The elasticity of taxable income in a developing economy: Evidence from Zambia's 2017 Pay-As-You-Earn [PAYE] reform

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ABSTRACT

This study estimates the elasticity of taxable income (ETI) at the top of the income distribution in a low-income African economy and translates the estimates into welfare and optimal-rate implications for Pay-As-You-Earn (PAYE) policy. The analysis is guided by the optimal taxation sufficient-statistic framework, in which the ETI, the Pareto parameter of the upper-income tail, and the social welfare weight on top earners jointly determine welfare-consistent tax rates. A difference-in-differences design is applied to the Zambia Revenue Authority administrative panel data for 2014 –2019, exploiting the 2017 increase in the top marginal PAYE rate from 35 percent to 37.5 percent. The sample contains 3,646,850 person-year observations for 372,223 private formal sector employees. The baseline ETI is 0.27 and is robust to alternative specifications and sample restrictions. Responsiveness varies sharply by age and gender, from 0.134 for young men to 1.182 for young women. At the prevailing top rate, the baseline marginal excess burden is 0.162, the marginal welfare cost is 0.193, and the marginal cost of public funds is 1.19. With a Pareto parameter of 2.0, the full-sample revenue-maximising top rate is found to be 48.1 percent with a social welfare weight of 0.5. This exceeds the prevailing 37 percent, although the optimal rate for young women lies below the current rate. The results show that Zambia retains modest fiscal space at the top of the private formal PAYE distribution, but the aggregate masks costly subgroup responses. PAYE reform should therefore combine cautious, evidence-led rate appraisal with regular monitoring of demographic heterogeneity and targeted measures that protect formal employment among highly responsive groups.

Keywords: Elasticity of Taxable Income; Gender; Optimal Income Tax; Pay-As-You-Earn; Welfare Cost; Zambia

I. INTRODUCTION

The elasticity of taxable income (ETI) measures the percentage change in reported taxable income associated with a one-percent change in the net-of-tax rate, defined as one minus the marginal tax rate. It summarises responses through labour supply, effort, formal employment, income shifting, avoidance and evasion, and has therefore become a central parameter for evaluating the efficiency consequences of income taxation (Feldstein, 1995, 1999). The ETI links directly to three further policy variables. The Pareto parameter describes the thickness of the upper-income tail; the social welfare weight represents the value society assigns to an additional unit of income received by top earners; and the optimal tax rate balances mechanical revenue, behavioural erosion of the tax base and, for a welfare-consistent rate, distributional preferences. A higher ETI or Pareto parameter lowers the optimal top rate, while a lower social welfare weight on top earners raises it (Saez, 2001; Gruber & Saez, 2002; Saez et al., 2012).

Credible ETI estimates remain concentrated in high-income economies. Evidence for Sub-Saharan Africa is thin despite the region's need for domestic revenue mobilisation and the expanding availability of administrative tax records. This study addresses that gap for Zambia through the 2017 reform of Pay-As-You-Earn (PAYE), the system under which employers withhold personal income tax from employment earnings. The reform raised the top marginal rate from 35 percent to 37.5 percent while increasing the monthly tax-exempt threshold from K3,000 to K3,300 (Republic of Zambia, 2016; Ministry of Finance of Zambia, 2016). Because only employees above the top-bracket threshold experienced the marginal rate increase, the reform created treatment and comparison groups for a difference-in-differences (DiD) design.

The analysis uses Zambia Revenue Authority (ZRA) administrative records for 2014–2019. The panel contains 3,646,850 person-year observations for 372,223 employees after sample restrictions. Its scope is private formal sector employment: central government and much of the public sector are administered separately and are excluded. All estimates and policy conclusions therefore concern the private formal PAYE base rather than Zambia's whole workforce or economy. The paper contributes in three ways. First, it provides Zambia's first modern behavioural ETI estimate identified from a tax reform, updating Byrne's (1983) revenue-elasticity analysis without treating that earlier aggregate concept as equivalent to behavioural responsiveness. Second, it identifies substantial age and gender heterogeneity. Third, it integrates the elasticities with the upper-tail Pareto parameter and explicit social welfare weights in Saez's

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(2001) optimal taxation framework. This third contribution turns the ETI from an isolated estimate into an operational input for PAYE rate setting.

1.1 Statement of the Problem

Zambia must mobilise domestic revenue while avoiding tax changes that weaken formal employment or erode the reported tax base. PAYE is a major revenue source, contributing approximately 22–26 percent of tax revenue during 2013–2019 based on ZRA tax statistics bulletins, yet collections are concentrated on a comparatively narrow formal employment base (Zambia Revenue Authority, 2020). The policy stakes are therefore high: an excessive top rate may contract taxable income, while an unduly low rate may leave revenue uncollected.

The evidence needed to resolve this trade-off is missing. Most ETI evidence comes from high-income economies, and the small African literature shows that responses vary with third-party reporting, enforcement, deductions and formal-sector participation. For Zambia, Byrne (1983) estimated the elasticity of aggregate tax revenue for 1966–1977, not the modern behavioural response of taxable income to the net-of-tax rate. No reform-based administrative estimate has established how private formal sector taxable income responds, whether responses differ by age and gender, or what the responses imply for welfare costs and optimal top PAYE rates. Without those quantities, policymakers cannot determine whether the 37.5 percent rate is below or above the revenue-maximising and welfare-consistent benchmarks.

1.2 Research Objectives

i. To estimate the baseline ETI for Zambian private formal sector employees by using the 2017 PAYE reform and administrative panel data.
ii. To examine heterogeneity in the ETI by age and gender.
iii. To translate the baseline and subgroup elasticities into marginal welfare metrics and optimal top PAYE rates using the sufficient-statistic optimal taxation framework.

II. LITERATURE REVIEW

2.1 Theoretical Review

2.1.1 Optimal Taxation and ETI Sufficient-Statistic Theory

The study is guided by Saez's (2001) sufficient-statistic theory of optimal income taxation, which translates behavioural and distributional parameters into a top-rate rule. Its behavioural foundation is the ETI. Feldstein (1995, 1999) argued that taxable income, rather than hours worked alone, captures the margins through which taxation changes the base. Gruber and Saez (2002) developed the empirical application, while Saez et al. (2012) clarified the identification conditions and the sensitivity of estimates to income definitions, mean reversion and secular income trends.

In the framework, the revenue-maximising top rate is $t^* = 1/(1 + a\varepsilon)$, where ε is the ETI and a is the Pareto parameter of the upper-income tail. A larger elasticity or a thinner upper tail, represented by a larger Pareto parameter, increases behavioural revenue loss and lowers the rate. The welfare-consistent rate is $t^* = (1 - \bar{g})/(1 - \bar{g} + a\varepsilon)$, where $\bar{g}$ is the average social welfare weight on top earners. A higher social welfare weight lowers the optimal rate because income retained by top earners receives greater social value. Mirrlees (1971) provides the broader nonlinear-tax foundation; Piketty and Saez (2013) and Piketty et al. (2014) extend the top-rate analysis to multiple response channels and rent seeking.

This theory guided the research design in three concrete respects. First, it made log real taxable income the dependent variable and the change in the log net-of-tax rate the price variation of interest. Second, it required a reform-based design able to identify a causal ETI, motivating the DiD comparison and event-study validation. Third, it required estimation of the Pareto parameter and explicit social welfare scenarios so that the resulting ETIs could be translated into marginal excess burden (MEB), marginal welfare cost (MWC), marginal cost of public funds (MCPF), and optimal rates. he sufficient-statistic interpretation is not unconditional. Chetty (2009) shows that when responses shift income across tax bases or consume resources differently from the tax avoided, a raw ETI may overstate efficiency cost. Slemrod and Kopczuk (2002) likewise show that the ETI depends on tax-base design and enforcement rather than being a fixed structural constant. These qualifications are especially relevant when comparing tightly withheld wages with self-assessed or deduction-rich income.

2.2 Empirical Review

2.2.1 Baseline ETI and identification

International estimates vary substantially. Feldstein (1995) used the 1986 United States tax reform to show that taxable income responds strongly to net-of-tax rates, but Gruber and Saez (2002) report an overall elasticity near 0.4 and greater responsiveness at high incomes, while Neisser's (2021) meta-regression spans 0.074–0.827. Much of this variation reflects differences in income concepts, tax institutions and research design rather than immutable behavioural

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differences. Saez et al. (2012) stress that estimates are sensitive to income definitions, mean reversion and secular income trends: mean reversion can make temporarily high earners appear tax responsive, and secular divergence can confound comparisons if top incomes follow different trends. Weber (2014) develops instruments for consistent DiD estimation under heterogeneous income dynamics, while bunching designs use kinks in tax schedules to identify local responses (Kleven et al., 2011). The present study addresses the methodological gap in Zambia with fixed pre-reform group assignment, individual and time fixed effects, clustered standard errors, event-study evidence on pre-trends, and robustness restrictions around the threshold.

2.2.2 Heterogeneity by age and gender

Evidence from high-income economies shows that average elasticities conceal systematic differences by gender and age. Blomquist and Selin (2010) use Swedish register data and the tax reforms of the 1980s and estimate taxable labour income elasticities of 0.19–0.21 for married men but 0.96–1.44 for married women, although they regard the male estimates as more robust than the female estimates. Díaz-Caro and Onrubia (2018) reach a similar ordering with Spanish personal income tax panel data after the 2007 dual-income-tax reform: elasticities are higher for women than for men, higher for single than for married taxpayers, and decline with age. Kleven and Schultz (2014), using full-population Danish administrative data, find modest labour income elasticities of about 0.05 for wage earners and 0.10 for the self-employed, which shows that institutional design can compress responses even when the population is large and heterogeneous. These studies agree that women are more responsive than men, but they concern married or dual-income households in welfare states with broad bases and strong third-party reporting, so their magnitudes cannot be transferred directly to a low-income African PAYE system.

African evidence indicates that average estimates can conceal sharply different behavioural margins. Bell (2020) finds bunching among South African self-employed taxpayers but not wage earners, with women more responsive than men and responsiveness declining with age. Kanina et al. (2025) use Kenyan administrative tax data to estimate an average elasticity of about 0.3 that conceals large disparities between inelastic public workers and a rather elastic private sector. Jouste et al. (2025) find very limited behavioural reactions to Uganda's reform on average, but heterogeneity analysis shows that top-income workers in firms handled by ordinary taxpayer offices report lower incomes after the reform. Together these patterns suggest that gender, life-cycle and sectoral constraints interact with access to adjustment margins. However, none of these African studies estimates age-by-gender responses among employees facing an actual rate reform: Bell (2020) relies on bunching among the self-employed, Kanina et al. (2025) and Jouste et al. (2025) disaggregate by sector, income and employer type rather than by demographic group. The present study fills that empirical and contextual gap by estimating age-by-gender responses in a Zambian private formal sector PAYE panel.

2.2.3 Welfare metrics and optimal rates

African applications that carry behavioural estimates through to policy rules remain limited. Kemp (2020) estimates a South African ETI of about 0.4 overall and 0.5 for the top decile. Wright et al. (2023) use elasticities between 0.05 and 0.5 in microsimulation and demonstrate the revenue-efficiency trade-off in broadening and deepening South Africa's personal income tax base. Axelson et al. (2024) estimate a medium-run ETI of 1.2 after South Africa's 2017 increase from 41 percent to 45 percent and conclude that affected top earners were on the declining side of the revenue curve. Jouste et al. (2021) study Uganda's introduction of a 40 percent top bracket and report an elasticity of taxable income larger than earlier estimates from developed countries, while McKay et al. (2024) show that personal taxation can affect formal work across Sub-Saharan African countries. The published Ugandan analysis (Jouste et al., 2025) instead finds very limited average behavioural responses, which underlines how sensitive welfare conclusions are to the estimation strategy and sample.

These studies establish the importance of institutions but do not resolve the Zambian policy question. Strong employer reporting may suppress ordinary wage responses, while deductions, non-monetary compensation, self-employment and formality choices create other margins. Axelson et al. (2024), for example, attribute South Africa's high response to deductions and non-monetary compensation rather than standard monthly earnings. Zambia's narrower administrative and employment context may therefore produce a lower average ETI, but this is an empirical question rather than an inference transferable from another country. Four gaps follow from the review. The theoretical gap is the limited application of sufficient-statistic optimal-rate theory to a low-income African PAYE system. The empirical gap is the absence of a modern behavioural ETI for Zambia. The methodological gap is the lack of a Zambian administrative-panel estimate based on legislated price variation and explicit pre-trend tests. The contextual gap is the absence of age-and-gender estimates that connect private formal employment responses to welfare costs and optimal rates. The three research objectives address these gaps sequentially.

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III. METHODOLOGY

3.1 Research Design

The study adopts a quantitative, quasi-experimental research design that is explanatory in purpose: it seeks to identify the causal effect of a change in the top marginal PAYE rate on reported taxable income and to translate that effect into welfare and optimal-rate implications. The design follows from the sufficient-statistic theory in Section 2.1, which makes the elasticity of taxable income the behavioural parameter of interest and a legislated rate change the source of price variation.

The unit of analysis is the individual private formal sector employee observed annually over 2014–2019 in the Zambia Revenue Authority administrative PAYE panel. The 2017 increase in the top marginal rate from 35 to 37.5 percent provides the policy shock. Employees whose pre-reform monthly income exceeded K6,200 form the treatment group, and employees below that threshold form the comparison group. Assignment is fixed on pre-reform income so that group membership cannot respond to the reform. The design therefore compares changes in log real taxable income between the two groups before and after 2017 in a difference-in-differences (DiD) framework, supported by an event-study specification that tests for pre-reform trend differences. Heterogeneity is examined by estimating the same design separately for age and gender subgroups, and the estimated elasticities are then combined with the Pareto parameter and social welfare weights to obtain welfare metrics and optimal rates.

3.2 Data

The analysis uses administrative Pay-As-You-Earn (PAYE) records maintained by the Zambia Revenue Authority for the period 2014–2019. The raw data comprise the population of employees subject to PAYE withholding, linked over time into a panel through anonymised taxpayer identifiers. Before sample restrictions the data contain 382,988 distinct taxpayers; after the restrictions described below, the baseline estimation sample comprises approximately 372,223 taxpayers and more than 3.6 million person-year observations (3,646,850). The data record monthly gross emoluments, taxable income, and PAYE withheld, together with limited demographic information including age and gender.

A crucial scope condition governs the interpretation of all results. The PAYE panel covers private formal sector employment. Employees of central government and much of the public sector are administered separately and are not represented in the estimation sample. Because public and central government workers constitute an estimated 18 to 22 percent of formal wage employment in Zambia, the estimates apply specifically to private formal sector employees and should not be read as economy-wide parameters. As discussed in Section 4.3, this scope condition implies that the baseline elasticity of 0.27 is likely to be an upper bound for the full formal wage economy, since public sector earnings, subject to rigid pay scales, would be expected to respond less to marginal rate changes.

Several sample restrictions ensure a clean estimation panel. The analysis is restricted to individuals aged 22–70 to focus on the prime and near-retirement working population. Observations with zero or negative taxable income are dropped, as are observations with annual income exceeding K1.5 million, which are treated as outliers likely to reflect one-off or misrecorded amounts. The dependent variable is the natural logarithm of real taxable income, deflated to a constant price base using the consumer price index (2020/2021 base year), so that measured responses reflect real rather than nominal changes.

Table 1

Descriptive statistics of the estimation sample

Characteristic	Value
Distinct taxpayers (baseline sample)	372,223
Person-year observations	3,646,850
Mean real taxable income (K)	8,474
Median monthly income, nominal (K)	3,822
99th percentile income, nominal (K)	79,008
Mean age (years)	36.9
Share female	24%
Share male	76%
Consumption Gini (approx.)	0.57

Source: Author's calculations from ZRA PAYE administrative panel, 2014–2019. Sample restricted to private formal sector employees aged 22–70.

The descriptive statistics in Table 1 confirm the character of the sample. Mean real taxable income is K8,474, but the distribution is highly skewed: the median monthly income is K3,822 while the 99th percentile stands at K79,008 in nominal terms, roughly K76,305 in real terms. This skewness is the empirical counterpart of the thick upper tail that

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the Pareto parameter summarises, and it is the feature of the distribution that gives the top-rate reform its analytical purchase. The sample is predominantly male, with women accounting for 24 percent of observations and men 76 percent, a composition that reflects the gender imbalance of Zambian formal sector employment and that lends particular importance to the gender-disaggregated analysis. The mean age of 36.9 years indicates a relatively young formal workforce, and the approximate consumption Gini of 0.57 situates the analysis in a high-inequality setting typical of the region.

3.3 Identification and Estimating Equation

Identification exploits the 2017 increase in the top marginal PAYE rate. Taxpayers are assigned to the treatment group if their pre-reform monthly income exceeded K6,200, the threshold above which the marginal rate increase applied; assignment is fixed on the basis of pre-reform income to avoid the endogeneity that would arise if group membership were allowed to respond to the reform itself. The post-reform period comprises the years 2017 onward. On this basis the treatment group comprises approximately 38 percent of the sample.

The baseline specification is a difference-in-differences (DiD) model with individual and time fixed effects:

$$log(TI_{it}) = \beta_0 + \beta_1 \text{Treated}_i + \beta_2 \text{Post}_t + \beta_3 (\text{Treated}_i \times \text{Post}_t) + \varepsilon_{it} \quad (1)$$

where log(TI_it) is the log of real taxable income for individual i in year t, Treated_i indicates membership of the top bracket group defined on pre-reform income, Post_t indicates the post-reform period, and the interaction term captures the differential change in taxable income for the treatment group after the reform. Individual fixed effects absorb time-invariant heterogeneity, and time fixed effects absorb common macroeconomic shocks; standard errors are clustered at the individual level to allow for arbitrary within-person serial correlation.

The coefficient of interest is β_3. The elasticity of taxable income (ETI) is recovered by scaling this coefficient by the change in the log net-of-tax rate experienced by the treatment group:

$$ETI = \beta_3 / \Delta \log(1 - \tau) \quad (2)$$

where τ is the top marginal rate, so that the denominator is the change in the log net-of-tax rate from 0.65 to 0.625. The validity of the design rests on the parallel trends assumption, namely that in the absence of the reform the treatment and comparison groups would have followed common trends in log taxable income.

3.4 Welfare and Optimal-Rate Framework

The estimated elasticities are translated into welfare metrics and optimal rates following the Saez (2001) framework. The marginal excess burden (MEB) of the top rate is

$$MEB = [\tau / (1 - \tau)] \times ETI \quad (3)$$

which, evaluated at the post-reform top rate of $\tau = 0.375$, reduces to MEB = 0.6 × ETI. The marginal welfare cost (MWC) and the marginal cost of public funds (MCPF) are then

$$MWC = MEB / (1 - MEB) \quad (4)$$

$$MCPF = 1 / (1 - MEB) \quad (5)$$

The revenue-maximising top rate implied by the Saez (2001) formula is

$$t^* = 1 / (1 + a\varepsilon) \quad (6)$$

and the welfare-consistent optimal rate, incorporating the social welfare weight $\bar{g}$ on top earners, is

$$t^* = (1 - \bar{g}) / (1 - \bar{g} + a\varepsilon) \quad (7)$$

where a is the Pareto parameter of the upper income tail. The Pareto parameter is estimated by maximum likelihood from the sample income distribution above a threshold z_min:

$$\hat{a} = n / \Sigma \ln(z_i / z_{min}) \quad (8)$$

with robustness examined across z_min multiples of 1.25, 1.5 and 2.0 times the top bracket threshold, and across social welfare weight scenarios of $\bar{g}$ equal to 0, 0.25 and 0.5. The estimated Pareto parameter is approximately 2.0. This optimal rate machinery, rather than the point elasticity in isolation, is the analytical core of the wider research programme from which this paper is drawn.

3.5 Data Analysis

Data analysis proceeds in five steps. First, the raw PAYE records are cleaned and restricted as described in Section 3.2, and taxable income is deflated by the consumer price index and transformed into natural logarithms. Descriptive statistics for the estimation sample are reported in Table 1. Second, the baseline DiD model in Equation 1 is estimated as a linear panel regression with individual and time fixed effects and standard errors clustered at the individual level, and the coefficient on the interaction term is converted into the ETI using Equation 2. The validity of the parallel-trends assumption is assessed with an event-study specification and a joint test of the pre-reform interaction coefficients.

Third, the same specification is estimated separately for age and gender subgroups (young workers aged 30 and below, elderly workers aged 60 and above, women and men, and their age-by-gender combinations) to answer Objective 2. Fourth, robustness is examined with alternative treatment thresholds, time windows, individual-specific linear trends,

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exclusion of taxpayers near the bracket threshold, instrumentation of base-year income to address mean reversion following Weber (2014), and a balanced-panel restriction. Fifth, the Pareto parameter is estimated by maximum likelihood (Equation 8), and the baseline and subgroup elasticities are inserted into Equations 3 to 7 to compute the marginal excess burden, marginal welfare cost, marginal cost of public funds and the revenue-maximising and welfare-consistent top rates for social welfare weights of 0, 0.25 and 0.5, which addresses Objective 3. Results are reported in Section 4.1 and interpreted against the international evidence in Sections 4.2 and 4.3.

IV. FINDINGS & DISCUSSION

4.1 Findings

4.1.1 Baseline ETI

The baseline DiD estimate yields an ETI of 0.27 for private formal sector employees. The independent variable of interest is the interaction between treatment status, defined by pre-reform placement above the K6,200 monthly threshold, and the post-2017 period. This interaction represents exposure to the reduction in the net-of-tax rate. The dependent variable is log real taxable income. The underlying interaction coefficient, scaled by the change in the log net-of-tax rate, has a standard error of 0.0256 and is significant at the 1 percent level. Thus, a 1 percent increase in the net-of-tax rate is associated with a 0.27 percent increase in reported real taxable income.

The parallel-trends evidence supports a causal interpretation. Pre-treatment interaction coefficients in the event-study specification are small and statistically insignificant, and a joint test cannot reject common pre-reform trends (F-test p-value greater than 0.1). The reform reduced the net-of-tax rate by roughly 3.8 percent and the estimate therefore implies an approximately 1 percent fall in reported taxable income among affected employees. This behavioural contraction is modest relative to the mechanical revenue gain. Robustness: alternative treatment thresholds, time windows and individual-specific linear trends leave the ETI broadly unchanged. Excluding taxpayers near the bracket threshold and instrumenting base-year position address mean reversion in the spirit of Weber (2014). Fixing assignment on pre-reform income and restricting the sample to a balanced core address bracket crossing and compositional change. Across these checks, the estimate remains close to 0.27. The panel's 3,646,850 person-year observations yield a standard error of 0.0256. This precision matters for Objective 3 because the distance between the current rate and the full-sample optimal-rate benchmarks is not driven by an imprecise baseline ETI.

4.1.2 Heterogeneity by Age and Gender

Table 2 reports estimates from the same treatment and outcome relationship within demographic subgroups. Women are more responsive than men within each age band, while young and elderly employees are more responsive than prime-age employees. Young women have the largest ETI, 1.182, whereas the estimate for young men is 0.134 and not statistically significant. The nearly tenfold difference demonstrates why a single aggregate parameter is insufficient for distribution-sensitive PAYE appraisal.

Table 2

Elasticity of taxable income by demographic subgroup

Subgroup	ETI	Standard error
Full sample	0.270***	0.0256
Young workers (≤30)	0.435**	0.196
Elderly workers (60+)	0.402***	0.0986
All women	0.348***	0.0588
All men	0.246***	0.0303
Young women (<30)	1.182***	0.242
Young men (<30)	0.134 (n.s.)	0.202
Elderly women (60+)	0.526***	0.127
Elderly men (60+)	0.366***	0.116

Source: Author's calculations from ZRA PAYE administrative panel, 2014–2019. Significance: *** p<0.01, ** p<0.05, * p<0.1; n.s. denotes not statistically significant.

4.1.3 Welfare Metrics and Optimal PAYE Rates

At the statutory rate of 37.5 percent, the full-sample ETI gives an MEB of 0.162. Applying the transformation in Equations 4 and 5 gives an MWC of 0.193, approximately 19 ngwee of efficiency loss per additional kwacha raised at the top margin, and an MCPF of 1.19. For young women, the MWC is 2.436 and the MCPF is 3.44. The subgroup estimates therefore translate directly into markedly different efficiency costs. With the estimated Pareto parameter a = 2.0 and zero social welfare weight on top earners, the full-sample revenue-maximising rate is 64.9 percent, 27.4 percentage points above 37.5 percent. With a balanced-planner social welfare weight $\bar{g} = 0.5$, Table 3 gives a full-sample

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welfare-consistent rate of 48.1 percent. This rate is 10.6 percentage points above the current rate but below the pure revenue-maximising benchmark, as the theory predicts.

Table 3

Welfare-consistent optimal PAYE rates by demographic subgroup ($\bar{g} = 0.5$)

Subgroup	ETI (ε)	Pareto (a)	Optimal rate t* (%)	Current rate (%)	Gap (percentage points)
Whole sample	0.270	2.0	48.1	37.5	+10.6
Young workers (<30)	0.435	2.0	36.5	37.5	-1.0
Elderly workers (60+)	0.402	2.0	38.3	37.5	+0.8
All women	0.348	2.0	41.8	37.5	+4.3
All men	0.246	2.0	50.4	37.5	+12.9
Young women (<30)	1.182	2.0	17.5	37.5	-20.0
Young men (<30)	0.134	2.0	65.1	37.5	+27.6
Elderly women (60+)	0.526	2.0	32.2	37.5	-5.3
Elderly men (60+)	0.366	2.0	40.6	37.5	+3.1

Source: Author's calculations using the constrained formula $t = (1 - \bar{g})/(1 - \bar{g} + a\varepsilon)$. The social welfare weight is $\bar{g} = 0.5$ for all subgroups.

The current rate exceeds the welfare-consistent rate for young workers overall by 1.0 percentage point, elderly women by 5.3 points and young women by 20.0 points. By contrast, young men and all men have positive gaps of 27.6 and 12.9 percentage points. These calculations establish average fiscal space but also show that its distribution is highly uneven.

4.2 Cross-Country Comparison

Table 4 places the baseline estimate within the international evidence. Zambia's 0.27 lies within Neisser's (2021) meta-analytic range and close to the United States estimates of Gruber and Saez (2002). It is lower than Kemp's (2020) South African estimate and much lower than the 1.2 estimated by Axelson et al. (2024) for South African top earners. The young-women estimate of 1.182, however, is nearly identical to the latter figure. Differences in samples, income definitions and institutions mean these estimates are comparative benchmarks rather than directly interchangeable parameters.

Table 4

Selected international estimates of the elasticity of taxable income

Study	Country	ETI	Method or note
Feldstein (1995)	United States	0.24–0.40	Panel, 1986 Tax Reform Act
Gruber and Saez (2002)	United States	0.20–0.30	Panel DiD
Saez et al. (2012)	United States	0.12–0.40	Review range
Kleven et al. (2011)	Denmark	0.2–0.6	Audit and bunching
Neisser (2021)	61 countries	0.074–0.827	Meta-analysis
Kemp (2020)	South Africa	0.4 (top 10%: 0.5)	Bracket creep
Bell (2020)	South Africa	No wage bunching	Bunching
Wright et al. (2023)	South Africa	0.05–0.5	Microsimulation
Axelson et al. (2024)	South Africa	1.2 (top earners)	DiD plus pre-trend
This study	**Zambia**	**0.27**	**DiD, PAYE panel**

Source: Author's calculations; Neisser's (2021) meta-analysis; and the cited studies. Estimates reflect different income definitions, samples and identification strategies and are not strictly comparable.

4.3 Discussion

The modest aggregate elasticity and the extreme responsiveness of young women both invite mechanistic interpretation. The starting point is the institutional architecture of PAYE. Because employment income is withheld at source and reported by employers, the standard monthly earnings of ordinary wage earners offer little scope for the reporting responses that inflate elasticities in self-assessment systems. This structural feature provides a plausible explanation for the modest aggregate Zambian elasticity of 0.27. The finding agrees with South African evidence that tightly reported monthly wages respond less than income components with greater adjustment scope.

The comparison with Axelson et al. (2024) is instructive and worth drawing out in detail. Their decomposition of the South African 2017 reform shows that the medium-run top-earner elasticity of 1.2 was not driven by changes in standard monthly labour earnings, which did not respond significantly, but by increases in deductions, reductions in non-monetary compensation such as bonuses and fringe benefits, and declines in investment income. In their setting, treated taxpayers were found to be on the wrong side of the Laffer curve, so that personal income tax revenue fell after

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the rate increase, and firms employing treated workers experienced an output decline of 4.6 percent. The Zambian result agrees with and extends the first element of that decomposition to a lower-income PAYE setting: standard monthly earnings, subject to third-party reporting, are relatively unresponsive, which is precisely why the average Zambian elasticity is low.

Where the Zambian evidence departs from the South African average is in the tail of responsiveness. The young-women elasticity of 1.182 in Zambia parallels the South African top-earner elasticity of 1.2, but the available evidence suggests a different mechanism. Whereas the South African response reflects the deduction and non-monetary compensation channels available to high earners, the young-women response in Zambia plausibly reflects a participation and reservation-wage margin. Occupational concentration in lower-paid formal roles, disproportionate household caregiving responsibilities that raise the effective cost of formal employment, differential access to informal income margins, and limited bargaining power together place young women closer to their reservation wage for formal labour force participation. A rate increase that lowers the after-tax return to formal employment therefore tips a larger share of young women below their participation threshold, producing a larger measured elasticity. These proposed mechanisms are consistent with, but are not directly identified by, the international literature on female labour supply and with the age-declining responsiveness documented for South African taxpayers by Bell (2020).

The methodological correspondence between the two studies also merits emphasis. Axelson et al. (2024) employ a modified difference in differences design that explicitly models pre-reform trends, following Jakobsen and Søgaard (2022), in order to guard against the mean reversion that has long troubled the ETI literature. The present study addresses the same threat through fixed pre-reform group assignment, event-study validation of parallel trends, and robustness checks in the spirit of Weber (2014). The convergence of two regional administrative-data studies using complementary identification strategies strengthens the broader inference that top-margin responsiveness can be substantial even where ordinary wages are relatively inert. Zambia's lower aggregate estimate qualifies the South African result by showing that this conclusion need not apply to the average private formal employee.

A further interpretive question concerns the relationship between the estimated elasticity and the true efficiency cost of taxation. As Chetty (2009) established, when part of the behavioural response consists of income shifting or avoidance whose social cost differs from the revenue transferred, the raw ETI overstates the deadweight loss and a modified elasticity is required. In the Zambian PAYE setting, the third-party reporting architecture limits precisely the shifting and avoidance margins that drive a wedge between the ETI and the efficiency cost, so that the raw elasticity is likely to be a closer approximation to the true efficiency-relevant parameter than in self-assessment systems. This lends additional weight to the welfare and optimal-rate calculations, which take the estimated elasticity as their input. For the most responsive groups, however, and in particular for young women whose response plausibly reflects a real participation margin rather than pure shifting, the efficiency interpretation of the high elasticity is direct and the welfare cost is genuine rather than a reflection of relabelled income.

Taken together, the mechanisms imply a clear interpretive conclusion. The low aggregate elasticity should not be read as evidence that behavioural responses are uniformly small; rather, it is the average of a highly unequal distribution of responsiveness. For policy, the relevant object is not the aggregate but the schedule of subgroup elasticities, since it is this schedule that determines both the efficiency cost of taxation and the optimal rate for each group.

V. CONCLUSION & RECOMMENDATIONS

5.1 Conclusion

For Objective 1, the 2017 PAYE reform yields a precisely estimated baseline ETI of 0.27 for Zambian private formal sector employees. The estimate is robust to alternative specifications and sample restrictions, and the pre-reform evidence supports the identifying parallel-trends assumption. For Objective 2, the aggregate conceals substantial age and gender heterogeneity. Subgroup elasticities range from 0.134 for young men to 1.182 for young women, with women more responsive than men within each age band. For Objective 3, the baseline MEB is 0.162, the MWC is 0.193 and the MCPF is 1.19. With a Pareto parameter of 2.0, the revenue-maximising full-sample top rate is 64.9 percent. At a social welfare weight of 0.5, the welfare-consistent full-sample rate is 48.1 percent, above the prevailing 37.5 percent. The subgroup calculations qualify this average result: the welfare-consistent rates for young workers, elderly women and especially young women lie below the current rate. The evidence therefore indicates fiscal space at the top of Zambia's private formal PAYE distribution on average, but not uniformly across demographic groups. The estimates do not represent public sector employees, informal workers or the economy as a whole, and they identify local behaviour around a 2.5 percentage point reform.

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5.2 Recommendations

Ministry of Finance and National Planning: Use the estimated ETI, Pareto parameter and explicit social welfare weights in formal appraisal of proposed top PAYE rate changes. Any increase should be moderate, phased and evaluated against both the 64.9 percent revenue benchmark and the 48.1 percent balanced-planner benchmark, rather than treated as an immediate target. Zambia Revenue Authority: Institutionalise annual monitoring of taxable-income responses by age and gender. Administrative dashboards should track entry, exit, taxable income and threshold crossing among the most responsive groups after each schedule change. Ministry of Finance and National Planning and ZRA: Protect formal employment among young women and elderly women through measures that reduce participation costs and remove administrative barriers. Any tax relief should be designed and evaluated at group level without weakening equal-treatment safeguards or creating avoidable complexity.

Declaration of Interest

The authors declare that they do not have any known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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