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.

Table 5: Benchmark DiD results for treatment group 'top taxpayers'

	'Top taxpayers'		'Top taxpayers', censored	
	(1)	(2)	(3)	(4)
	Simple	Weighted	Simple	Weighted
Basic:				
$Treat_i$*$After_t$	-0.0779**	-0.317**	-0.0765**	-0.174***
	(0.0343)	(0.129)	(0.0342)	(0.0611)
Year and month dummies	Yes	Yes	Yes	Yes
R-squared	0.561	0.627	0.562	0.705
Implied elasticity	0.5453**	2.219**	0.5355**	1.218***
	(0.2401)	(0.903)	(0.2394)	(0.4277)
Observations	2,015,531		2,015,531 (censored 2,039)	

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 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.

Results for our basic specification in column (1) show 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 0.55, which is at the upper end of estimates reported in the literature (see e.g., Neisser 2018), although the literature as discussed concentrates mainly

on developed countries. When we use income weights (column 2), the elasticity increases further to around two.

Although there were no evident differences in the income trends between the treated and the control group, we have also estimated specifications that take potentially diverging pre-trends into account. These results are available in Table A.1 in the Appendix. Adjusting responses for possibly different pre-trends does not appear to make a marked difference for the size of our estimates.

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 99.99th percentile for each year.[9] Capping taxable incomes at the top makes a large difference: the income-weighted elasticity drops from 2.2 to 1.2. This suggests that the very high elasticity found in the basic specification is driven by a few large observations.

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 Table 6, and results are in line with our previous findings. The response among the lower half of the 'top taxpayers' is more muted, with an elasticity of 0.28 (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 1.26.

Table 6: DiD results for the upper and lower halves of the treatment group 'top taxpayers'

	Top 1–0.5%		Top 0.5%, censored	
	(1)	(2)	(3)	(4)
	Simple	Weighted	Simple	Weighted
Basic:				
$Treat_i$*$After_t$	-0.0405***	-0.0397***	-0.113***	-0.180***
	(0.0107)	(0.0099)	(0.0408)	(0.0526)
Year and month dummies	Yes	Yes	Yes	Yes
R-squared	0.316	0.434	0.539	0.793
Implied elasticity	0.2835***	0.2779***	0.791***	1.260***
	(0.0749)	(0.0690)	(0.2856)	(0.3682)
Observations	1,913,501		1,913,497 (censored 2,039)	

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 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.

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 7 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

[9] The censoring applies to just over 2,000 observations, i.e. around 35 taxpayers annually if they have taxable income in every month of the year.

in the face of higher tax rates. Results in Table 7 indicate that response to the reform is more pronounced among large firms.

Table 7: Heterogeneity analysis for treatment group 'top taxpayers' in small and large firms, censored

	Baseline		Small firms		Large firms	
	(1)	(2)	(3)	(4)	(5)	(6)
	Simple	Weighted	Simple	Weighted	Simple	Weighted
Basic:						
$Treat_i$*$After_t$	-0.0765**	-0.174***	-0.0397**	-0.187***	-0.146*	-0.225*
	(0.0342)	(0.0611)	(0.0199)	(0.0619)	(0.0813)	(0.115)
Year and month dummies	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.562	0.705	0.553	0.701	0.577	0.714
Implied elasticity	0.5355**	1.218***	0.2779**	1.309***	1.022*	1.575*
	(0.2394)	(0.4277)	(0.1393)	(0.4333)	(0.5691)	(0.805)
Observations	2,015,531		989,784		1,025,747	

Note: we use median numbers of employees by firm to define large and small firms. The estimated models include tax office fixed effects. There are 2,039 censored observations. 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.

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.[10] 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.[11] Otherwise a firm is monitored by a standard tax office. Firms under the remit of the LTO might on one hand thus be or perceive themselves as more strongly monitored; at the same time, they likely are better equipped to collude with their employees in declaring lower taxable incomes.

Table 8 shows that employers under the remit of the LTO appear to react far more strongly than those classified under the MTO or other tax offices to the tax reform. While the lack of statistical significance of the results for other tax offices may be due to fewer observations, point estimates are also smaller for firms not handled by the LTO. As shown in Table 8, the largest share of employees and thus employers report to the LTO; the shares of firms reporting to the different types of tax offices are similar before and after the reform.

Finally, turning to robustness analysis, we first examine responses in a sample consisting of the same set of firms across the analysis period. This enables us to add firm fixed effects to the regression, backing out any firm-specific factors that might be driving the results. Perhaps more importantly, using the PAYE records submitted by the same set of firms across time isolates any effect stemming from selection issues among new taxpayers: if the highest-income earners have

[10] 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.

[11] 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.

always been in the tax net but lower-income individuals also become taxed as the tax net expands, the previous estimates might be upwardly biased.

The results based on the balanced firm panel PAYE records reported in Table 9 are still statistically significant, but the size of the estimates is much smaller. The estimate, for instance, of the income-weighted elasticity for the censored sample declines from 1.21 to around 0.5. This finding implies that it is especially firms that are filing PAYE with URA for the first time (or filing again after not filing) that pay lower salaries in the top tax bracket. Since this phenomenon may not necessarily be due to the tax system, the high elasticities reported may not be fully caused by the tax reform alone, and we consider the estimates reported in Table 9 our preferred estimates.

Table 8: Heterogeneity analysis for treatment group 'top taxpayers' in MTO, LTO, and all other tax offices, censored

	LTO firms		MTO firms		All other tax offices	
	(1)	(2)	(3)	(4)	(5)	(6)
	Simple	Weighted	Simple	Weighted	Simple	Weighted
Basic:						
$Treat_i$*$After_t$	-0.0965*	-0.199**	-0.0247	-0.0485	-0.0416	-0.0929
	(0.0509)	(0.0783)	(0.0228)	(0.0591)	0.0404	(0.0916)
Year and month dummies	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.591	0.710	0.489	0.668	0.513	0.685
Implied elasticity	0.6755*	1.393**	0.1729	0.3395	0.2912	0.6503
	(0.3563)	(0.5481)	(0.1596)	(0.4137)	(0.2828)	(0.6412)
Observations	1,240,972		337,085		437,474	

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; we further include tax office fixed effects in these specifications. There are 2,039 censored observations. 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 9: DiD results for a balanced firm panel

	'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
Basic:								
$Treat_i$*$After_t$	-0.0495**	-0.164*	-0.0484**	-0.0679**	-0.0504***	-0.0467***	-0.0573***	-0.0682***
	(0.0229)	(0.0932)	(0.023)	(0.0294)	(0.00164)	(0.00164)	(0.00417)	(0.0134)
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	0.3465**	1.148*	0.3388*	0.4753**	0.3528***	0.3269***	0.4011***	0.4774***
	(0.1603)	(0.6524)	(0.161)	(0.2058)	(0.01148)	(0.01148)	(0.02919)	(0.0938)
Observations	1,681,849		1,681,849 (censored 1,631)		1,601,130		1,601,127 (censored 1,631)	
No. of firms	2,294		2,294		2,292		2,289	

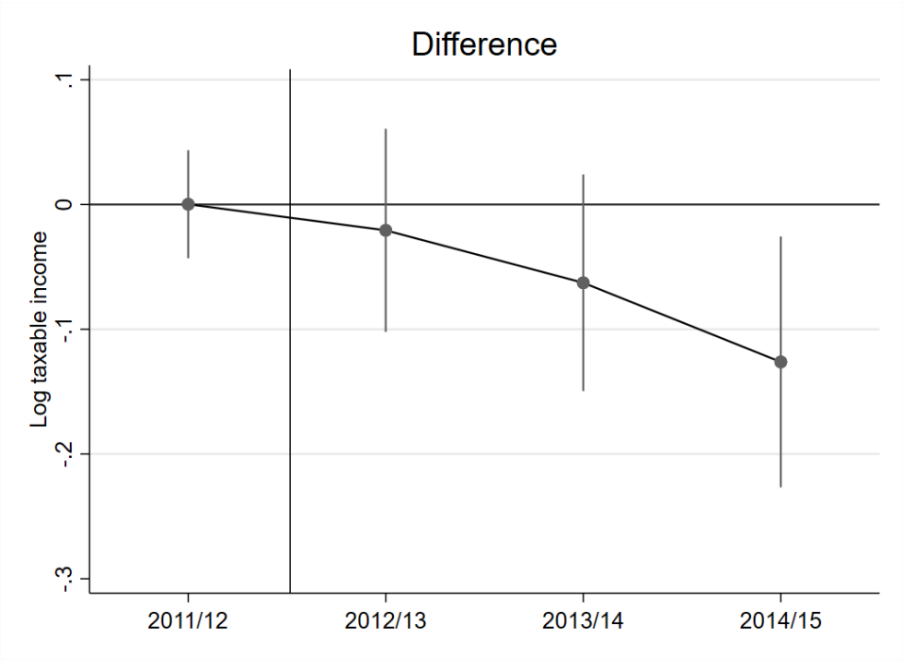
Note: columns (2), (4), (6), and (8) present weighted least squares estimates with income used as weights. In columns (3–4) and (7–8), incomes exceeding the top one per cent threshold among the treated group (that is, income above 0.01 per cent of all income earners) are censored to the threshold value. The 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.

We further examine whether the results are sensitive to the selection of the control group. Instead of using the next nine per cent of the distribution as the control group, we narrow the control group down to the next four per cent of observations ranked just below the treated individuals (see Table A2 in the Appendix for detailed results). This lowers the elasticity estimate in the basic specification from 0.55 (Table 5, column 1) to 0.39, while the weighted estimate declines from 2.2 to 2.1. On the other hand, including the entire tax bracket as controls raises elasticities somewhat. The size of the estimate thus seems to hinge significantly on the composition of the treatment group, rather than on the exact definition of the control group.

Finally, we study how taxable income responds across time using event study methods. Estimation results (with corresponding confidence intervals) are plotted in Figure 6. 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. 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 6: Event study plots for the treatment group 'top taxpayers', censored



Note: difference estimated using the DiD regression model. The vertical line indicates the time of the reform in July 2012.

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

5.2 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.

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 10 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.

Table 10: Summary statistics of basic salary and other income.

	Obs	Mean	St dev.	Min	Max
Control group, before the treatment					
Basic salary	463,604	3.547	1.798	0.000	17.590
Other income	463,604	0.385	0.835	-10.653	9.956
Taxable income	463,604	3.932	1.802	2.118	10.000
Control group, after the reform					
Basic salary	1,347,983	3.689	1.839	0.000	24.941
Other income	1,347,983	0.348	0.831	-21.824	10.000
Taxable income	1,347,983	4.037	1.829	2.118	10.000
Treatment group, before the treatment					
Basic salary	47,767	20.120	92.405	0.000	15417.000
Other income	47,767	4.436	19.590	-8.852	2326.000
Taxable income	47,767	24.556	102.043	10.000	17743.000
Treatment group, after the reform					
Basic salary	156,177	18.560	27.618	0.000	4741.141
Other income	156,177	3.451	15.093	-15.487	1927.756
Taxable income	156,177	22.011	32.279	10.000	4741.141

Note: Summary statistics before and after the reform for the uncensored repeated cross-sectional data in millions of UGX, by treatment status.

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

To examine this further, Table 11 contains DiD results for the same specifications as Table 5, but with basic salary as the outcome variable. The results from the specification with no control for potentially different pre-trends show a reduction in basic salary, yet the effect is not statistically significant. This suggests that for the treatment group as a whole, it is other income that renders the response in taxable income larger and statistically significant. This conforms with the general perception that basic salary is more rigid and less under taxpayers' control than the items collected under other income. However, for the upper half of the treatment group (results not reported for brevity), the decline in basic salary is statistically significant at conventional levels.

Table 11: DiD results for treatment group 'top taxpayers', dependent variable: basic salary.

	'Top taxpayers'		'Top taxpayers', censored	
	(1)	(2)	(3)	(4)
	Simple	Weighted	Simple	Weighted
Basic:				
$Treat_i$*$After_t$	-0.0374	-0.283*	-0.0363	-0.136
	(0.0443)	(0.145)	(0.0439)	(0.0859)
Year and month dummies	Yes	Yes	Yes	Yes
R-squared	0.462	0.565	0.387	0.637
Implied elasticity	0.2618	1.981*	0.254	0.952
	0.3101	(1.015)	(0.307)	(0.601)
Pre-trend controls:				
$Treat_i$*$After_t$	-0.0751*	-0.320**	-0.0764*	-0.176**
	(0.0444)	(0.146)	(0.0439)	(0.0859)
Year and month dummies	Yes	Yes	Yes	Yes
R-squared	0.396	0.514	0.462	0.581
Implied elasticity	0.5257*	2.240**	0.535*	1.267***
	0.3108	(1.022)	(0.307)	(0.4277)
Observations	2,007,509		2,007,509	

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. In the lower panel, we first predict income growth for post-reform years from pre-reform data separately for the treatment and control groups; we then subtract the trend from post-reform data, and use these values as outcomes. 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.

Next, we examine 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.

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 12 presents the means of various firm-level variables, such as log sales, costs, profits, proposed dividends,[12] 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

[12] 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.

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 12). To put it simple, 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.

5.3 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 (see detailed results in the Appendix). 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. Results in Table A3 in the Appendix indicate that incomes increase more for these groups than among the control group. But the estimated treatment effects are small, and their significance is sensitive to whether or not possibly different linear trends are controlled for. The corresponding elasticities are also small, at around 0.1.[13] In terms of estimating the reform's dynamic impacts on revenue, the response of the 'top taxpayers' group seem to dominate.

[13] For the group whose marginal tax rate does not change, an intensive margin elasticity cannot be calculated (division by zero). Individuals in this group also report higher incomes after the reform. If there were significant income effects, they would instead lower their earnings since their average tax rate declined. This channel is probably not so important for salaried workers with mid-level incomes in a poor country. Instead, it is more likely that the positive response arises from (a discrete decision about) starting to report incomes when the tax rate falls.

Table 12: 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.

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. In particular, we are interested in how far the behavioural response along the taxable income margin generates less revenue. For that purpose, we first calculate the actual tax revenues recorded by URA for all fiscal years. Second, we compare those values to simulated revenue in the absence of behavioural responses to the reform. For the latter we apply the post-reform tax schedule to the uprated pre-reform taxable incomes. The uprating factor for incomes is the difference in the mean income growth between the control and treatment groups.[14] Finally, comparing the actual revenue with the simulated revenue reveals how much revenue the behavioural responses 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 13 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.

For the counterfactual scenario of the 'top taxpayers' treatment group, uprated incomes are seven per cent higher than actual incomes in the post-reform period. This uprating factor of seven per cent reflects a conservative mean estimate for the DiD results discussed in Section 5; this would correspond to the weighted estimates in the case of the firm panel in Table 9, column (4); i.e. our preferred estimates. To sum up, simulated revenues are obtained by first uprating employees' taxable incomes in the treatment group by seven 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 UGX46 billion (Table 13, columns (2) and (3), mean post-reform UGX435 minus UGX389 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 (seven 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

[14] We do not use estimates of the DiD regressions from Section 5 as the uprating factor, because estimates depend significantly on the chosen specifications. Instead, we use a simple illustrative calculation of mean income growth.

extent that these other payouts are within the tax net, the overall revenue consequences would be smaller.

Table 13: PAYE actual revenues and counterfactual simulated revenues in the case of no behavioural changes 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	182	119	
2011–12	346	202	
2012–13	428	341	378
2013–14	500	389	433
2014–15	549	439	495
Mean, pre-reform	264	161	
Mean, post-reform	493	389	435

Note: all monetary values are in UGX billions. 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.

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:

$$\tau^* = \frac{1}{1+a*e} \qquad [3]$$

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 so as 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 [3].

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] This would suggest that the current Ugandan top tax rate is quite close to the theoretical rate maximizing revenues from top earners. 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).

[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

Similarly, as for the top taxpayers, we calculate the actual and simulated tax revenues for the other treatment groups and the respective control group in Table 14. The actual and simulated revenues for the other treatment groups ('to zero', 'MTR down', and 'ATR down, lower incomes') are shown in columns (1–5), and actual revenue from the control group (monthly incomes UGX410,000–704,447, the threshold of the 70th percentile) pertaining to these treatment groups is shown in column (6).

Table 14: PAYE actual revenues and counterfactual simulated revenues in the case of no behavioural changes for other treatment groups

Fiscal year	'To zero'	'MTR down'		'ATR down, lower incomes'		Control group
	(1)	(2)	(3)	(4)	(5)	(6)
	Actual revenue	Actual revenue	Simulated revenue	Actual revenue	Simulated revenue	Actual revenue
2010–11	4.3	4.1		4.6		22.9
2011–12	5.2	6.9		7.0		35.8
2012–13	0	2.7	2.0	4.5	3.8	36.0
2013–14	0	3.3	2.6	5.5	4.7	50.0
2014–15	0	4.1	3.2	10.7	9.3	71.7
Mean, pre-reform	4.8	5.5		5.8		29.4
Mean, post-reform	0	3.4	2.6	6.9	5.9	52.6

Note: all monetary values are in UGX billions. Columns (1–5) show revenues, both actual and simulated, for treatment groups. 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 simulated revenues that would be available from the treatment group 'MTR down' after the reform if there were no behavioural responses to the reform. Column (4) shows the actual revenue for the treatment group 'ATR down' (incomes UGX335,001–410,000); simulated revenues without behavioural responses for the same treatment group are in column (5). Column (6) 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.

The revenue calculations in Table 14 follow the changes in tax rates for the treatment groups. 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).

As for the 'top taxpayers' group, we use uprated incomes and post-tax rules to simulate PAYE revenues for the treatment groups for a scenario without behavioural responses. Depending on the treatment group, the uprated incomes are around two to three per cent lower than actual incomes in the post-reform period, reflecting the DiD results found in the empirical analysis. The simulated revenues are therefore lower than actual revenues. This suggests that without behavioural reactions, the revenue loss stemming from those treatment groups would be larger. The annual revenue gains due to behavioural responses are on average UGX0.8 billion (Table 14, columns (2) and (3), mean post-reform UGX3.4 minus 2.6 billion) or 23 per cent of actual revenues from the treatment group 'MTR down', and UGX1 billion (Table 14, columns (4) and (5), mean post-reform UGX6.9 minus 5.9 billion) or 14 per cent of actual revenues from the treatment group 'ATR down, lower incomes'.

As pointed out above, these calculations rest on a strong simplification. Nevertheless, we would argue that the revenue simulations for the treatment groups captured in Table 14 are less upwardly biased than the revenue calculations for the 'top taxpayers' treatment group in Table 13, because

low-income wage earners have fewer opportunities than high-income earners to shift incomes between tax bases or adjust their incomes by colluding with their employers.

6.3 Overall revenue implications

If there were no behavioural effects (i.e. according to the simulated revenues), the annual revenues from the 'top taxpayers' group would increase by UGX274 billion (Table 13, column (2), mean pre-reform, and column (3) mean post-reform UGX435 minus UGX161 billion) and decline by UGX7.6 billion[16] from groups that experience a tax rate decrease. Taken together, the increase in revenues would dominate, leaving overall revenue of UGX266.4 billion. With behavioural impacts included (i.e. using the actual revenue numbers), the revenue gain from the top group is UGX228 billion, and the revenue loss from the lower-income taxpayers amounts to UGX5.8 billion, implying an overall gain of UGX222.2 billion.

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. 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 incomes – of the reform must be towards lower after-tax income inequality. On top of the mechanical impact, the behavioural reaction to the new top tax rate further reinforces the impact. In the pre-reform years in our data set, the Gini coefficient for after-tax income was on average 0.635. Had incomes not adjusted downwards at the top, the Gini for after-tax income would have been 0.611 in the period after the reform. This has been calculated by adjusting upwards the actual incomes in the top bracket by 7 per cent, which may be seen as a mean income reduction due the reform on the basis of the econometric estimates. The actual Gini after the reform was, in turn, 0.606. This overall reduction in the Gini coefficient, approximately 5 per cent, may be regarded as modest, and even after the reform, earnings inequality remains at a high level in the country.

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 that for the longest time other sources of tax have made up the bulk of government revenue in developing countries. Personal income tax has thus not been a major concern. Yet in the age of DRM, 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.

[16] The value UGX7.6 billion is calculated from Table 12. Summing all mean pre-reform actual revenues from columns (1), (2), and (4), we then subtract the sum of all mean post-reform simulated revenues from columns (3) and (5), which results in (4.8+5.5+5.8) - (2.6+5.9) = 7.6.

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 shifted 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 DiD 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, in comparison with income developments for employees situated just below them in the taxable income distribution. Further analysis reveals that the bulk of the response stems from a small set of observations at the very top. Our preferred elasticity estimates are around 0.33 to 0.48.[17] Since we only examine one reform episode, it might be the case that other, simultaneous non-tax forces that lowered the highest incomes in the country confound the estimates (implying that our estimates are upwardly biased); but on the other hand, the estimates from income-weighted regressions with no censoring lie substantially above the range referred to above.

Taking into account that the analysis applies to wage earners, our estimates are greater than those for developed countries, where the average estimate is 0.2 (Neisser 2018). A likely reason is that tax avoidance may be a larger problem in an environment with a lower tax capacity. This has interesting implications for thinking about optimal income taxation in poor countries. On one hand, their pre-tax inequality is often higher than in developed economies, which implies that tax progressivity should be greater for similar redistributive tastes. On the other hand, our analysis suggests that the efficiency costs of taxes may well also be greater, in turn lowering the optimal tax. In any case, the increase in the top tax rate reduces after-tax income differences, and the behavioural response makes the inequality reduction even more pronounced.[18]

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 no behavioural response, the revenue increase would have been greater. However, the estimated response is not so large that Uganda would be 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.

[17] Such estimates correspond to the censored responses from regressions for a model where taxpayers are restricted to a balanced panel of firms.

[18] This argument assumes that reported earnings reflect true changes in income levels.

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Appendix

Table A.1: Benchmark DiD results for treatment group 'top taxpayers' with pre-trend controls

	'Top taxpayers'		'Top taxpayers', censored	
	(1)	(2)	(3)	(4)
	Simple	Weighted	Simple	Weighted
$Treat_i$*$After_t$	-0.0828**	-0.322**	-0.0823**	-0.181***
	(0.0343)	(0.129)	(0.0342)	(0.0611)
Year and month dummies	Yes	Yes	Yes	Yes
R-squared	0.553	0.621	0.551	0.698
Implied elasticity	0.5796**	2.254**	0.5824**	1.267***
	(0.2401)	(0.903)	(0.2394)	(0.4277)
Observations	2,015,531		2,015,531 (censored 2,039)	

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. In all the models, we first predict income growth for post-reform years from pre-reform data separately for the treatment and control groups; we then subtract the trend from post-reform data, and use these values as outcomes. 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.

Table A2: Benchmark DiD results using the control group 'next four per cent' for the treatment group 'top taxpayers'

	Top taxpayers		**Top taxpayers, censored**	
	(1)	(2)	(3)	(4)
	Simple	Weighted	Simple	Weighted
Basic:				
$Treat_i$*$After_t$	-0.0551*	-0.298**	-0.0537	-0.156***
	(0.0334)	(0.128)	(0.0332)	(0.0601)
Year and month dummies	Yes	Yes	Yes	Yes
R-squared	0.642	0.549	0.648	0.652
Implied elasticity	0.3857*	2.086**	0.3759	1.092***
	(0.2338)	(0.896)	(0.2324)	(0.4207)
Pre-trend controls:				
$Treat_i$*$After_t$	-0.0707**	-0.314**	-0.0711**	-0.173***
	(0.0334)	(0.128)	(0.0333)	(0.0601)
Year and month dummies	Yes	Yes	Yes	Yes
R-squared	0.611	0.528	0.613	0.627
Implied elasticity	0.4949**	2.198**	0.4977**	1.211***
	(0.2338)	(0.896)	(0.2331)	(0.4207)
Observations	1,029,046		1,029,046 (censored 2,039)	

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. In the lower panel, we first predict income growth for post-reform years from pre-reform data separately for the treatment and control groups; then we subtract the trend from post-reform data, and use these values as outcomes. 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.

Table A3: Benchmark 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:						
$Treat_i$*$After_t$	0.0443***	0.0431***	0.0147***	0.0147***	0.0298***	0.0319***
	(0.00875)	(0.00811)	(0.00467)	(0.00453)	(0.00516)	(0.00524)
Year and month dummies	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.925	0.911	0.860	0.829	0.602	0.596
Implied elasticity	0.3987***	0.3879***	0.1176***	0.1176***		
	(0.07875)	(0.07299)	(0.03736)	(0.03624)		
Pre-trend controls:						
$Treat_i$*$After_t$	0.0113	0.0102	0.011**	0.011**	0.0192***	0.0213***
	(0.00876)	(0.00813)	(0.00466)	(0.00453)	(0.00509)	(0.00517)
Year and month dummies	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.942	0.931	0.867	0.837	0.665	0.630
Implied elasticity	0.1017	0.0918	0.088**	0.088**		
	(0.07884)	(0.07317)	(0.03728)	(0.03624)		
Observations	6,695,346		5,735,298		4,541,420	

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. In the lower panel, we first predict income growth for post-reform years from pre-reform data separately for the treatment and control groups; then we subtract the trend from post-reform data, and use these values as outcomes. 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 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.