RAPID Working Paper

January 2026

Effective Income Taxation and Fiscal Capacity in Developing Economies: Evidence from Bangladesh

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RAPID
Empowering Development

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Published in January 2026

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Citation: Chowdhury, K.I. (2026). Effective Income Taxation and Fiscal Capacity in Developing Economies: Evidence from Bangladesh, RAPID Working Paper, January.

Effective Income Taxation and Fiscal Capacity in Developing Economies: Evidence from Bangladesh*

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Abstract

This paper estimates the effective personal income tax schedule in Bangladesh using administrative tax return data. It combines nonparametric evidence with multiple parametric representations of average and marginal tax rates to document how income taxation operates in practice in a developing economy with limited fiscal capacity. The findings reveal modest effective progressivity: tax rates remain low across most of the income distribution, rising meaningfully only at the very top. In contrast, marginal rates fall well below statutory benchmarks. Consequently, the income tax offers a constrained scope for redistribution and revenue mobilisation, limiting fiscal policy's role in addressing economic shocks under heightened external uncertainty. The study provides empirically grounded parameters for quantitative macroeconomic models and underscores the need to differentiate between statutory design and implementation when evaluating fiscal capacity in developing economies.

JEL Classification: H24, D31, E62, O23

Keywords: Effective Taxation, Tax Progressivity, Developing Economies

*I thank Cagri Kumru, M. Abdur Razzaque, Md. Deen Islam, and Farzana Nazneen for helpful comments and discussions. I also thank participants at the Research and Policy Integration for Development (RAPID) workshop in Bangladesh for valuable feedback. I gratefully acknowledge the National Board of Revenue, Bangladesh, for granting access to anonymised administrative income tax return data for academic research, and research support from RAPID, Bangladesh. All remaining errors are my own.

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1 Introduction

Tax progressivity, the extent to which tax liabilities rise with income, plays a central role in shaping income distribution, economic incentives, and welfare in modern economies. In quantitative macroeconomic models, the degree of progressivity of the personal income tax (PIT) is a key structural input influencing labour supply, savings, consumption, and redistribution outcomes. A more progressive tax system can mitigate inequality, but it may also distort individual behaviour and affect aggregate efficiency (Heathcote et al., 2017). For this reason, accurately characterising the tax schedule actually faced by individuals is essential for both positive and normative macroeconomic analysis.

A central insight from recent advances in macro-public finance is that tax rules alone do not adequately describe fiscal incentives. Instead, the relevant object for quantitative analysis is the *effective* tax schedule that maps reported income into reported tax liabilities. Using administrative tax return data, Guner et al. (2014) recover smooth parametric representations of the U.S. federal income tax schedule and show that these effective schedules differ meaningfully from statutory rules. Their measurement-based approach has since become a benchmark in quantitative macroeconomics, where empirically estimated tax functions are routinely embedded into heterogeneous-agent models of labour supply, savings, and inequality.

Recent global developments further underscore the importance of understanding effective taxation in developing economies. Rising trade tensions, geopolitical fragmentation, supply-chain disruptions, and financial decoupling have increased the frequency and persistence of external shocks faced by emerging and developing economies. In such environments, fiscal policy plays a central role in macroeconomic stabilisation, particularly when monetary policy transmission is weakened or constrained. The effectiveness of fiscal responses to fragmentation-related shocks depends critically on domestic fiscal capacity, which in turn is determined not by tax schedules but by the tax system as implemented in practice. Measuring effective income taxation is therefore essential for assessing the scope and limits of countercyclical fiscal policy in developing economies exposed to heightened fragmentation risks.

While this measurement literature is well developed for advanced economies, empirical evidence on effective income tax progressivity remains scarce in developing economies, where tax capacity is limited, and implementation constraints are central to fiscal outcomes. Under-

standing effective taxation in such environments is particularly important because statutory tax schedules often provide a poor guide to actual fiscal incentives. This gap is especially consequential because many low- and middle-income countries rely heavily on indirect taxes, such as value-added and excise duties, which tend to be regressive, while collecting relatively little revenue from progressive direct taxes (Thomas, 2023). In such settings, the PIT is often viewed as the primary instrument for achieving vertical equity and offsetting the distributional consequences of indirect taxation. Whether the income tax fulfils this role, however, depends not only on statutory rates but also on enforcement capacity, compliance behaviour, tax expenditures, and the breadth of the tax base.

Bangladesh exemplifies these challenges, with limited compliance, a narrow tax net, a large informal sector, and extensive use of exemptions via Statutory Regulatory Orders (SROs) (Khan et al., 2023), weakening the link between statutory rates and realised liabilities. Existing evidence indicates that lower-income households bear a disproportionate burden of indirect taxation (Razzaque et al., 2023). By contrast, the PIT is designed to promote vertical equity through a graduated rate structure, with marginal tax rates ranging from zero at the exemption threshold to 25% for high-income earners. In principle, such a schedule should generate a progressive tax burden and contribute meaningfully to redistribution. Despite the central role of tax progressivity in macroeconomic analysis and policy debates, no empirical study has previously quantified the effective progressivity of the PIT in Bangladesh using administrative tax return data.

When effective income taxation is weakly progressive and narrowly based, the scope for revenue mobilisation during downturns is limited, constraining fiscal policy's ability to respond countercyclically without relying on debt accumulation or inflationary financing. Understanding the implemented income tax schedule is, therefore, central not only for distributional analysis but also for evaluating the effectiveness of fiscal policy frameworks in developing economies operating under heightened uncertainty and external vulnerability.

A growing body of empirical work has developed measurement-oriented methods to characterise income tax systems using administrative and micro-level data, constructing parametric representations suitable for quantitative macroeconomic analysis. A prominent approach uses smooth log-linear or closely related functional forms, building on early insights by Feldstein (1969) and Benabou (2000), and has since been widely adopted in modern

macro-public finance models (Heathcote et al., 2017). Using U.S. tax return data, Guner et al. (2014) estimate the effective average tax rate (ATR) and the marginal tax rate (MTR) and show that the tax system differs systematically from statutory rules. Subsequent studies examine how effective tax progressivity has evolved (Heathcote et al., 2020; Wu, 2021), across subnational jurisdictions (Fleck et al., 2025), and over the life cycle (Borella et al., 2023). Related measurement exercises extend this framework beyond the United States, including studies for Australia (Tran and Zakariyya, 2021), China (Li and Ma, 2017), Spain (García-Miralles et al., 2019), Germany (Kaas et al., 2021), and Canada (Kurnaz and Yip, 2022). Recent comparative evidence (Qiu and Russo, 2025) further demonstrates that simple parametric representations can capture key features of income taxation across a wide range of countries while highlighting systematic differences associated with economic development and household characteristics.

This paper contributes to this literature by empirically characterising the effective PIT schedule in Bangladesh using individual-level administrative income tax return data from the National Board of Revenue (NBR). The analysis covers the observed filers in administrative microdata, rather than a sample, allowing us to recover effective tax schedules for the full population of digitally observed taxpayers. We estimate multiple parametric representations of the effective tax schedule that map reported income to observed tax liabilities, drawing on functional forms widely used in the quantitative macro–public finance literature. Specifically, we estimate a log-level specification, a log-linear specification, a power-function specification, and the flexible functional form proposed by Gouveia and Strauss (1994). All specifications are treated symmetrically as alternative measurement devices, and no single functional form is assumed to represent the true tax schedule. The analysis is measurement-oriented and does not attempt to identify behavioural responses, tax evasion, or avoidance mechanisms.

For each specification, we assess how closely the implied ATR schedules track the raw data across the income distribution. We also compute the MTR implied by each parametric tax function and compare it with those constructed directly from the data using finite-difference estimates of tax liabilities across income percentiles. This comparison allows us to evaluate how conclusions about incentives and progressivity depend on the choice of functional form and to identify systematic gaps between statutory and implemented taxation.

Beyond income-based progressivity, we exploit information on declared net wealth to

examine whether effective tax burdens vary systematically with wealth conditional on income. It allows us to assess the extent to which asset ownership interacts with income taxation in practice and whether wealthier individuals face systematically different effective tax burdens than otherwise similar taxpayers. Finally, we assess the redistributive impact of the PIT by comparing pre-tax and post-tax income inequality among filers.

Our analysis reveals three empirical facts. First, the PIT is progressive in effective terms among filers, but only modestly so, as effective tax rates are low across most of the income distribution and rise meaningfully only at the very top. Second, effective marginal tax rates remain well below statutory benchmarks, implying weaker incentives than legislated rates suggest. Third, wealth interacts only weakly with effective income taxation, with meaningful differentiation emerging only at the very top; as a result, the redistributive impact of the PIT among filers is limited by low effective tax rates and a narrow tax base. Together, these facts highlight the importance of distinguishing between statutory tax design and tax implementation when assessing fiscal capacity in developing economies.

The remainder of the paper is organised as follows. Section 2 describes the institutional features of the PIT in Bangladesh, introduces the administrative tax return data, and discusses data coverage and measurement scope. Section 3 outlines the methodology. Section 4 presents the empirical results. Section 5 concludes.

2 Institutional Background and Data

This section summarises the main institutional features of the PIT in Bangladesh and describes the administrative tax return data used in the analysis. The goal is to clarify (i) the income tax environment and major institutional features that shape tax liabilities, and (ii) the scope of the observed tax base, since all estimates are conditional on participation in the formal income tax system.

2.1 PIT in Bangladesh

Bangladesh levies a progressive PIT on annual reported income. During the 2021-2022 financial year, the PIT schedule featured MTR ranging from zero to 25%, as specified in the Finance Act (2022). The schedule applied a zero tax rate up to the basic exemption threshold, followed by increasing marginal rates across successive income slabs. Appendix A.1 summarises the income tax schedule in force during this period. Under this benchmark system, MTR increases monotonically with income, reflecting the ability-to-pay principle embedded in the tax code.

In addition to income-based taxation, the PIT system includes a surcharge on individuals whose declared net wealth exceeds specified thresholds. The surcharge is intended to increase tax liabilities at the top of the distribution and introduce an explicit link between income taxation and wealth holdings. While the aggregate revenue contribution of the wealth surcharge is relatively small, it provides informative variation for assessing how effective tax burdens vary with wealth among income tax filers.

A prominent institutional feature of Bangladesh's tax system is the extensive use of tax expenditures, including exemptions, allowances, investment rebates, reduced rates, and special regimes. A significant portion of these provisions is implemented not only through the core income tax law but also through SROs and related notifications, which can grant sector- or activity-specific relief and provide presumptive or final tax arrangements. Khan et al. (2023) emphasise that these provisions are wide-ranging and can materially narrow the effective tax base. Using a revenue-forgone approach, they estimate tax expenditures of 2.28% of GDP for FY2018/19, indicating that preferential regimes are quantitatively meaningful rather than marginal.

Another institutional feature of Bangladesh's personal income tax system is the presence of minimum tax liabilities. The income tax code[1] contains several provisions that can generate a positive tax payment even when taxable income is low. First, taxpayers whose income exceeds the basic exemption threshold may be subject to a fixed minimum tax, the amount of which depends on the taxpayer's location and filing status. Second, taxpayers with gross receipts above specified thresholds may be liable for a minimum tax linked to declared net

[1]The Income Tax Ordinance, 1984; the Income Tax Act 2023.

wealth, irrespective of reported taxable income. Third, and most importantly, for selected sources of income, tax deducted at source constitutes the final or minimum tax liability, meaning that withheld taxes are not refundable even if the taxpayer's overall tax liability under the regular schedule would otherwise be lower.

Together, these provisions imply that some taxpayers face positive average and marginal tax burdens that do not scale proportionally with reported income. These institutional features imply that deviations between statutory and observed tax burdens may reflect both compliance and the legal structure of preferential tax treatment.

2.2 Administrative Tax Return Data and Coverage

The analysis uses anonymised micro-level administrative PIT return data provided by the NBR, Bangladesh. The dataset consists of individual income tax returns filed for the 2022-2023 assessment year, corresponding to income earned during the 2021-2022 income (fiscal) year. Accordingly, tax provisions under the Finance Act 2022 govern the tax liabilities observed in the data. The database contains more than two million individual tax returns and represents the universe of available PIT returns in digital form. The analysis is therefore not based on a survey sample, but on the universe of digitally observed filers in the administrative records. Each observation corresponds to a single individual tax return. Further details on data access, digitisation, and cleaning procedures are provided in Appendix A.2.

The administrative records report total taxable income, tax liability, and, where applicable, declared net wealth. These variables allow direct measurement of effective average and marginal tax burdens across the observed income distribution and enable analysis of wealth-related provisions, including the wealth surcharge. The administrative nature of the data ensures precise measurement of reported tax liabilities among participating taxpayers.

The unit of observation is the individual tax return. ATR is computed as the ratio of tax liability to reported income. Taxpayers with zero tax liability are retained in the analysis, as they are informative about the lower end of the effective tax schedule and capture the role of exemption thresholds, allowances, and other features of the PIT system.

Finally, the administrative tax data cover only individuals who participate in the formal PIT system. Individuals who do not need to file a tax return and those earning income entirely

in the informal sector are not observed (Khan et al., 2019). Consequently, all measures of inequality, progressivity, and redistribution reported in the paper are conditional on the population of PIT filers. Incorporating informal income would likely increase measured inequality and further attenuate the redistributive impact of the PIT. This limitation is inherent to administrative tax data. It does not affect the internal consistency of the estimated effective tax schedules or the comparison between statutory and effective taxation among filers.

3 Measuring Effective Income Tax Schedules

This section describes how we recover the effective PIT schedule from administrative tax return data and how we quantify its progressivity. The analysis follows the measurement-oriented approach adopted in Guner et al. (2014) and subsequent work, with adaptations appropriate to the institutional setting and data coverage in Bangladesh.

3.1 Effective ATR

Let y denote reported annual income and $T(y)$ the corresponding PIT liability. The effective ATR is defined as

$$t(y) = \frac{T(y)}{y}.$$

ATR provides a direct measure of the overall tax burden faced by taxpayers at different income levels and serves as a primary basis for assessing income tax progressivity.

We normalise income by its sample mean prior to estimation. Let

$$\tilde{y} = \frac{y}{\bar{y}},$$

where $\bar{y}$ denotes the mean reported income among tax filers. Normalisation renders the estimated tax functions scale-invariant and does not affect the implied degree of progressivity, which depends on relative rather than absolute income levels. It facilitates comparisons across

specifications and their use as calibration inputs in quantitative models.

To obtain smooth and parsimonious representations of the effective tax schedule, we approximate the relationship between normalised income and ATR using several parametric tax functions commonly employed in the literature. Each specification provides an alternative representation of the implemented tax schedule, differing in functional flexibility but sharing the objective of capturing the systematic relationship between reported income and observed tax burdens.

The first specification follows the Benabou (2002)-type functional form commonly used in quantitative macroeconomic applications for its flexibility,

$$t(\tilde{y}) = 1 - \lambda \tilde{y}^{-\tau},$$

where $\lambda > 0$ governs the overall level of taxation (a lower λ corresponds to a higher average tax rate) and $\tau \geq 0$ controls the curvature of the schedule. When $\tau = 0$, the tax system is proportional, while $\tau > 0$ implies progressivity (ATR increases with income).

The second specification is a log-linear form,

$$t(\tilde{y}) = \alpha + \beta \log(\tilde{y}),$$

which provides a simple approximation to a gradually increasing ATR schedule.

The third specification is a power-function form,

$$t(\tilde{y}) = \delta + (1 + \varepsilon)\gamma \tilde{y}^{\varepsilon},$$

which allows for nonlinear curvature in ATR and offers additional flexibility in capturing changes in progressivity across the income distribution.

The fourth specification follows the functional form proposed by Gouveia and Strauss (1994),

$$t(\tilde{y}) = b\left[1 - (s\tilde{y}^{p} + 1)^{-1/p}\right],$$

which has been widely used in quantitative macroeconomic applications and is known to provide a flexible fit to observed tax data, particularly at higher income levels.

All specifications are estimated from the same sample of income tax filers, using linear or nonlinear least squares (OLS and NLS), as appropriate. They are treated symmetrically as alternative measurement devices rather than as benchmark or nested models. Comparing the implied tax schedules across specifications allows us to assess the robustness of conclusions regarding effective progressivity and the sensitivity of estimated tax burdens to functional form choice. See appendix A.3 for computational details.

3.2 Construction of ATR and MTR

While ATR summarises overall tax burdens, MTR captures the incentives faced by taxpayers at the margin. We construct effective MTR from the administrative data as local changes in tax liabilities associated with changes in reported income. These effective MTR reflects the combined influence of tax rules, tax expenditures, and compliance behaviour[2].

In addition, we compute the statutory MTR implied by the benchmark tax schedule by applying tax brackets and marginal rates to reported income under a counterfactual of full compliance and no preferential treatments. This benchmark serves as a reference point for assessing how actual incentives differ from those implied by the tax code.

We also derive implied MTR from the estimated parametric tax functions by differentiating the associated tax liability schedules. Comparing (i) effective MTR constructed from the data, (ii) MTR implied by the parametric estimates, and (iii) statutory MTR serves two purposes. First, it provides a diagnostic check of the parametric specifications' ability to capture effective incentives. Second, it quantifies the gap between statutory and implemented MTR across the income distribution, particularly at higher income levels.

[2]The analysis is intentionally measurement-oriented. Estimated effective tax schedules capture the realised relationship between reported income and observed tax liabilities among income tax filers, reflecting rates, exemptions, income composition, and enforcement as implemented in practice. The approach does not identify behavioural responses, evasion or avoidance mechanisms, or causal effects of taxation. Differences across wealth groups should therefore be interpreted as reduced-form heterogeneity in the implementation of taxation rather than structural differences in behaviour.

3.3 Wealth and Effective Taxation

Finally, we examine how effective tax burdens vary with declared net wealth conditional on income. Because the PIT system includes a surcharge on individuals whose net wealth exceeds specified thresholds, wealth may directly influence tax liabilities. More broadly, the joint distribution of income, tax, and wealth provides descriptive evidence on whether high-wealth taxpayers face systematically different effective ATR or MTR than otherwise similar income tax filers.

Our analysis proceeds in two complementary ways. First, we document nonparametric differences in effective tax burdens across income and wealth groups. Second, we estimate parametric effective tax schedules separately by wealth groups, allowing the entire mapping from income to tax liability to vary with declared wealth. This analysis is descriptive in nature and does not attempt to identify evasion or avoidance mechanisms.

4 Results

This section presents empirical evidence on the implementation of the PIT in Bangladesh. We begin with descriptive evidence on the distribution of income, tax payments, and wealth among tax filers. We then document nonparametric patterns in effective ATR across the income distribution. Next, we report parametric estimates of effective tax schedules using multiple functional forms. We then examine how effective tax burdens vary with wealth conditional on income. Finally, we summarise the redistributive impact of income tax.

4.1 Income, Tax, and Wealth Distribution

Table 1 reports the distribution of reported income, income tax payments, and declared net wealth. Income and tax payments are highly concentrated at the top of the distribution. The top 20% of filers account for more than half of total reported income and over 90% of total income tax payments. Declared wealth is even more concentrated, indicating substantial heterogeneity in asset holdings among taxpayers. These patterns underscore the narrowness

of the effective tax base and the importance of measuring how taxation operates at the upper tail of the income and wealth distributions.

Table 1: Income, Tax, and Wealth Distribution Among Tax Filers

Quantile (share)	Income	Tax	Wealth
0–20%	5.6	0.0	1.9
20–40%	9.4	0.9	5.5
40–60%	12.2	1.3	9.2
60–80%	16.5	5.4	16.3
80–100%	56.3	92.4	67.1
95–99%	15.4	26.0	18.8
99–100%	18.1	48.4	21.0
Gini	0.493	0.897	0.634

It is important to interpret these distributions in light of the limited coverage of the personal income tax system. The administrative data capture only individuals who file income tax returns and therefore excludes a large share of households operating entirely in the informal sector. As a result, inequality measured among tax filers understates inequality at the national level. Survey-based evidence from Bangladesh confirms this gap. Using Household Income and Expenditure Survey (HIES) data, Razzaque et al. (2024) documents a national Gini coefficient of approximately 0.50 in 2022 and shows that income inequality has risen steadily over the past decade, driven in part by the heavy reliance on indirect taxation and the limited reach of progressive direct taxes.

4.2 Nonparametric Evidence on Effective ATR and MTR

Before imposing any parametric structure, we examine nonparametric patterns in effective ATR and MTR across the income distribution. This evidence provides a transparent description of taxation and serves as a benchmark for assessing the parametric estimates.

Effective ATR is computed as the ratio of observed total PIT liability to reported income, $t(y) = T(y)/y$, and then averaged within income percentiles. Figure 1 plots the resulting effective ATR schedule together with a statutory benchmark ATR schedule obtained by applying the legislated tax rules. Two features stand out. First, effective ATR is low across

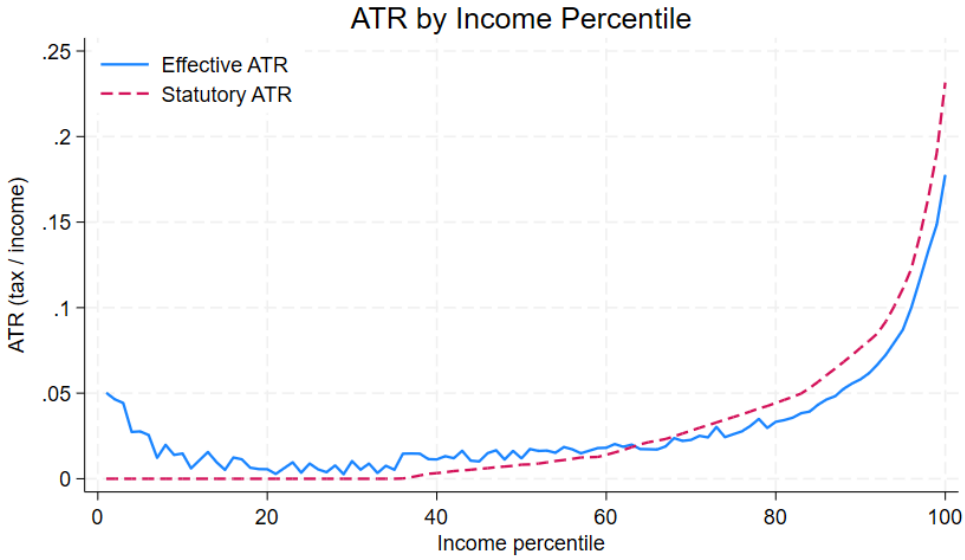

Figure 1: ATR by Income Percentile: Effective vs. Statutory Benchmark

most of the income distribution, and it rises sharply only in the upper tail. Even among the top decile, the effective ATR remains below 10%, and among the top 1% it remains below 18%, well below the top marginal rate of 25% (see table 2). It confirms that statutory progressivity translates only partially into realised average tax burdens.

Table 2: Average Effective Tax Rates by Income Group

Income Group	ATR (%)
Bottom 20%	1.82
20-40%	1.25
40-60%	1.46
60-80%	2.43
Top 10%	9.62
Top 1%	17.77

Second, the effective ATR lies *above* the statutory benchmark for a large segment of the lower- and middle-income distribution, up to roughly the 60th percentile. Table 3 helps anchor this pattern in income levels: the median filer reports income of about 360,000 BDT [3], and the 60th percentile is about 410,000 BDT. In our data, a significant fraction of filers

[3]Bangladeshi Taka

are clustered at or below the taxable threshold, implying that the tax schedule generates zero or very small ATR for much of the bottom half of the filer distribution. In contrast, as discussed in section 2.1, implemented taxation includes discrete components, most notably Bangladesh's non-refundable minimum tax regime, that generate positive liabilities even when reported income is low. Mechanically, a fixed minimum payment implies a positive ATR for low-income filers and therefore pushes the effective ATR above the statutory ATR until incomes move sufficiently far into the positive-rate region.

Table 3: Income Levels at Selected Percentiles Among Tax Filers

Income Percentile	Income Cutoff	Income Percentile	Income Cutoff
10th	190,000	60th	410,000
20th	247,510	70th	492,700
30th	281,500	80th	639,600
40th	321,872	90th	980,212
50th	360,000	99th	4,448,750

Notes: Cutoffs are exact percentiles of reported annual total income. Income is expressed in BDT.

Significantly, this lower-tail wedge contributes little to aggregate revenue. As shown in Table 1, the bottom 60% of the income distribution accounts for only 2.2% of total PIT revenue, despite comprising the majority of filers. Hence, while the effective ATR exceeds the statutory benchmark for much of the lower distribution, the overall tax incidence is overwhelmingly concentrated in the upper tail: the top 20% alone accounts for 92.4% of total tax revenue, and the top 1% accounts for 48.4%. The central message of Figure 1 is therefore not that low- and middle-income filers bear a significant tax burden. Instead, liabilities at the bottom are largely governed by discrete provisions, most notably minimum taxes, rather than by the smooth bracket-based benchmark schedule.

We next examine effective MTR, which captures marginal incentives. Effective MTR is constructed directly from the data using finite differences in mean tax liabilities across adjacent income percentiles and is compared to the statutory MTR implied by the benchmark tax schedule applied to mean income within each percentile. Table 4 reports the resulting effective and statutory MTR at selected percentiles. See appendix A.3 for the raw nonparametric plot of MTR.

Two patterns emerge. First, effective marginal rates are systematically below statutory marginal rates in the upper tail. At the top percentile, the statutory MTR is 25%, while the

Table 4: Nonparametric MTR by Income Percentile

Income Percentile	Effective MTR (%)	Statutory MTR (%)
20	7.4	0
40	9.4	5
60	9.4	10
80	11.5	10
90	12.5	15
95	17.2	20
100	19.3	25

effective MTR is about 19%.

Second, effective MTR is positive at income levels where statutory marginal rates are low or even zero. For example, at the 20th percentile, the statutory MTR is zero while the effective MTR is about 7%. It again reflects discrete features of the implemented system, including minimum tax liabilities and nonlinear liability rules, that can generate marginal payments even when the statutory schedule implies no liability at the threshold. As income rises, effective MTR increases gradually but remains below statutory benchmarks, especially near the top.

To summarise, the nonparametric ATR and MTR evidence conveys a consistent picture of implemented taxation in Bangladesh. The PIT is progressive among filers, but progressivity is modest and concentrated in the upper tail. For a large share of filers at or near the taxable threshold, the tax system departs from the smooth statutory benchmark because discrete rules, such as minimum taxes, generate positive liabilities even at low incomes; however, these taxpayers contribute only a negligible share of total revenue. By contrast, the bulk of tax revenue and the main redistributive force of the income tax arise from high-income filers, where effective marginal incentives remain substantially below statutory benchmarks. These patterns motivate the parametric analysis that follows, which provides smooth representations of the effective tax schedule suitable for quantitative macroeconomic applications.

4.3 Parametric Estimates of the Effective Tax Schedule

We now estimate parametric representations of the effective average tax schedule using four functional forms commonly employed in the quantitative macro–public finance literature. In

all specifications, income is normalised by the mean income prior to estimation, ensuring scale invariance and facilitating the use of the estimates as calibration inputs in quantitative models. All specifications are estimated on the same population of income tax filers and are treated symmetrically as alternative measurement devices rather than as benchmark or nested models.

Table 5 reports parameter estimates and goodness-of-fit statistics for the four specifications. Across all models, the estimated curvature parameters are positive and precisely estimated, implying that effective ATR increases with income in implemented taxation. At the same time, the magnitude of curvature and overall fit differ across functional forms, reflecting differences in how each specification captures the nonlinearity of the tax schedule.

Table 5: Parametric Estimates of Effective ATR Functions

Parameter	Estimate	Std. Error
Benabou $(t(\tilde{y}) = 1 - \lambda\tilde{y}^{-\tau})$		
τ (curvature)	0.0229	(0.00003)
λ (level)	0.9622	(0.00003)
R^2	0.394	
Root MSE	0.0421	
Log-linear $(t(\tilde{y}) = \alpha + \beta\log(\tilde{y}))$		
β (slope)	0.0239	(0.00003)
α (intercept)	0.0385	(0.00003)
R^2	0.189	
Root MSE	0.0418	
Power $(t(\tilde{y}) = \delta + (1+\varepsilon)\gamma\tilde{y}^{\varepsilon})$		
ε (curvature)	0.4227	(0.00088)
δ (shift)	-0.0324	(0.00019)
γ (scale)	0.0682	(0.00021)
R^2	0.308	
Root MSE	0.0386	
Gouveia–Strauss $(t(\tilde{y}) = b[1 - (s\tilde{y}^p + 1)^{-1/p}])$		
p (curvature)	1.8348	(0.00363)
b (asymptotic rate)	0.2114	(0.00031)
s (scale)	0.3573	(0.00143)
R^2	0.556	
Root MSE	0.0360	

Notes: All parameters are statistically significant at the 1% level.

Figure 2 overlays the fitted ATR schedules from each specification with a benchmark "data" schedule constructed nonparametrically from the tax-return microdata (and interpolated over the income grid). The figure makes clear that all four parametric representations capture the broad shape of the implemented tax system: ATR is close to zero over a broad middle range of incomes and rises rapidly only in the upper tail. At the same time, there are meaningful differences in how well each functional form tracks the benchmark schedule over the whole income range.

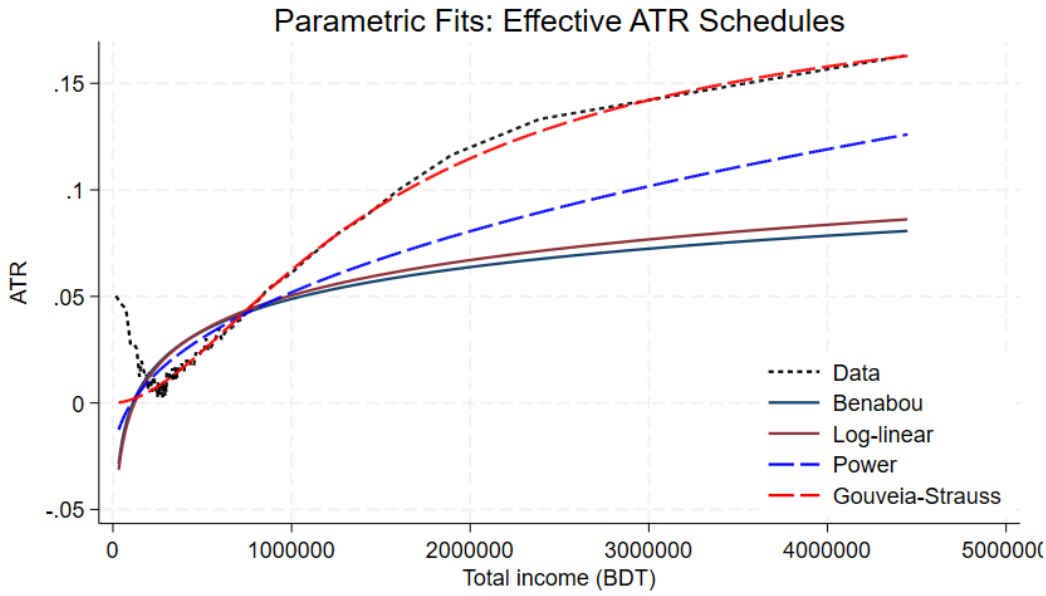

Figure 2: Parametric Fits: Effective ATR Schedules

Two patterns are particularly salient. First, the Benabou and log-linear forms fit the middle of the distribution reasonably well but imply comparatively mild curvature at higher incomes. As a result, these specifications tend to understate the steepness of the benchmark schedule in the upper tail, where effective ATR rises more rapidly. Second, the power function generates substantially more curvature than the log-level and log-linear forms, improving the fit at higher incomes. However, it departs from the benchmark in parts of the mid-to-upper range by implying a more uniformly convex schedule.

Among the four alternatives, the Gouveia-Strauss specification provides the closest overall match to the benchmark schedule. Consistent with its higher R^2 and lower Root MSE

in Table 5, the Gouveia–Strauss form tracks the benchmark schedule more tightly across both the middle of the distribution and the upper tail. Its flexibility allows it to capture the pronounced nonlinearity in implemented average tax burdens without forcing excessive curvature at lower incomes. For quantitative applications that require a single, smooth approximation of the effective tax schedule, this superior fit is a practical advantage. However, the main qualitative conclusions are not sensitive to the choice of functional form.

Despite differences in fit and curvature, all specifications imply relatively low effective tax rates across most of the observed income range. For incomes up to roughly four million BDT, the fitted ATR remains below 10% under the Benabou and log-linear specifications and below about 13% under the power specification. The benchmark schedule and the Gouveia–Strauss fit imply higher average burdens in the upper tail, reaching approximately 15–16% near the top of the observed range. Taken together, the parametric and benchmark evidence indicate that the PIT in Bangladesh is progressive among filers, but the degree of effective progressivity is modest and concentrated at high incomes. Differences across functional forms matter mainly for the steepness of the schedule in the upper tail, which is precisely the region most relevant for assessing top-end incentives and for calibrating heterogeneous-agent models with concentrated income distributions.

Before turning to international comparisons, we assess the sensitivity of the estimated curvature parameter to bottom-tail distortions. We re-estimate the Benabou-type effective ATR function after excluding filers with reported income below BDT 300,000, corresponding to the tax-free threshold. This restriction removes the lower portion of the income distribution, where minimum tax provisions and other discrete features of the tax system strongly influence effective tax rates. The results are reported in Table 6.

Table 6: Robustness: Benabou-Type Parameter Estimates Excluding Bottom Incomes

	Baseline	Income $\geq$ 300,000 BDT
λ	0.9622	0.9409
	(0.00003)	(0.00004)
τ	0.0229	0.0608
	(0.00003)	(0.00007)
N	2,108,287	1,378,659
R^2	0.394	0.574

Notes: The restricted-sample estimates exclude filers with reported income below the tax-free threshold.

Two findings stand out. First, the estimated curvature parameter increases substantially, from $\tau = 0.0229$ in the full sample to $\tau = 0.0608$ in the restricted sample. It indicates that income progressivity is considerably steeper once low-income filers below the tax-free threshold are excluded. Second, the level parameter λ declines, implying higher average effective tax burdens among the remaining filers. Despite this increase in curvature, the estimated τ remains modest relative to advanced economies, reinforcing the conclusion that limited effective progressivity in Bangladesh reflects structural features of the implemented tax system rather than being driven solely by bottom-tail distortions.

4.4 Institutional Sources of the Statutory-Effective Tax Gap

The gap between statutory and effective taxation documented in the preceding sections reflects a combination of institutional features of Bangladesh's personal income tax system. While the statutory tax schedule is progressive by design, several aspects of implementation systematically flatten the effective tax schedule faced by taxpayers.

First, extensive use of tax expenditures narrows the effective tax base. Numerous exemptions, reduced rates, and preferential treatments are granted through SROs, often outside the annual budget process. These provisions apply disproportionately to specific income sources and sectors, weakening the link between statutory marginal tax rates and observed tax liabilities, particularly at higher income levels. As a result, taxpayers with similar reported incomes may face markedly different effective tax burdens depending on income composition.

Second, enforcement capacity remains limited. Audit coverage is low relative to the number of registered taxpayers, and enforcement resources are concentrated on a narrow segment of filers (National Board of Revenue, 2023). In such an environment, statutory marginal rates provide a poor guide to actual incentives, as the probability of detection and adjustment is low for much of the distribution. This institutional setting helps explain why effective marginal tax rates remain well below statutory benchmarks even at the top of the income distribution.

Third, minimum tax provisions and withholding arrangements play an important role in shaping effective taxation. These provisions raise effective marginal tax rates at lower income

levels while compressing variation in effective rates across the middle of the distribution. At the same time, they do not generate proportionally higher liabilities at the top, contributing to the overall flatness of the effective tax schedule.

Overall, these institutional features imply that the effective personal income tax system is shaped not only by statutory rates but also by base definition, enforcement intensity, and the structure of tax liabilities across income sources. The resulting tax schedule differs substantially from the statutory design, with limited effective progressivity and modest redistributive impact. Importantly, these patterns arise even in the absence of explicit behavioural responses and are therefore intrinsic to the way the tax system is implemented in practice.

4.5 Global Comparison of Effective Progressivity

To place the effective progressivity of the Bangladesh PIT in an international context, we compare our estimated curvature parameter, τ, with cross-country estimates reported by Qiu and Russo (2025). That study estimates a standard Benabou-type progressivity parameter for a broad set of countries using harmonised data and methodology, making it a natural benchmark for international comparison. For consistency, we focus exclusively on the estimated curvature parameter τ, which governs the income tax progressivity.

Our estimate for Bangladesh, $\tau = 0.0229$, places the country at the very low end of the international distribution (see table 7). Among advanced economies, estimated τ values are substantially higher. For example, the United States exhibits a progressivity parameter of $\tau = 0.046$, while the United Kingdom ($\tau = 0.062$), Australia ($\tau = 0.059$), Canada ($\tau = 0.083$), France ($\tau = 0.075$), and Germany ($\tau = 0.133$) all display markedly steeper effective tax schedules. Spain, often cited as having a strongly progressive PIT, has a curvature parameter of $\tau = 0.157$, nearly seven times our estimate for Bangladesh. Even countries with relatively flat tax systems by OECD standards exhibit effective progressivity well above the Bangladesh level.

Relative to middle-income and emerging economies, Bangladesh's effective progressivity remains low. Brazil ($\tau = 0.038$) and Greece ($\tau = 0.042$) exhibit nearly double the curvature implied by the Bangladeshi PIT, while Colombia ($\tau = 0.018$) and Peru ($\tau = 0.013$) are

Table 7: International Comparison of Tax Progressivity Parameter τ

Country	τ	Country	τ
Peru	0.013	Australia	0.059
Colombia	0.018	United Kingdom	0.062
Bangladesh	0.023	France	0.075
Brazil	0.038	Canada	0.083
Greece	0.042	Germany	0.133
United States	0.046	Spain	0.157

Notes: Estimates from Qiu and Russo (2025), except Bangladesh from this paper.

among the few countries with comparably low effective progressivity. These comparisons indicate that Bangladesh's implemented PIT schedule is flatter not only relative to advanced economies but also relative to many peer emerging markets.

Significantly, this international comparison is based on *effective* rather than statutory progressivity. The low estimated curvature for Bangladesh is therefore consistent with the central findings of this paper: marginal rate schedules substantially overstate the degree of progressivity actually implemented, due to a narrow tax base, widespread exemptions, and enforcement constraints. From a global perspective, Bangladesh lies toward the lower end of the international distribution of effective progressivity, despite having statutory marginal rates that appear comparable to those of more progressive countries. This comparison suggests that calibrations based on statutory or advanced-economy effective progressivity are likely to overstate fiscal capacity in developing economies.

4.6 Wealth and Effective Taxation

This subsection examines whether effective tax burdens vary systematically with declared net wealth, conditional on income. We proceed in two steps. First, we present descriptive (nonparametric) evidence based on average effective tax rates across income and wealth groups. Second, we provide a structural assessment by estimating parametric effective tax schedules separately by wealth quintile, allowing the entire mapping from income to tax liability to differ across the wealth distribution.

Table 8 reports effective ATR by income group and wealth tercile. Three features stand out. Among middle-income filers (40–60%), effective ATR is uniformly low across all wealth

categories, ranging from about 1% to below 3%. While effective tax rates increase modestly with wealth within this income range, the absolute levels remain small, indicating limited wealth-related differentiation in realised tax burdens among middle-income taxpayers.

Table 8: Average Effective Tax Rates by Income and Wealth Groups

Income Group	Low Wealth	Middle Wealth	High Wealth
Middle income (40–60%)	1.04	1.63	2.71
Top 10% income	9.79	7.83	8.92
Top 1% income	9.12	4.78	18.39

Notes: Entries report mean effective ATR within income and wealth groups.

Among the top 10% of income earners, effective ATR exhibits no clear monotonic relationship with wealth. High-wealth individuals in this group do not face systematically higher ATR than their lower-wealth counterparts. In fact, middle-wealth filers face the lowest effective ATR. This non-monotonic pattern suggests that higher declared wealth does not automatically translate into higher effective income tax burdens, even among relatively high-income taxpayers. It is likely to reflect differences in income composition, such as greater reliance on capital gains, dividends, or other preferentially taxed sources among certain high-wealth filers, or heterogeneous take-up of exemptions and special regimes.

Substantial wealth-related dispersion emerges only within the top 1% of the income distribution. In this group, effective ATR ranges from below 5% for middle-wealth filers to over 18% for high-wealth filers. This sharp gradient indicates that wealth-related provisions, such as the wealth surcharge and asset-based income taxation, are observably relevant only for a narrow set of very high-income, high-wealth individuals. Even within this group, however, effective tax burdens remain highly heterogeneous.

To assess whether wealth systematically affects the *shape* of implemented taxation rather than only average levels, we estimate parametric effective ATR functions separately by wealth quintile. Table 9 reports estimates of both the Benabou-type and Gouveia–Strauss tax functions by wealth quintile.

The Benabou estimates indicate that effective progressivity is weak or absent for most of the wealth distribution. The curvature parameter τ is close to zero for the bottom four wealth quintiles. Small negative estimates should be interpreted as indicating an approximately flat schedule within those wealth groups, rather than economically meaningful regressivity,

Table 9: Parametric Effective ATR Functions by Wealth Quintile

	Q1 (Lowest)	Q2	Q3	Q4	Q5 (Highest)
Panel A: Benabou-type function					
λ	0.9815	0.9923	0.9839	0.9672	0.9393
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
τ	0.0092	−0.0047	−0.0022	0.0077	0.0346
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Panel B: Gouveia–Strauss function					
b	0.1666	0.0891	0.1255	0.1856	0.2457
	(0.0006)	(0.0008)	(0.0015)	(0.0024)	(0.0009)
s	0.6592	1.9419	0.4723	0.2605	0.2659
	(0.0098)	(0.0692)	(0.0127)	(0.0062)	(0.0022)
p	2.7680	3.0642	1.6636	1.1531	1.1199
	(0.0173)	(0.0318)	(0.0144)	(0.0087)	(0.0053)

Notes: Each column reports NLS estimates of effective ATR functions within a wealth quintile.

given discrete liabilities and limited variation in ATR over much of the support. In contrast, curvature rises sharply in the top wealth quintile ($\tau = 0.0346$), indicating a substantially steeper effective tax schedule for high-wealth filers. At the same time, the level parameter λ declines monotonically with wealth, consistent with higher average effective tax burdens among wealthier taxpayers once curvature is allowed to increase at the top.

The Gouveia–Strauss estimates reinforce this interpretation using a more flexible functional form. The upper-bound parameter b, which governs the maximum attainable effective ATR, increases steadily with wealth and reaches 0.246 in the top quintile. Meanwhile, the curvature parameter p declines markedly across the wealth distribution, from values above 2.7 in the bottom quintile to close to 1.1 in the top quintile. Taken together, these estimates imply that effective ATR rises more rapidly with income and converges to higher levels only for high-wealth taxpayers, while remaining flatter and more compressed for lower-wealth filers.

4.7 Redistribution and Inequality Among Tax Filers

We now assess the redistributive impact of the PIT by comparing income inequality before and after taxation among tax filers. Rather than relying on summary progressivity indices, we focus on changes in the income distribution induced by taxation, which provide a direct and transparent measure of redistribution. This approach is particularly appropriate in the

present context, where the tax code differs substantially from the implemented tax system and where effective tax rates vary markedly across the income distribution.

Table 10 reports the Gini coefficient for pre-tax and post-tax income among tax filers. The PIT reduces the Gini coefficient from 0.494 to 0.464, corresponding to a Reynolds–Smolensky redistribution effect of 0.029. While this reduction indicates that the income tax operates in a redistributive direction, the magnitude of the effect is modest.

Table 10: Income Inequality Before and After Taxation

	Gini Coefficient
Pre-tax income	0.494
Post-tax income	0.464
Difference (RS index)	0.029

This limited reduction in inequality is consistent with the nonparametric and parametric evidence presented earlier. Although tax payments are highly concentrated among top-income taxpayers, effective ATR remains low across most of the income distribution and rises meaningfully only in the upper tail. As a result, the mechanical scope for redistribution through income taxation is constrained. Even a progressive tax schedule generates limited inequality reduction when average effective tax rates are small and when a large share of income remains untaxed or lightly taxed.

4.8 Macroeconomic Implications

Our estimates of modest effective progressivity in Bangladesh's PIT have direct implications for macroeconomic stabilisation. In standard frameworks, progressive taxation acts as an automatic stabiliser by generating revenue responses to income fluctuations, but this depends on *implemented* rather than statutory progressivity. Given low ATR and MTR across most of the distribution, rising only at the top, the PIT's revenue elasticity to aggregate income is limited, weakening its role as a stabiliser during downturns, especially if shocks hit middle-income groups. It reduces fiscal multipliers, as empirical evidence from advanced economies suggests multipliers are higher under progressive effective taxation due to constrained households amplifying spending responses (Guo et al., 2023). In developing contexts like Bangladesh, exposed to external shocks and financial tightening, weak progressivity may lower multipliers

relative to statutory benchmarks, according to calibrated heterogeneous-agent models.

From a quantitative perspective, calibrating macro models to these effective schedules—rather than statutory ones or advanced-economy proxies—can alter assessments of optimal shock responses and revenue capacity, highlighting the need for implementation-focused reforms to enhance fiscal space.

5 Conclusion

This paper provides the first empirical characterisation of the effective PIT schedule in Bangladesh using administrative tax return data for all digitally observed individual filers. Combining nonparametric evidence with multiple parametric representations, it documents the implemented tax system rather than statutory prescriptions.

Key findings include modest effective progressivity among filers, where ATR increases with income but remain low for most of the distribution and rise sharply only in the upper tail, while MTR lies below statutory levels; robustness across specifications, with flexible forms showing steeper upper-tail curvature but all indicating limited taxation over the broader income range due to implementation constraints like narrow bases and weak enforcement; and limited wealth influence on tax burdens conditional on income, characterised by dispersion rather than systematic increases, such that meaningful progressivity tied to wealth emerges only for high-income, high-wealth individuals, resulting in modest redistribution driven by low effective rates and incomplete coverage.

When effective income taxation is weakly progressive and narrowly based, governments face greater difficulty mobilising revenue in response to adverse shocks without resorting to debt accumulation, expenditure compression, or increased reliance on indirect taxation. This constraint is especially relevant in economies exposed to external shocks and global financial tightening, where countercyclical fiscal responses are most needed. In this sense, limited implementation of progressivity weakens not only redistribution but also the insurance properties of fiscal policy—precisely when external shocks raise the value of automatic stabilisation.

The analysis contributes to macro-public finance by offering grounded estimates for low-capacity settings, emphasising effective over statutory schedules in model calibration, fiscal capacity assessment, and stabilisation evaluation amid uncertainty. Policy-wise, prioritising base broadening and implementation strengthening may yield greater revenue gains than statutory rate hikes. These results also highlight Bangladesh's position near the lower end of international comparisons of effective tax progressivity, underscoring the challenges of building fiscal capacity in developing economies with large informal sectors.

Limitations include conditioning on formal filers (excluding informal sectors and non-filers) and focusing solely on PIT, abstracting from indirect taxes and expenditures central to overall incidence. Future research could integrate tax data with surveys, track changes over time, and encompass the entire tax-transfer system to provide deeper insights into taxation, redistribution, and fiscal resilience in developing economies.

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A Appendix

A.1 Statutory PIT Schedule

Table 11 summarises the PIT schedule in Bangladesh for the tax year under study. The benchmark schedule features a basic exemption threshold and increasing MTR across income brackets, with a top marginal rate of 25%.

Table 11: Statutory Benchmark PIT Schedule (Income Year 2021–22; Assessment Year 2022–23)

Income Slab (BDT)	**MTR (%)**
Up to first 300,000	0
Next 100,000	5
Next 300,000	10
Next 400,000	15
Next 500,000	20
Balance amount	25

Source: Finance Act (2022).

Two additional features are important for interpreting effective taxation in the administrative data. First, exemption thresholds differ across taxpayer categories. In particular, the tax-free threshold for female taxpayers is BDT 350,000, which implies that a non-trivial share of filers may face zero liability even when their reported income is positive. Second, Bangladesh applies a non-refundable *minimum tax* once reported income exceeds the relevant exemption threshold. Under the provisions applicable in the tax year studied, the minimum tax payable (between BDT 3,000, and BDT 5,000 depending on the taxpayer's location of income.

In addition to income-based taxation, a surcharge applies to individuals whose declared net wealth exceeds specified thresholds. The surcharge is intended to increase the tax burden on very high-wealth individuals, although its contribution to total income tax revenue is limited.

A.2 Data

This study uses confidential administrative data on individual PIT returns obtained from NBR, Bangladesh. The data correspond to the 2022–2023 assessment year and cover income earned during the 2021–2022 financial year. In total, 3,683,226 individual income tax returns were submitted to the NBR in this assessment year (National Board of Revenue, 2023).

During this period, the NBR operated a mixed filing system. Tax returns were submitted either electronically via the *eReturn* system or on paper at tax offices. Paper returns

were subsequently digitised as part of the Office Management System project. Due to administrative and human resource constraints, not all paper returns could be digitised immediately. The final database used in this study combines returns submitted electronically and those successfully digitised from paper submissions. While the database does not include every paper return submitted, it constitutes a large and representative subset of the population of filed returns. It covers the full income distribution of registered taxpayers.

NBR granted the author access to the confidential administrative income tax return data under Memorandum Number *08.01.0000.039.04.002.22 (Part-6)/801*, dated 23 February 2023. All analysis complies with the data access conditions imposed by the NBR. Results are reported exclusively in anonymised and aggregated form, and no information that could permit the identification of individual taxpayers is disclosed. The dataset cannot be shared.

The raw dataset contains duplicate observations resulting from data entry errors during digitisation. After removing multiple entries corresponding to the same tax return, the number of unique observations is 2,113,795. Additional data cleaning steps include excluding returns reporting negative total income and removing observations with implausibly high ATR. Specifically, any return with an ATR exceeding 45% is excluded, as no income source in Bangladesh is subject to taxation at such a rate. After applying these cleaning procedures, the final analysis sample consists of 2,108,287 individual tax returns.

All descriptive and distributional statistics reported in the paper are robust to alternative normalisations by income percentiles, indicating that incomplete digitisation of paper returns does not materially affect the shape of the estimated tax schedules. Due to confidentiality restrictions imposed by the NBR, the author cannot share the administrative tax return data used in this study.

A.3 Computation

This appendix describes the computational procedures in Stata and provides diagnostic evidence on the effectiveness of MTR from administrative return data. All estimates are based on individual-level NBR data and employ standard Stata routines with custom transformations.

Key variables—total reported income and tax—are directly from returns. Effective ATR is tax liability divided by reported income, excluding cases with zero or negative income. Filers

are ranked by income and grouped into percentiles or broader categories for distributional analysis.

Nonparametric ATR estimates the average within groups. Effective MTR uses finite differences in mean tax and income across percentiles: for mean tax $\bar{T}_p$ and income $\bar{y}_p$ in percentile p,

$$\widehat{\mathrm{MTR}}_p^{\,\mathrm{eff}} = \frac{\bar{T}_p - \bar{T}_{p-1}}{\bar{y}_p - \bar{y}_{p-1}}, \quad p = 2, \ldots, 100.$$

Statutory MTR applies legislated brackets to mean income per percentile, ignoring exemptions and preferences. Redistribution compares pre- and post-tax Gini coefficients.

Parametric functions are estimated via OLS (linear) or NLS (nonlinear), with income normalised by the mean for scale invariance. Specifications are symmetric approximations; parameters generate fitted ATR and MTR on a common grid for comparison.

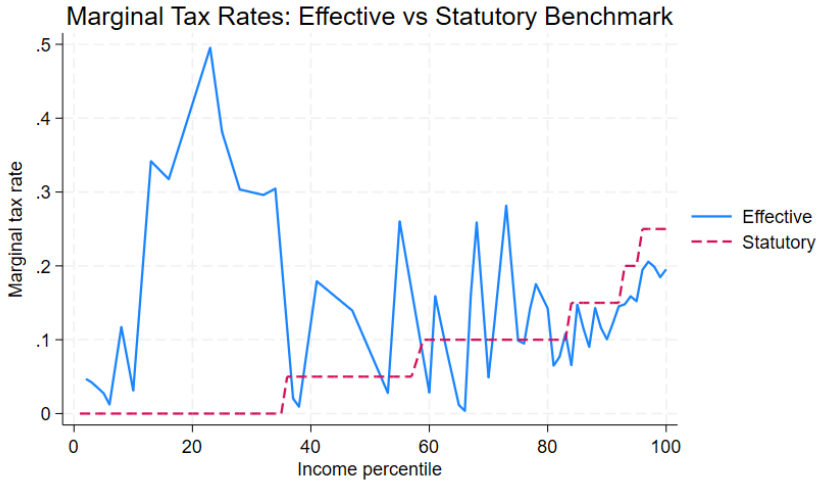

Figure 3: MTR by Income Percentile: Effective vs. Statutory Benchmark

Figure 3 plots unsmoothed effective and statutory MTR by percentile. The effective series shows noise from discrete differences, amplified by bunching and tax features—view as measurement variation, not incentive volatility. Main text focuses on Table 4 comparisons and smoothed summaries, confirming effective MTR below benchmarks in the upper tail due to exemptions, regimes, compliance, and enforcement.

Tables and figures are derived from reproducible Stata scripts that rely solely on observed data, without behavioural assumptions.

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