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The effects of personal income tax reform on employees' taxable income in Uganda

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Abstract: We evaluate a major personal income tax reform in Uganda that came into effect in 2012–13. 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 administrative data submitted by employers in the formal sector, we analyse the impact on taxable income of the introduction of the additional top tax band. Our results indicate that the elasticity of taxable income in Uganda is larger than in previous results from developed countries. Overall, the additional revenue generated from the introduction of the additional top tax band by far offset the revenues lost from the decreased revenues from employees with medium to lower taxable incomes, despite the large elasticity of taxable income at the top. We contribute to the very scarce literature on the effects of personal income tax reform on employees' income in a low-income country in Africa.

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

JEL classification: C31, H24, O23

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1 Introduction

Developing countries are increasingly aiming to raise their own revenues. Apart from decreasing such 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, and containing inequality, are therefore also key elements of the Sustainable Development Goals.

While developing countries' tax receipts have traditionally relied mainly on taxes on (multinational) firms, trade taxes, and more recently increasingly on value added tax and other consumption taxes, personal income taxation has often received less attention. Yet not only does personal income tax hold potential to boost DRM, but personal income tax policy can also be a highly equitable tax tool, addressing inequality concerns and social protection goals at the same time. The increased use of digital technologies by revenue authorities, together with taxpayer awareness campaigns, has further leveraged the potential of personal income tax collection.

Understanding taxpayer behaviour in response to tax rate changes is key for an equitable personal income tax policy. 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 nearly 81 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 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 the responses to the 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) for the fiscal years before and after the reform took place through the pay-as-you-earn (PAYE) system. We further compare simulated revenue changes using pre-reform and post-reform revenue changes.

A vast literature concentrates on estimating elasticities of taxable income, or in other words on tax responsiveness. Much of this work has focused on developed countries, since access to administrative tax data in developing countries has been challenging, or the 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). Most papers examine tax policies influencing firms, and studies examining the taxation of individuals in low- and middle-income countries are not common. Among these, Kleven and Waseem (2013) use Pakistani tax administrative data to analyse the elasticity of taxable income for wage earners and the self-employed, detecting substantial bunching at notch points. Kemp (2019) uses the bracket creep approach in the South African context, and his preferred elasticity is

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.

approximately 0.3, while Tortarolo et al. (2020) examine intertemporal labour supply elasticity using Argentinian data.

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.² Furthermore, we use the universe of thoroughly cleaned and checked administrative data on employees in the formal sector. Finally, since arguably the most interesting aspect of the reform was the sizeable increase in the top marginal tax rate, the results of the paper speak to the feasibility of increasing income tax progressivity in a low-income economy.

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 a control group, i.e. those in a lower tax band. The estimated elasticities with respect to the change in the retention rate are large, ranging from approximately 0.5 to two, depending on whether income weighting is used or not. However, the largest elasticities are very sensitive to the removal of a few outliers, and that is why our preferred elasticity estimates fall to the range between 0.5 and one. Further, when the analysis is restricted to the same set of firms, the elasticity estimates are in the ballpark of 0.5. These are still substantially large for wage earners, especially compared with corresponding results from developed countries. The 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. Suggestive evidence comparing firms whose PAYE incomes paid to the top taxpayer group decreased the most with other similar firms indicates that dividends increased more among the former set of firms. Part of the response was therefore probably driven by income shifting between different tax bases.

The paper is structured as follows. Section 2 explains the institutional background of the income tax in Uganda. In Section 3 we turn to the data and descriptive evidence, before moving on to describe the empirical approach in Section 4. Section 5 presents the regression results, while the revenue implications of the reform are discussed in Section 6. Section 7 concludes.

2 Institutional background

2.1 Taxation of individual income in Uganda

Income tax in Uganda is governed by the Income Tax Act (of 1 July 1997, Cap 340 of the Laws of Uganda 2000) drawn from Article 189 of the Constitution of the Republic of Uganda of 1995, which outlines the functions of central government. 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 listed in the First Schedule to the Act. Each of these persons may be assessed for income tax if he,

² Ours is also one of the first studies to examine personal income taxation in a low-income country, along with Kleven and Waseem (2013).

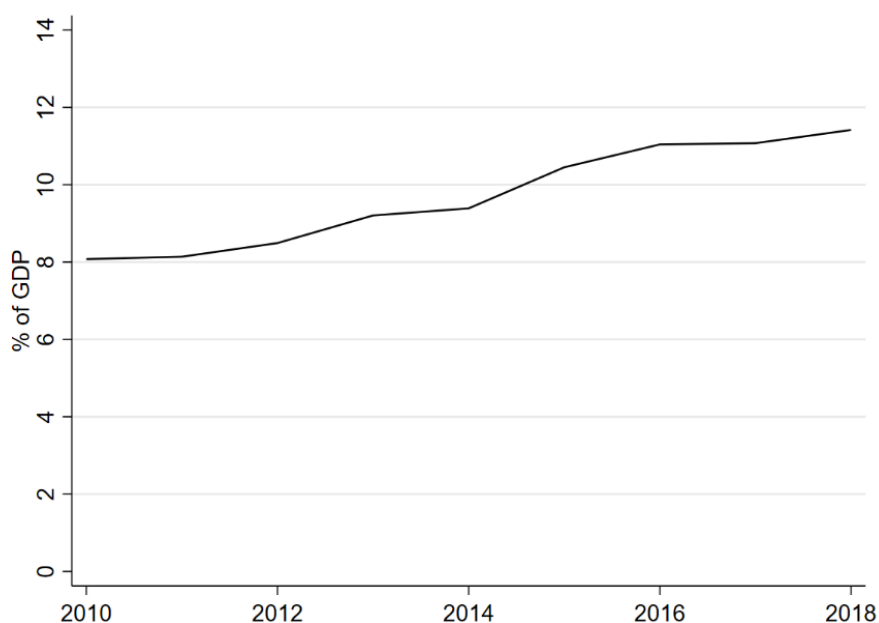
³ Income Tax Act, Cap 340 of the Laws of Uganda 2000, Section 5(1).

she, or it earns taxable income. URA, which was established in 1991 by the URA Statute,⁴ is responsible for the enforcement and implementation of the income tax.

PAYE is a form of individual tax charged on employment income⁵ in the scope of income taxation. The tax is deducted from the employment emoluments before the last payment for the period (normally a month) is made to the employee. PAYE is therefore a source (withholding) tax, because the money 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. This term is usually applied to persons who are self-employed in business. However, individual income tax is not limited to business income alone. It includes all income earned by an individual from all sources, except that income which is assessable separately.⁶ Individual income tax rates 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 (Income Tax Act, of 1 July 1997, Cap 340 of the Laws of Uganda 2000, Section 9(1)). 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 the employee earns from him/her (Income Tax (Withholding Tax) Regulations 2000, of 1 July, Regulations 3(11) and (15)).

Figure 1: Total tax revenue as a share of GDP



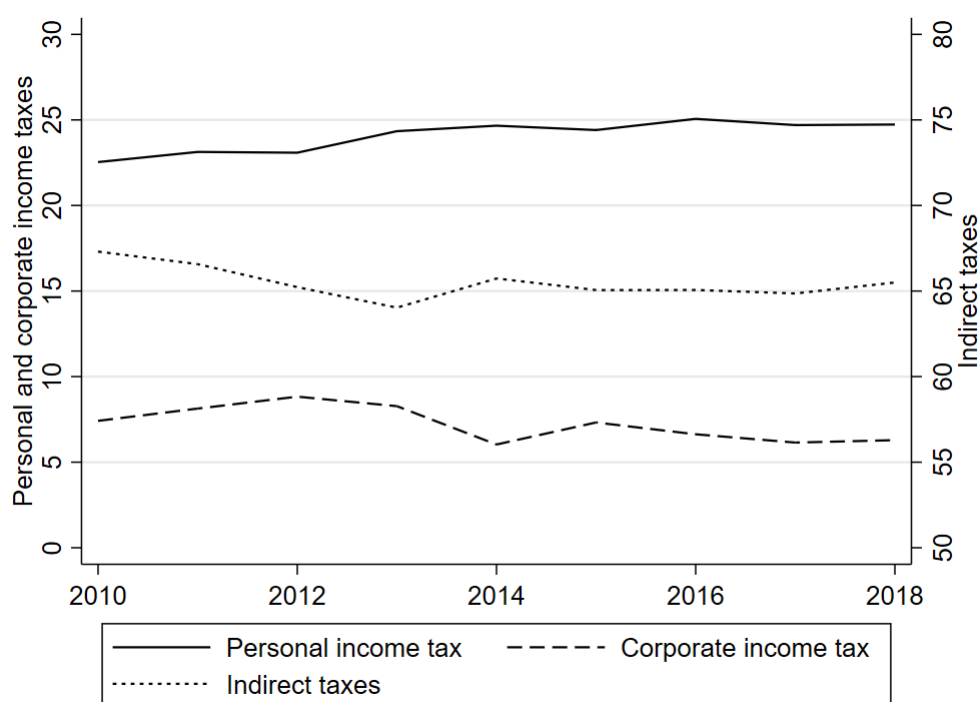
Source: authors' visualization based on data from UNU-WIDER (2020).

⁴ URA Act 1991, of 5 September, Cap 196 of the Laws of Uganda 2000.

⁵ 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)).

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.

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



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

Uganda increased its tax take in the 2010s, and the share of revenues from taxing individuals also rose, from approximately 23 per cent in 2010 to over 25 per cent in 2016 (see Figures 1 and 2). The contribution of PAYE alone was UGX2.4 trillion⁷ 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 gross revenues, with taxes on international trade contributing the rest (URA 2018; Waiswa et al. 2020).

The growth in PAYE revenue was enhanced by several reforms, including 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 processes 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). According to Section 4(1) of the Tax Procedures Code Act (Act 14 of 2014, of 1 July 2016), all employees are required to register and acquire a TIN. However, in practice, employers are currently not required to report TINs for all their employees, and employers cannot force their employees to acquire a TIN. Employers are

⁷ In 2020, US\$1 = UGX3,700.

therefore not held to report all employees' TINs by URA, to avoid them not reporting PAYE at all for those employees.

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 (Local Government (Amendment) (No. 2) Act 2008, of 7 July).

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.

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.⁸

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

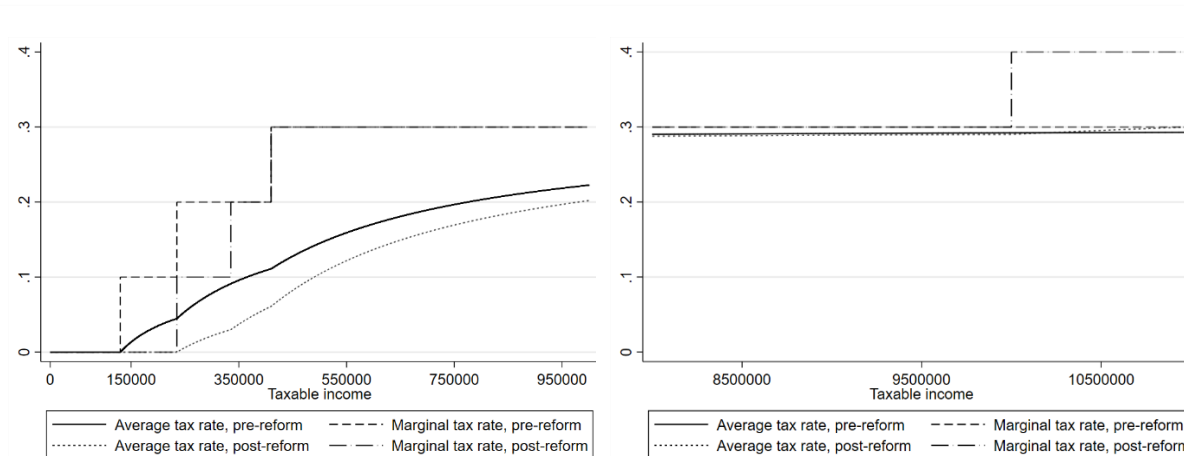
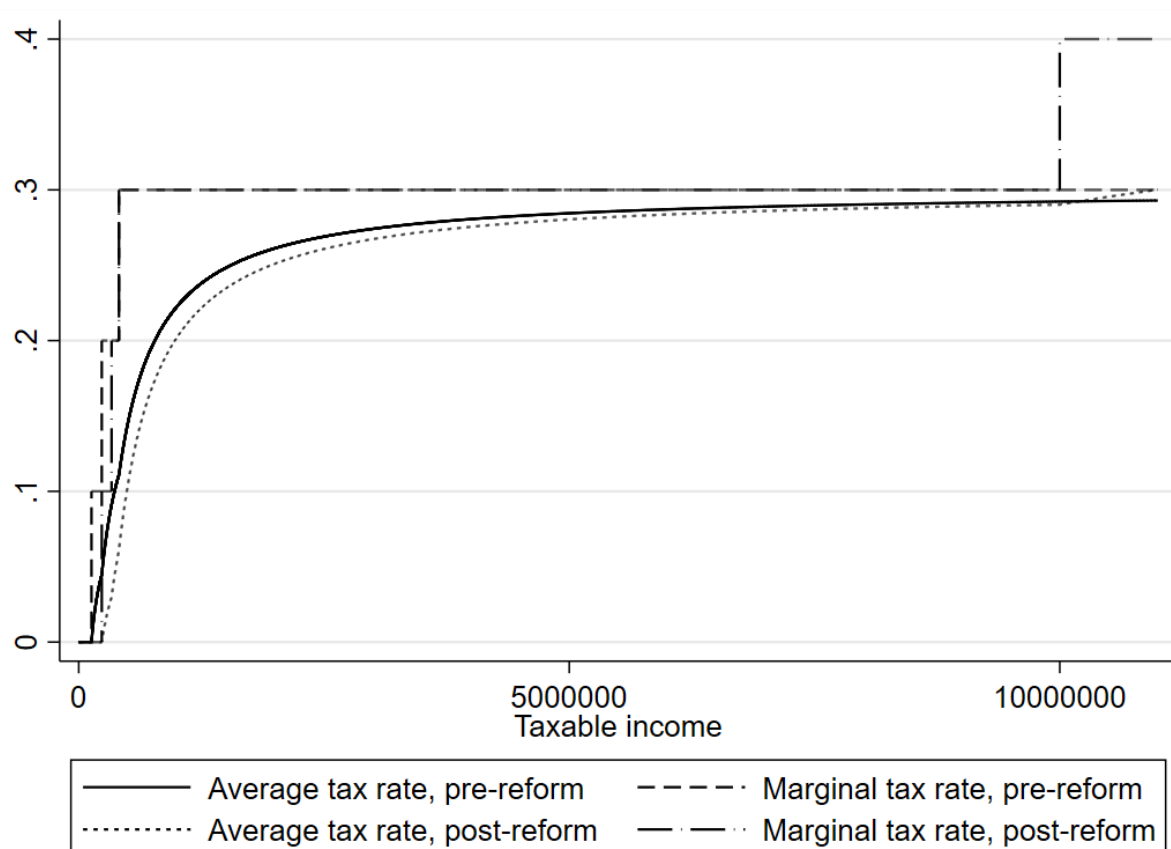
	Monthly taxable income	Tax rate
Pre-reform: 1997–98 to 2011–12	Not exceeding 130,000	0%
	Over 130,000, but not exceeding 235,000	10% of the amount exceeding 130,000
	Over 235,000, but not exceeding 410,000	10,500 plus 20% of the amount exceeding 235,000
	Over 410,000	45,500 plus 30% of the amount exceeding 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 (of 1 July 1997, Cap 340 of the Laws of Uganda 2000) and the Income Tax (Amendment) Act 2012 (of 1 July).

⁸ 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).

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 in the reformed scheme.

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.

3 Data and descriptive evidence

We use the universe of PAYE data extracted from URA databases. 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 quality and coverage due to the roll-out of the e-tax system. 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 thus cannot create a panel of taxpayers.

Linking employers’ TINs across time is nevertheless possible, as employers’ TINs are recorded in the data. This employer-based panel serves as an important robustness check: the data in digital format does not cover all regions in the first years, because of 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.

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. They represent only around two per cent of observations and are not our main interest of analysis.

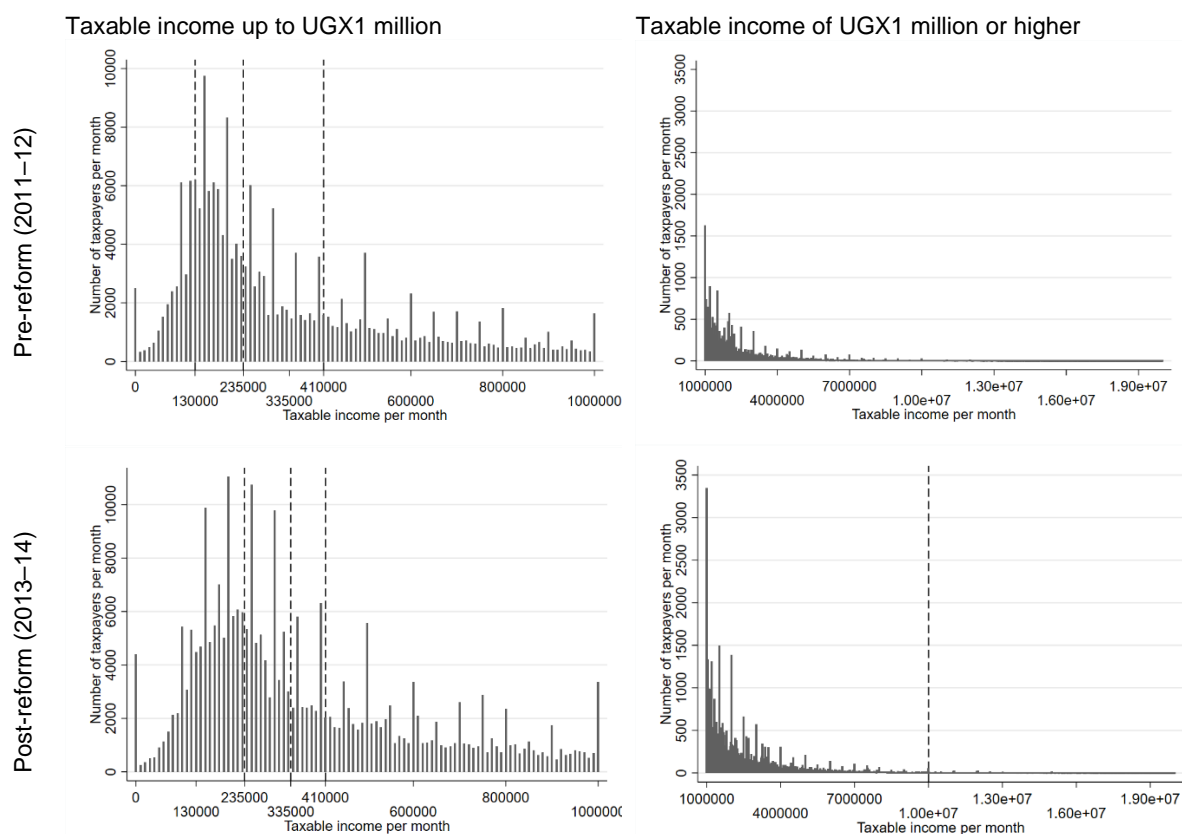
Table 2: Summary statistics of employees subject to PAYE

		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 is identifiable.

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.

In the following we concentrate on the ‘top taxpayers’ and the highest earning employees in the ‘ATR down, higher incomes’ taxpayer group, situated just below the top group in the taxable income distribution. Specifically, we compare the ‘top taxpayer’ group, who constitute roughly one

per cent, with the next nine per cent of taxpayers, ranging from the 90th percentile to the threshold of the ‘top taxpayers’ (roughly to the 99th percentile). We opt to use a smaller set of the ‘ATR down, higher incomes’ taxpayer group as the group is very large and thus likely heterogeneous, as observations are located further away from the threshold of the top taxpayer group. Furthermore, the difference in the average tax rates pre- and post-reform becomes negligible, making the change in the marginal tax rate the only difference between the two groups. We thus refer to the ‘top taxpayer’ group as the treatment group, and the next nine per cent in the distribution as the control group, in the descriptive and econometric analysis below, unless indicated otherwise.

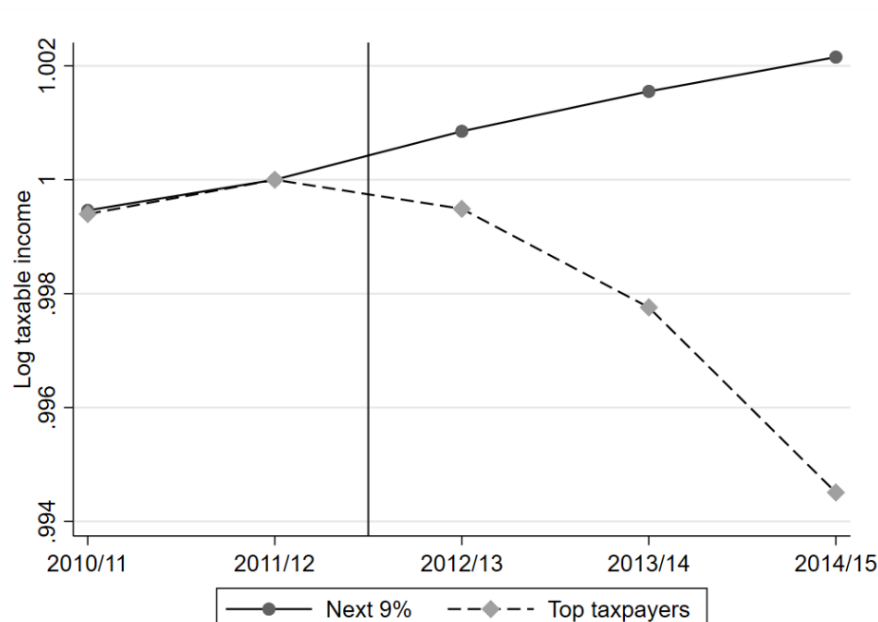
Table 4: Mean monthly incomes (in millions) for the ‘top taxpayers’ treatment and control groups

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 to one 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 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 treated ‘top taxpayers’ and the control group. The parallel trends assumption appears to hold for the (admittedly short, two-year) period before the reform. After the reform, the log income drops noticeably for treated individuals.

4 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 includes people from the 90th to the 99th percentiles. In the DiD analysis we then basically compare the mean taxable income across these two otherwise similar groups before and after the reform. 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.

We thus estimate the basic DiD regression equation:

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

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 $(\text{Treat}_i \times \text{After}_t)$, 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].

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.

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

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

5 Results

5.1 Main results

Table 5 presents DiD estimation results using different specifications. The upper panel provides the basic DiD results, whereas results in the lower panel have been adjusted for group-specific pre-treatment trends. 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) Simple	(2) Weighted	(3) Simple	(4) Weighted
Basic:				
Treat _i *After _t	-0.0779** (0.0343)	-0.317** (0.129)	-0.0765** (0.0342)	-0.174*** (0.0611)
Year and month dummies	Yes	Yes	Yes	Yes
R-squared	0.561	0.627	0.562	0.705
Implied elasticity	0.5453** (0.2401)	2.219** (0.903)	0.5355** (0.2394)	1.218*** (0.4277)
Pre-trend controls:				
Treat _i *After _t	-0.0828** (0.0343)	-0.322** (0.129)	-0.0823** (0.0342)	-0.181*** (0.0611)
Year and month dummies	Yes	Yes	Yes	Yes
R-squared	0.553	0.621	0.551	0.698
Implied elasticity	0.5796** (0.2401)	2.254** (0.903)	0.5824** (0.2394)	1.267*** (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 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.

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. Whether estimates are adjusted 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). 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) Simple	(2) Weighted	(3) Simple	(4) Weighted
Basic:				
Treat _t *After _t	-0.0405*** (0.0107)	-0.0397*** (0.0099)	-0.113*** (0.0408)	-0.180*** (0.0526)
Year and month dummies	Yes	Yes	Yes	Yes
R-squared	0.316	0.434	0.539	0.793
Implied elasticity	0.2835*** (0.0749)	0.2779*** (0.0690)	0.791*** (0.2856)	1.260*** (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.

5.2 Additional results concerning ‘top taxpayers’

In this section we provide further evidence of how the response to the tax reform might vary across different factors, and we 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 might be in colluding to report lower incomes in the face of higher tax rates. Results in Table 7 indicate that the response to the reform is more pronounced among large firms.

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.

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

	Baseline		Small firms		Large firms	
	(1) Simple	(2) Weighted	(3) Simple	(4) Weighted	(5) Simple	(6) Weighted
Basic:						
Treat _i *After _t	-0.0765** (0.0342)	-0.174*** (0.0611)	-0.0397** (0.0199)	-0.187*** (0.0619)	-0.146* (0.0813)	-0.225* (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** (0.2394)	1.218*** (0.4277)	0.2779** (0.1393)	1.309*** (0.4333)	1.022* (0.5691)	1.575* (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.

Another margin of response heterogeneity might be the type of tax office overseeing an employer's tax matters. 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 under 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. 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, and these shares in different tax offices are similar before and after the reform.

Turning to the 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, it isolates any effect stemming from selection issues among new taxpayers: if the highest-income earners have 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 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

¹⁰ The LTO criteria also include other indicators besides the value of turnover or taxes: for instance, businesses 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.

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.

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) Simple	(2) Weighted	(3) Simple	(4) Weighted	(5) Simple	(6) Weighted
Basic:						
Treat _i *After _t	-0.0965* (0.0509)	-0.199** (0.0783)	-0.0247 (0.0228)	-0.0485 (0.0591)	-0.0416 0.0404	-0.0929 (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* (0.3563)	1.393** (0.5481)	0.1729 (0.1596)	0.3395 (0.4137)	0.2912 (0.2828)	0.6503 (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) Simple	(2) Weighted	(3) Simple	(4) Weighted	(5) Simple	(6) Weighted	(7) Simple	(8) Weighted
Basic:								
Treat _i *After _t	-0.0495** (0.0229)	-0.164* (0.0932)	-0.0484** (0.023)	-0.0679** (0.0294)	-0.0504*** (0.00164)	-0.0467*** (0.00164)	-0.0573*** (0.00417)	-0.0682*** (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** (0.1603)	1.148* (0.6524)	0.3388* (0.161)	0.4753** (0.2058)	0.3528*** (0.01148)	0.3269*** (0.01148)	0.4011*** (0.02919)	0.4774*** (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.

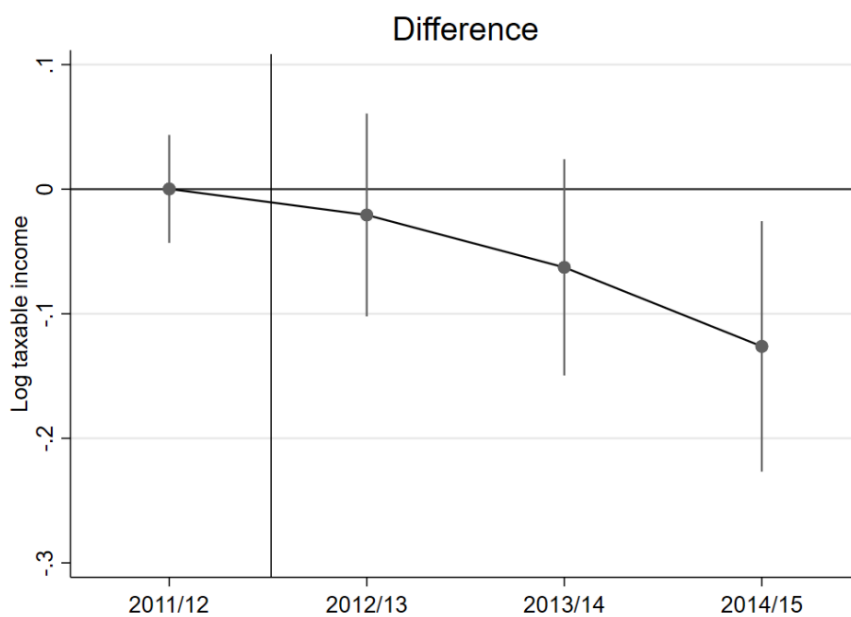
Source: authors’ calculations based on URA PAYE administrative tax records.

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 A1 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.

We further study how taxable incomes react across time through the lens of 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. 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, 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.

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.

5.3 Investigating possible mechanisms

To understand better the potential mechanisms underlying the response of the ‘top taxpayers’ group to the marginal tax rate increase, we investigate more closely the 100 firms whose PAYE records drop the most after the reform. For that purpose, we first identify these firms in the PAYE balanced panel data, and then we merge information from these firms with the corporate income tax (CIT) returns.¹² Second, in order to create a comparison group, we check the size of the firms that experience the largest drop in PAYE income paid to their employees based on their sales, and we identify other firms subject to CIT that show similar sales figures to the firms with the largest PAYE income drops. This leaves us with around 3,500 firms for the comparison group. Finally,

¹² In URA’s e-tax system, a company (i.e. corporate or unincorporate income taxpayer, or a unit trust, and any entity other than a partnership firm deriving income from business or profession) files an income tax return form for a non-individual. The return data generated from this form is referred to as CIT returns data in this paper.

we identify the firms from the comparison group in the PAYE balanced panel records, and we further restrict the comparison group to firms that have employees in the highest tax bracket. This exercise leaves us altogether with 321 firms with matched PAYE balanced panel and CIT records that fulfil the criteria set out above.

Table 10 presents average log sales, costs, profits, proposed dividends,¹³ and PAYE income, 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. By contrast, among firms in the comparison group, proposed dividends decrease, although their 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 larger dividends to be paid out to shareholders (see DiD values in Table 10). Following our definition of firms with the largest drop in PAYE incomes, their PAYE incomes decrease after the reform. The comparison group's PAYE incomes increase, which makes the difference between two groups substantial. To put it simply, firms whose employees' taxable incomes (i.e. PAYE incomes) fall report an increase in profits and dividends. Firms with no such change in PAYE incomes see higher economic activity after the reform, but they do not increase dividends.

The above analysis cannot be interpreted as causal evidence; we are discussing strictly descriptive evidence. It nevertheless clearly points to one possible mechanism, namely income shifting between PAYE incomes and dividends.

Table 10: Descriptive evidence of average sales, costs, profits, proposed dividends, and salaries for largest-drop and other firms

		Log sales	Log costs	Log profits	Log proposed dividends	Log PAYE income	No. of firms
Largest-drop firms	Before	22.97	22.43	20.15	22.45	2.65	100
	After	22.67	22.27	20.29	22.51	2.30	100
	Difference	-0.30	-0.16	0.14	0.06	-0.35	
Other firms	Before	23.07	22.59	20.61	20.94	5.23	321
	After	23.43	22.84	20.85	20.84	6.12	321
	Difference	0.36	0.25	0.24	-0.10	0.89	
	DiD	-0.66	-0.41	-0.11	0.16	-1.24	

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. Log sales, log costs, log profits, and log proposed dividends are calculated from CIT returns data, and log PAYE incomes from PAYE balanced panel records.

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

¹³ 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.

5.4 Results for other tax brackets

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 A2 in the Appendix indicate that incomes increase more for these groups than among the controls, but the treatment impacts 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 0.1.¹⁴ In terms of estimating the reform's dynamic impacts on revenue, the reactions of the 'top taxpayers' group seem to dominate.

6 Revenue 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 a difference in the mean income growth between the control and treatment groups.¹⁵ 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. We finally close this section with the overall implications for PAYE revenues.

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 11 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, for example, to the simple estimates in columns (1) and (3) in the lower part of Table 5, or to weighted estimates in the case of the firm panel in Table 9, column (4). To sum up, simulated revenues are obtained by first uprating employees' taxable incomes in the treatment

¹⁴ 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.

¹⁵ 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.

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 11, columns (2) and (3), mean post-reform UGX435 minus UGX389 billion), or 12 per cent of the treated group actual revenues. 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 are increased.

Needless to say, this calculation is a simplified exercise, as we only take into account the PAYE part of the income tax, and we disregard any revenue changes stemming from taxes on small business owners. On the other hand, 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 11: 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:

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

where a is the Pareto parameter estimated from fitting a Pareto distribution using income data, and e is the elasticity of taxable income. 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. These estimates suggest that the Ugandan earnings distribution is quite uneven. Since the Pareto parameter measures the

thinness of the upper tail, the results indicate that the Ugandan earnings data has a fairly fat upper tail. Other things being equal, this raises the revenue-maximizing top tax rate.

With an elasticity equal to, say, 0.5, the revenue-maximizing top tax rate would then amount to around 53 per cent. We should note that this tax rate also includes the tax burden stemming from indirect taxes. When we take indirect taxes into account, the current Ugandan top tax rate is approximately 50 per cent.¹⁶ This would suggest that the current Ugandan top tax rate is quite close to the theoretical rate maximizing revenues from top earners. It is 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).

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 12. 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 12: 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) Actual revenue	(2) Actual revenue	(3) Simulated revenue	(4) Actual revenue	(5) Simulated revenue	(6) 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 12 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

¹⁶ 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.

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 if there were no 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 12, 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 12, 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 we 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 12 are less upwardly biased than the revenue calculations for the ‘top taxpayers’ treatment group in Table 11, 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 11, column (2), mean pre-reform, and column (3) mean post-reform UGX435 minus UGX161 billion) and decline by UGX7.6 billion¹⁷ from groups that experience a tax rate decrease. Overall, 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).

7 Conclusion

Personal income tax has not often been the prime focus of tax analysis in developing countries. Prime reasons for this have been the challenges of accessing high-quality data, and the facts that other sources of tax have long made up the bulk of government revenue in developing countries and personal income tax was not 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

¹⁷ 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 $(4.8+5.5+5.8) - (2.6+5.9) = 7.6$.

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 shifted subsequent thresholds upwards, and introduced an additional top tax rate to the 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 the 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 0.5.¹⁸ Since we only examine one reform episode, it might be the case that other, simultaneous changes 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.¹⁹

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.

¹⁸ Such estimates correspond to the simple unweighted estimate for the entire group and to censored responses from weighted regressions from a model where taxpayers are restricted to a balanced panel of firms.

¹⁹ This argument assumes that reported earnings reflect true changes in income levels.

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Appendix

Table A1: Benchmark DiD results using the control group ‘next four per cent’ for the treatment group ‘top taxpayers’

	Top taxpayers		Top taxpayers, censored	
	(1) Simple	(2) Weighted	(3) Simple	(4) Weighted
Basic:				
Treat _i *After _t	-0.0551* (0.0334)	-0.298** (0.128)	-0.0537 (0.0332)	-0.156*** (0.0601)
Year and month dummies	Yes	Yes	Yes	Yes
R-squared	0.642	0.549	0.648	0.652
Implied elasticity	0.3857* (0.2338)	2.086** (0.896)	0.3759 (0.2324)	1.092*** (0.4207)
Pre-trend controls:				
Treat _i *After _t	-0.0707** (0.0334)	-0.314** (0.128)	-0.0711** (0.0333)	-0.173*** (0.0601)
Year and month dummies	Yes	Yes	Yes	Yes
R-squared	0.611	0.528	0.613	0.627
Implied elasticity	0.4949** (0.2338)	2.198** (0.896)	0.4977** (0.2331)	1.211*** (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 A2: Benchmark DiD results for treatment groups 'to zero', 'MTR down', and 'ATR down, lower incomes'

	'To zero'		'MTR down'		'ATR down, lower incomes'	
	(1) Simple	(2) Weighted	(3) Simple	(4) Weighted	(5) Simple	(6) Weighted
Basic:						
Treat _i *After _t	0.0443*** (0.00875)	0.0431*** (0.00811)	0.0147*** (0.00467)	0.0147*** (0.00453)	0.0298*** (0.00516)	0.0319*** (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*** (0.07875)	0.3879*** (0.07299)	0.1176*** (0.03736)	0.1176*** (0.03624)		
Pre-trend controls:						
Treat _i *After _t	0.0113 (0.00876)	0.0102 (0.00813)	0.011** (0.00466)	0.011** (0.00453)	0.0192*** (0.00509)	0.0213*** (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 (0.07884)	0.0918 (0.07317)	0.088** (0.03728)	0.088** (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.