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On the redistributive impact of the personal income tax: Evidence from South Africa

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On the redistributive impact of the personal income tax

Evidence from South Africa

Nadine Riedel* and Ida Zinke*

April 2025

Abstract: South Africa is one of the most unequal economies globally. In this paper, we examine the design of its personal income tax (PIT), with a focus on its redistributive function. We apply the Pfähler decomposition method to analyse the redistributive effects of key components of the South African PIT system, including the marginal tax rate schedule, the definition of gross taxable income, and the provision of tax deductions and tax credits. Our findings highlight that the marginal tax rate schedule is the primary driver of redistribution, while tax expenditures often favour higher-income individuals, resulting in adverse redistributive effects. Additionally, we assess how recent changes to the PIT schedule have influenced redistribution. Among others, we show that below-inflation adjustments of marginal tax thresholds increased post-tax inequality and weakened the system's redistributive impact. We conclude by discussing policy options to enhance the redistributive capacity of South Africa's PIT system.

Key words: South Africa, personal income tax, Pfähler decomposition, redistribution, tax expenditures

JEL classification: H24, H23, D31, O55

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1 Introduction

South Africa is one of the most unequal economies in the world. Policies to reduce income inequality and improve social cohesion have been high on policy-makers' agendas for years. The personal income tax (PIT) serves as a main fiscal instrument to redistribute income from higher-earning to less-well off individuals (Goldman and Woolard 2022). In this paper, we shed light on how different elements of the South African PIT system—the marginal tax rate schedule, tax deductions, allowances and exemptions, and tax credits—contribute to the redistributive capacity of the PIT system.

The analysis draws on the population of personal income tax returns and PAYE (pay-as-you-earn) reports provided by the South African Revenue Service (SARS). Applying an extended version of the Pfähler decomposition (Onrubia et al. 2014), we evaluate all individual items of the South African PIT system (the tax rate schedule as well as the PIT system's tax expenditures) in terms of their absolute and relative redistributive impact. In additional analyses, we illustrate how recent reforms to the South African PIT schedule changed the redistributive capacity of the PIT system. Our study is—to the best of our knowledge—the first to decompose the redistributive effects of elements of the PIT system in a lesser-developed country context.

The results of the Pfähler decomposition show that the redistributive impact of the South African PIT scheme is predominantly driven by the progressive marginal tax rate schedule. Non-taxable allowances and exemptions have a minimal redistributive effect, while most tax deductions and tax credits exacerbate after-tax inequality as take-up is highly concentrated among higher-income earners. Additional analyses study the redistributive effect of three recent reforms to the South African PIT system:

- A reform of pension-related deductions in 2016, which aimed to make pension deductions more generous and fairer by harmonizing the treatment of different pension funds and adjusting deduction thresholds (Redonda and Axelson 2021).
- The introduction of a new top tax bracket of 45%, which increased the top income tax rate by 4 percentage points in 2017.
- Bracket-creep, that is, below-inflation adjustments of tax thresholds in the marginal tax schedule during our sample frame.

Our findings suggest that the pension deduction reform reduced the redistributive effect of the PIT schedule as higher-income individuals benefited relatively more from the reform than individuals with lower income. The increase in the top marginal tax rate, intuitively, *ceteris paribus* increased the redistributive capacity of the PIT system. We, however, also document that, after the reform, income grew more weakly at the upper end of the income distribution, implying that the redistributive impact of the marginal tax schedule did not increase. A recent paper by Axel-

son et al. (2024) suggests that the differential income trends might reflect a causal response of treated taxpayers to the top tax increase. Importantly, we further document that bracket creep increased the tax burden on middle-income individuals over time, thereby weakening the redistributive effect of the South African PIT schedule. We close by discussing policy options to increase the redistributive impact of the South African PIT system.

Our paper contributes to a small literature, which draws on tax administrative data to shed light on the redistributive effects of PIT systems and their individual elements. Studies have so far largely focused on developed country settings—see, for example, Kristjánsson (2013) for Iceland, Miyazaki and Kitamura (2016) for Japan, and Barbetta et al. (2018) for Italy. Research for lesser-developed economies is scarce and, if anything, quantifies the redistributive impact of the PIT as a whole or focuses on selected items (Goldman et al. 2021; Inchauste et al. 2015; Maboshe and Woolard 2018; Nhamo and Mudimu 2020; Redonda and Axelson 2021). A comprehensive perspective accounting for all key aspects of the PIT schedule is to date still missing—for South Africa and, to the best of our knowledge, also for other emerging or developing economies. This is, from our perspective, an important gap in the literature as insights from developed countries may not extend to economies in the developing world—which are often characterized by higher levels of income inequality, a sizeable informal sector, and weaker tax administrative capacity (Besley and Persson 2013).

The rest of the paper is structured as follows: Section 2 describes the institutional background. Sections 3–5 shed light on the South African PIT’s redistributive capacity. Sections 6 and 7 discuss policy options to strengthen the redistributive capacity of the South African PIT system and offer conclusions.

2 Institutional background

2.1 Inequality in South Africa

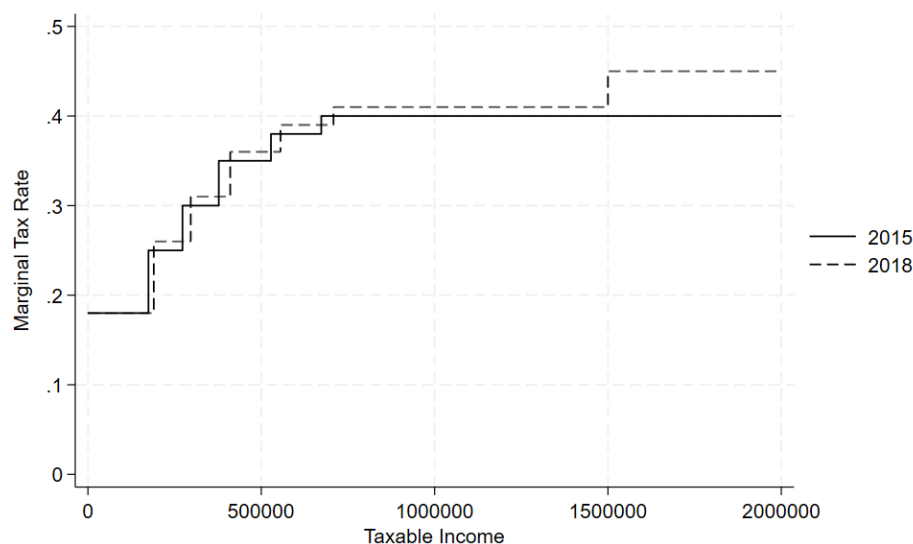
South Africa is a middle-income economy with a GDP per capita of around US\$7,000. It is characterized by a high level of income inequality: in 2018, the top 50% of income earners captured more than 92% of gross income; the top 1% captured 12.77% (own calculations based on the population of tax returns, see below for details). Despite democratization and several reforms after the end of the apartheid regime, the literature agrees that income inequality in South Africa has remained high (Leibbrandt et al. 2010), with a subtle decline since 2015, however (Goldman et al. 2021). Reducing inequality is high on the government’s agenda (see, e.g. the National Planning Commission’s 2011 *National Development Plan 2030*). Next to a number of ‘predistribution instruments’, such as minimum wages (World Bank Group 2018), the tax and transfer system is the main instrument in the government’s hands to redistribute

resources (Chancel et al. 2022)—and, within the tax system, redistribution is largely achieved through the PIT (e.g. Goldman et al. 2021).

2.2 Personal income tax in South Africa

The South African PIT, as outlined in the Income Tax Act 58 from 1962 (South Africa 1962), is levied on individuals' income and is residence-based (SARS 2021). Filing is done individually, and there are no distinctions between married or unmarried individuals (Maboshe and Woolard 2018). The analysis in this paper draws on data for two tax years: 2014/15 and 2017/18. The marginal tax rate schedules in these years are depicted in Figure 1. In 2014/15, the tax schedule had six tax brackets, with marginal tax rates ranging from 18% to a maximum of 40%. Individuals with income below ZAR70,000 were exempted from taxation (above the ages 65 and 75 exemption thresholds were higher, amounting to ZAR110,200 and ZAR123,350, respectively).

Figure 1: Tax rate schedule in South Africa, 2015 and 2018



Source: own depiction based on National Treasury (2015, 2017).

Over time, tax brackets, rebates, and thresholds have been adjusted to (partially) account for inflation (e.g. National Treasury 2016). The tax exemption threshold, for example, moved up to ZAR75,750 in 2017/18 (ZAR117,300 and ZAR131,150 for individuals above the ages of 65 and 70, respectively).

Between 2014/15 and 2017/18, the South African government furthermore implemented a number of changes to the PIT schedule: in tax year 2015/16, marginal tax rates increased by 1 percentage point in all but the lowest bracket, and a new top PIT tax bracket was introduced at ZAR1.5 million in tax year 2017/18, above which incomes were taxed at the new top tax rate of 45%.

See Appendix A for further details. In the following, we will shed light on the redistributive effect of the South African PIT system and its different elements, and will assess how reforms to the tax system impacted the redistributive capacity of the system.

3 Data

The analysis draws on tax administrative microdata provided by the SA-TIED programme through cooperation of the United Nations University World Institute for Development Economics Research (UNU-WIDER), SARS, and the National Treasury. The data are provided at the National Treasury Secure Data Facility in Pretoria and were accessed from November 2022 to December 2024.

We draw on anonymized data on income and income taxes of formally employed individuals in South Africa, the so-called ‘individual panel’ (National Treasury and UNU-WIDER 2019). This panel is created by merging the population of payroll tax returns (IRP5) and the population of PIT returns (ITR12). The IRP5 returns are submitted by employers for their employees and allow calculating the provisional tax liability. The ITR12 return is submitted by the taxpayer and aggregates all information to compute the final tax liability of an individual. It incorporates the information provided on the IRP5 certificate, and, furthermore, accounts for additional income (e.g. self-employment income), as well as tax deductions and tax credits.

We draw on information from two tax years: 2015 and 2018. The final dataset for analysis includes data on income, tax expenditures, and tax liability for 14,065,424 individual taxpayers in tax year 2018 and 13,997,951 taxpayers in 2015. The dataset is constructed by merging the source code panel and the income panel for both tax years. Duplicates and unassessed observations are removed. Implausible observations are dropped, where tax liability exceeds taxable income (0.2355% of the observations in 2018 and 0.2246% of the observations in 2015). Tax expenditure variables are derived by aggregating relevant source codes. Gross tax liability is calculated by applying the corresponding tax schedule to an individual's taxable income. The final tax liability is then determined by subtracting tax credits from gross tax liability. Final net income is the difference between gross income (excluding lump sums) and the calculated final tax liability. For a detailed discussion of cleaning steps, see Appendix B.

4 Tax expenditures in South Africa: a first look

Before we embark on the main analysis of the redistributive effects of the PIT, we provide a brief overview and descriptive statistics on tax expenditures in the South African PIT system. Following the OECD (2010), we classify tax expenditures in tax exemptions, allowances, and deductions and tax credits.

- Tax exemptions are specific incomes excluded from taxable income, such as minimum incomes or incomes from specific sources.
- Allowances and deductions are amounts subtracted from gross income that reduce the tax base. Allowances are typically defined as lump sums, while deductions are mostly proportional to income or related to specific expenditures (see, e.g. Avram 2018).
- Tax credits are amounts that can be deducted from the gross tax liability.

In South Africa, tax expenditures have been calculated to account for about ZAR238.178 billion in revenue forgone in tax year 2017/18 (4.6% of GDP), up from around ZAR139.1 billion in revenue forgone in the tax year 2014/15 (3.6% of GDP; National Treasury 2017, 2022). The fiscal costs of tax expenditures in South Africa are considered substantial when compared to other countries and regions (Redonda et al. 2022). Table C.1 in the Appendix lists and describes all relevant tax expenditures in tax years 2015 and 2018.

The policy objectives underlying tax expenditures fall into two broad categories. The first relates to fairness considerations: taxpayers may incur certain expenses that they cannot freely allocate. One example is work-related expenses, such as for home offices or business trips (e.g. travel or meals); another is health-related expenses when individuals are sick. The income spent on these items does not increase taxpayers' ability to pay and vertical and horizontal fairness considerations may render it desirable to allow related expenses to be tax deductible, through deductions from the PIT base or through a tax credit; or—in case of employer compensation—tax-exempt compensation payments. The second broad category is tax expenditures, which are in place to incentivize certain types of behaviour. This includes, for example, deductions for donations, which aim to foster charitable giving, and the deduction of venture capital company investments, designed to incentivize venture capital provision.

Still, tax expenditures in PIT systems are much debated, and the specific set of deductions and credits granted widely varies across countries—reflecting that they involve trade-offs. There are two main challenges when countries opt for tax expenditures. First, tax expenditures can offer scope for tax evasion and avoidance: in the work domain, taxpayers might, for example, declare private travel as business trips to deduct related costs from the income tax base. In line with this notion, empirical evidence suggests that tax systems with many tax expenditures tend to be particularly prone to tax avoidance and evasion behaviour (see, e.g. Benzarti and Wallossek 2023; Saez et al. 2012; Slemrod and Kopczuk 2002). Second, in many contexts, it is in practice a challenging endeavour to delineate expenses that qualify for tax expenditures from those that, conceptually, do not. One example is, again, travel expenditures. Here, it might be difficult to disentangle business-related expenditures (which should be tax deductible, following the above considerations) from private benefits (which should not be tax deductible, following the above considerations): individuals may, for example, during business

travel opt for a particularly agreeable (and expensive) option, which comes with private benefits.

Governments hence face trade-offs when deciding on tax deductions and tax credits. One relevant criterion for design decisions is the distributional impact of such tax expenditures. It is one aim of this paper to shed light on this in the South African tax system. Table 1 lists categories of exempted income, tax deductions, and tax credits in the PIT system in 2015 and 2018, respectively, sorted by their importance according to taxpayer use (cf. columns (1) and (3)). The table also highlights the average amount claimed per taxpayer (conditional on making use of the tax expenditure, cf. columns (2) and (4)).

Non-taxable income is earned by relatively few individuals. Tax deductions are more common—in particular, deductions for retirement fund contributions, which were claimed by around 26% of taxpayers in 2015. After a major reform in 2016—which expanded the generosity with which pension contributions could be deducted and streamlined deduction options across different instruments—the fraction of taxpayers claiming pension deductions increased to 48%. Tax deductions and non-taxable allowances are, moreover, provided for work-related expenses, such as travel expenses, subsistence expenses, employer-provided vehicles, public offices, or home office expenses. Some taxpayers who receive business or commission income also claim related deductions: accountancy fees, costs of depreciation, or commission income expenses. Further, there are incentive-based deductions for donations and investments in venture capital companies. All these deductions are claimed by relatively few taxpayers in South Africa, well below 1% of the full taxpayer population. But average deduction amounts can be high in some categories, such as commission income expenditures. Finally, there are two sets of tax credits in the South African tax system: the first accounts for medical scheme contributions and medical expenses ('medical tax credit' (MTC) and 'additional medical tax credit' (AMTC)). The second is a standard rebate granted to all taxpayers. Table 1 indicates that MTC are claimed by over 23% of taxpayers in 2015 and 2018, while AMTC are claimed by about 5% in both years. All taxpayers with a positive tax liability claim the standard rebate.

Table 1: Tax expenditure claims in South Africa, 2015 and 2018

Item	2015		2018	
	% of taxpayers	Avg. amount claimed (ZAR)	% of taxpayers	Avg. amount claimed (ZAR)
Non-taxable allowances and exemptions	3.6877	11,179.53	4.5838	19,352.90
Other non-taxable allowances (A)	1.8860	5,831.13	2.4072	7,309.81
Reimbursive non-taxable travel expenses (A)	0.6330	3,011.17	0.7994	4,270.83
Non-taxable income (E)	1.3419	20,836.72	1.5220	43,918.25
Non-taxable scholarship for basic education (E)	0.0146	22,835.29	0.0440	19,552.22
Deductions	29.2213	23,563.88	48.8577	39,354.28
Pension fund contributions (D)	25.7222	17,124.52	48.2634	35,105.28
Income insurance contributions (D)	5.0494	3,252.03	–	–
Travel expenses fixed costs (D)	2.7210	58,257.11	2.4162	64,335.08
Donations (employee) (D)	0.6226	10,229.51	0.5792	8,351.03
Employer-provided vehicle (D)	0.3734	58,107.50	0.3537	67,726.14
Commission income expenditures (D)	0.2353	81,336.49	0.1992	91,988.51
Travel expenses actual costs (D)	0.2338	40,826.83	0.1422	56,428.82
Home office expenses (D)	0.1104	26,532.70	0.1135	27,065.15
Accountancy fees (D)	0.0861	7,052.22	0.1011	8,180.89
Subsistence expenses (D)	0.0856	15,024.47	0.0664	17,074.35
Donations (employer) (D)	0.0622	705.04	0.0731	864.40
Depreciation (D)	0.0567	14,673.42	0.0528	18,709.35
Foreign income (D)	0.0169	508,730.5	0.0082	536,156.2
Public office (D)	0.0105	41,872.86	0.0095	40,703.37
Employer-provided vehicle, operating lease (D)	0.0082	72,771.46	0.0108	74,607.07
VCC (D)	0.000011	48,184.25	0.0041	1,233,355.00
Credits	44.4685	17,029.50	47.0187	18,543.09
MTC (C)	23.8104	6,186.69	23.7653	7,276.60
AMTC (C)	5.4156	5,357.15	6.2641	6,153.80

Note: (A) denotes non-taxable allowances, (E) exemptions, (D) deductions, and (C) credits. Grey rows depict the group of items. % of taxpayers presents the percentage of taxpayers claiming the tax expenditure; avg. amount claimed (ZAR) indicates the average claim for taxpayers with a non-zero item.

Source: own calculations based on National Treasury and UNU-WIDER (2019).

Table 2 illustrates how the use of tax exemptions and allowances, deductions, and credits is distributed across the income distribution. To do so, the table presents the so-called concentration index, which is constructed based on a concentration curve equivalently to a Gini index. Specifically, a concentration curve of taxes, C_X , is derived by plotting the cumulative share of taxes, X , against the share of taxpayers, which are ranked according to their pre-tax income. Larger concentration indices indicate that taxes are more concentrated among higher-income taxpayers. The table illustrates that deductions and tax credits are almost exclusively claimed by taxpayers at the very top of the income distribution. Complementarily, Figure 2 displays the concentration curves of tax deductions, tax credits, and tax-exempted income. The figure illustrates that tax deductions are even more concentrated than tax credits—which may relate to take-up behaviour but also to the fact that the tax reduction of a one-dollar deduction—contrary to tax credits—increases with the marginal tax rate and hence with taxpayers' taxable income. The claiming of tax-free income, in turn, is spread much more equally across the income distribution.

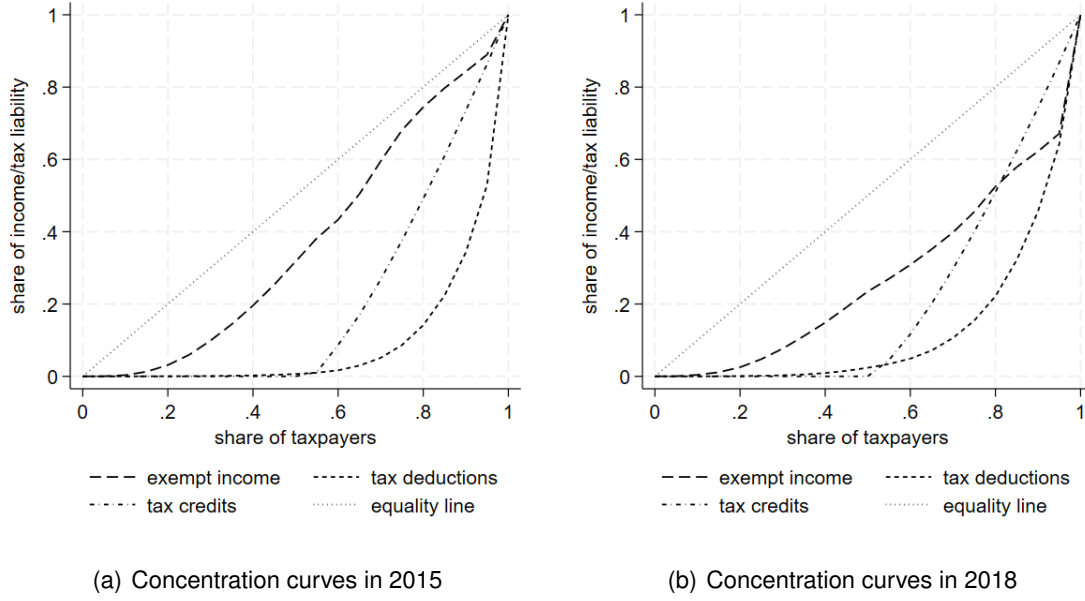
Table 2: Concentration indices of tax expenditures in South Africa, 2015 and 2018

Item	2015	2018
Non-taxable allowances and exemptions	0.254	0.4598
Other non-taxable allowances (A)	0.4312	0.4847
Reimbursive non-taxable travel expenses (A)	0.3648	0.4806
Non-taxable income (E)	0.1788	0.4580
Non-taxable scholarship for basic education (E)	0.0634	0.0044
Deductions	0.8131	0.7438
Pension fund contributions (D)	0.7739	0.7247
Income insurance contributions (D)	0.7922	—
Travel expenses fixed costs (D)	0.8967	0.8905
Donations (employee) (D)	0.8055	0.8805
Employer-provided vehicle (D)	0.8723	0.8661
Commission income expenditures (D)	0.9134	0.8925
Travel expenses actual costs (D)	0.8095	0.7970
Home office expenses (D)	0.8765	0.8527
Accountancy fees (D)	0.8630	0.8186
Subsistence expenses (D)	0.7932	0.7651
Donations (employer) (D)	0.0528	0.0165
Depreciation (D)	0.8724	0.8445
Foreign income (D)	0.9284	0.9186
Public office (D)	0.9080	0.9275
Employer-provided vehicle, operating lease (D)	0.8983	0.8867
VCC (D)	0.6264	0.9938
Credits	0.5902	0.5709
MTC (C)	0.7007	0.7026
AMTC (C)	0.7638	0.7370

Note: (A) denotes non-taxable allowances, (E) exemptions, (D) deductions, and (C) credits. Grey rows depict the group of items.

Source: own calculations based on National Treasury and UNU-WIDER (2019).

Figure 2: Concentration curves of tax expenditure categories in South Africa, 2015 and 2018



Source: own depiction based on National Treasury and UNU-WIDER (2019).

5 Redistribution in the PIT

5.1 Measuring the redistributive impact of the PIT system

The PIT's impact on the post-tax income distribution can be quantified by various measures of redistribution and progressivity. One of the most prominent measures of progressivity is the *Kakwani index* (Π^K ; Kakwani 1977), which measures how progressively tax liability is distributed relative to the taxpayer's income. A positive Kakwani index indicates progressivity of the tax system. Formally, it is defined as the difference between the concentration index of final tax liability (i.e. tax liability after tax credits), CI_{TF} , and the Gini coefficient of gross income (G_I):

$$\Pi^K = CI_{TF} - G_I \quad (1)$$

However, the total redistributive effect is not only determined by the distribution of the tax, but also by the level of the tax. A measure of the redistributive effect of a tax is the *Reynolds and Smolensky index* (R&S index; Π^{RS}) developed by Reynolds and Smolensky (1977). It expresses the redistributive effect of a tax as a function of the relative size of the tax as a proportion of net income ($\frac{t}{1-t}$) and the progressivity of the tax (Π^K ; Kakwani 1977; Verbist and Figari 2013):

$$\Pi^{RS} = \frac{t}{1-t} \Pi^K \quad (2)$$

Also note that, in practice, taxes can cause reranking—that is, they can change the order of individuals according to their income (Verbist and Figari 2013). While the R&S index measures vertical equity, reranking refers to the concept of horizontal inequity. The reranking effect (RR)

is calculated as the difference between the Gini (G_{NIF}) and the concentration index of final net income:

$$RR = G_{NIF} - CI_{NIF} \quad (3)$$

If reranking is present, the total redistributive effect of a tax (RE) is defined as the sum of vertical equity and the unequalizing reranking effect:

$$RE = \Pi^{RS} - RR \quad (4)$$

Table 3 summarizes the redistributive effects of the South African PIT for the tax years 2015 and 2018, indicating the system's effectiveness in redistribution in both years. The R&S index is positive in both years and broadly comparable to other countries.¹

Table 3: Redistribution measures for the South African PIT, 2015 and 2018

Measure	2015	2018
Average tax rate	15.69%	15.53%
Kakwani index	0.2178	0.2114
R&S index	0.0404	0.0387
Reranking	0.0002	0.0001
Redistributive effect (RE)	0.0405	0.0389
RE relative to pre-tax Gini	6.22%	6.07%

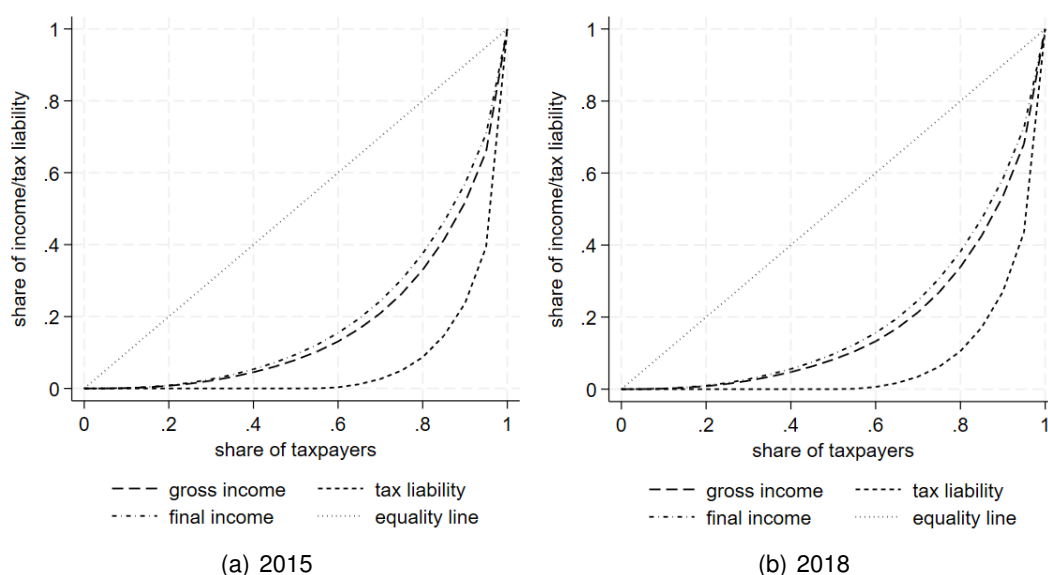
Source: own calculations based on National Treasury and UNU-WIDER (2019).

There is reranking, but the effect is quantitatively small, also compared to other countries.² Figure 3 depicts the Lorenz curves of gross income and the concentration curves of tax liability and final net income for 2018 and 2015, illustrating the progressive nature of the tax schedule. Also note that 53.96% of taxpayers in 2018 earn a taxable income that falls below the tax threshold (2015: 56.30%) and are therefore not liable for PIT, as illustrated by the figure.

¹ For example, the R&S index of the PIT was 0.0467 in Spain in 2007 (Onrubia et al. 2014), 0.0536 in Italy in 2011 (Di Caro 2018), and 0.0210 in Switzerland in 2011 (for all income and wealth taxes; Hübelin and Farys 2017).

² Di Caro (2018), for example, quantifies reranking in the Italian PIT system with 0.0193 to 0.0273.

Figure 3: Lorenz curve of gross income and concentration curves of tax liability and final income in South Africa, 2015 and 2018



Source: own depiction based on National Treasury and UNU-WIDER (2019).

5.2 The Pfähler decomposition

If observed data are available, the literature employs descriptive or decomposition methods that measure the redistributive effects of tax policies against alternative ‘what-if’ scenarios (Thoresen et al. 2016). The Pfähler decomposition method offers a comprehensive approach to analyse the redistributive dynamics of income tax systems and their components, going beyond a mere comparison of the pre- and post-tax income distribution. Developed by Pfähler (1990) and refined by Onrubia et al. (2014), the method deconstructs the overall redistributive effect of a PIT into the sum of the R&S indices of the tax rate, tax credits and tax deductions, and a reranking term.³ It therefore provides an in-depth analysis of how different items within the PIT contribute to income redistribution. Appendix D provides a detailed derivation of the Pfähler decomposition method.

The modified Pfähler decomposition formula, as per Onrubia et al. (2014), expresses the PIT’s redistributive effect (RE) as a weighted sum of partial progressivity effects, considering the tax schedule, m tax credits, and n tax deductions. By relying on the Kakwani decomposition (Equation 2), the overall redistributive effect—the difference in the Gini coefficients for gross income and final net income after taxation—of a PIT can be expressed as the sum of the redis-

³ In order to simplify the notation, Onrubia et al. (2014) use the term *deduction* for any tax expenditures subtracted from gross income in order to determine the taxable income base.

tributive effect of its components as follows:⁴

$$\begin{aligned}
 G_I - G_{NIF} = & \underbrace{\underbrace{\frac{\bar{T}}{\bar{NI}}}_{\text{group weight tax rate}} \underbrace{(CI_T - CI_{TI})}_{\text{Kakwani index tax rate}}}_{\text{R\&S index tax rate}} \\
 - & \underbrace{\underbrace{\frac{\bar{I}}{\bar{NIF}}}_{\text{group weight tax credits}} \sum_{i=1}^m \underbrace{\frac{\bar{C}_i}{\bar{I}}}_{\text{ind. weight credits}} \underbrace{(CI_{C_i} - CI_{NI})}_{\text{Kakwani index credits}}}_{\text{R\&S index credits}} \\
 - & \underbrace{\underbrace{\frac{\bar{I}}{\bar{TI}} \frac{\bar{T}}{\bar{NI}}}_{\text{group weight deductions}} \sum_{i=1}^n \underbrace{\frac{\bar{D}_i}{\bar{I}}}_{\text{ind. weight deductions}} \underbrace{(CI_{D_i} - CI_I)_{\text{Kakwani index deductions}}}_{\text{Kakwani index deductions}}}_{\text{R\&S index deductions}} - \underbrace{RR}_{\text{reranking}}
 \end{aligned} \tag{5}$$

See Appendix D for details on the derivation. Each component's R&S index is determined by first calculating its Kakwani index, using the income before its application as a reference. Further, each item is weighted by an individual weight, which measures the contribution of a single item within its category and its share in its pre-item tax base. The tax credits are measured against gross income so its redistributive effect is measured independently of other tax components. Finally, each category of tax items is weighted with a group weight that reflects the category's overall importance relative to net income (or final income for tax credits).

The Kakwani index of the tax rate is measured against taxable income, comparing the concentration index of tax liability (CI_T) and the concentration index of taxable income (CI_{TI}). The group weight of the tax rate is the mean of tax liability (\bar{T}) relative to mean net income after the tax schedule (before tax credits are deducted; \bar{NI}), consistent with the definition of the R&S index in Equation 2. The Kakwani index of a tax credit C_i is analogously measured by the difference of the concentration index of the tax credit and the concentration index of individual net income (i.e. income after tax before credits); the Kakwani index of a tax deduction D_i is given by the difference in the concentration index of the deduction and the concentration index of gross income. Individual and group weights apply as given.⁵ Finally, the reranking effect,

⁴ \bar{X} denotes the average of a variable X . Note that T denotes gross tax liability (before credits), NI denotes net income (i.e. income after tax rate, before tax credits; $I - T$), TI denotes taxable income, C_i is a specific tax credit i , D_i a specific deduction i , and NIF is final net income after tax rate and tax credits ($I - T - C$).

⁵ An individual credit i is weighted by the share of its mean (\bar{C}_i) in mean gross income (\bar{I}). The sum of all tax-credit-related R&S indices is weighted by a group weight: mean gross income (\bar{I}) relative to mean final income (after credits; \bar{NIF}). The individual weight for tax deductions is the share of the deduction in mean gross income. The group weight of deductions is scaled by the relation of gross income before deductions and taxable income post-deductions as well as by the relation of gross tax liability and net income, reflecting that deductions also affect redistribution via their effect on the tax rate schedule.

as defined in Equation 3, is subtracted.⁶ Following the literature, we calculate the tax liability based on derived taxable income instead of tax liability from tax returns (Ebrahim et al. 2019) to avoid discrepancies in the analysis, stemming from instances where taxable income and individuals' tax liability differ.⁷

5.3 Results of the Pfähler decomposition

The main results are presented in Table 4. The analysis confirms the overall redistributive effect of the PIT system: the difference between gross and net final income Gini coefficients is measured at 0.039 in 2018 and 0.040 in 2015. The table further depicts the R&S index of each item (columns (2) and (4)) and the share of the R&S index of the item in total redistribution (columns (3) and (5)). The R&S index of each item is derived according to Equation 5—that is, as the product of the group weight, the individual weight, and the item's Kakwani index. See Tables E.1 and E.2 in the Appendix for a detailed computation.

The tax rate is the most effective mechanism within the PIT for redistributing income, accounting for 103.00% of the overall redistributive effect in 2018 and 101.48% in 2015. This implies that the tax rate, in isolation, would have a more substantial redistributive impact than the entire PIT system inclusive of tax expenditures. The substantial redistributive impact of the tax rate is rooted in a positive Kakwani index, indicating progressivity, together with a significant weight within the overall tax system (for detailed Pfähler decomposition results, see Tables E.1 and E.2 in the Appendix). The analysis reveals that most tax expenditures have marginal or adverse effects on redistribution (Table 4). For instance, the tax base effect—that is, the collective effect of deductions, allowances, and exemptions—reduces redistribution by –7.41% in 2018 and –5.30% in 2015, reflecting that higher-income individuals are more likely to claim these tax benefits. This also, markedly, holds true for pension-related deductions, which are the quantitatively most important deduction in the South African PIT system. But it also applies for less frequently used deduction items. Apart from the VCC deduction in 2015, all deduction items lower the redistributive capacity of the South African PIT system. Analogously, the medi-

⁶ Note that only the redistributive effect of the tax rate has a positive weight, while credits and deductions have a negative weight. This compensates for negative Kakwani indices, as negative Kakwani indices of tax expenditures indicate a regressive distribution.

⁷ There are discrepancies between final tax liability as per IRP5/ITR12 certificates and the tax liability computed based on the income tax procedure and derived taxable income in 50.6% of all observations in 2018 (47.73% in 2015; see Ebrahim et al. 2019). To maintain analytical integrity to implement the Pfähler decomposition, deviations are trimmed at lowest and highest 1%. We also conduct a robustness test with capping the lowest and highest 5% of differences in both tax liability concepts and find similar results to the 1% cap (see Table B.1). Lastly, the actual amounts claimed for rebates and medical tax credits are computed, by assuming an order of the credits. As no order is defined in the Income Tax Act (South Africa 1962), it is assumed that the standard rebate is deducted first, followed by the MTC and the AMTC, where robustness checks show that this is not material for any of our results.

cal tax credits (MTC and AMTC, see above) are also overproportionally claimed by individuals at the upper end of the income distribution, exerting a—quantitatively relevant—negative effect on the redistributive capacity of the PIT system. Non-taxable income, in turn, is more equally spread across the income distribution and hence contributes positively to overall redistribution, although to a minimal extent (0.66% in 2018; 0.78% in 2015). Finally, and intuitively, the standard rebate accounts for the highest redistributive effect of all tax expenditures as it is granted to every individual in South Africa.

The overall redistributive effect of the South African PIT is confounded by a small reranking effect of 0.47% of the overall redistributive effect in 2018 (0.34% in 2015). Overall, the findings highlight the importance of the marginal tax rate schedule and the standard rebate for the redistributive effect of the South African tax system, while tax deductions and the medical tax credit tend to have a negative impact on redistributive outcomes.

Table 4: Pfähler decomposition, 2015 and 2018

Item	2015		2018	
	Absolute redistribution	Relative redistribution (%)	Absolute redistribution	Relative redistribution (%)
Total allowances and exemptions	0.00031517	0.7800	0.00025409	0.6573
Other allowances (A)	0.00004620	0.1153	0.00004356	0.1127
Reimbursive travel expenses (A)	0.00001051	0.0260	0.00000865	0.0224
Non-taxable income (E)	0.00025422	0.6292	0.00019324	0.4999
Basic education bursaries (E)	0.00000376	0.0093	0.00000866	0.0224
Total deductions	-0.00214116	-5.2990	-0.00311681	-8.0629
Pension contributions (D)	-0.00103749	-2.5676	-0.00223567	-5.7835
Income insurance contributions (D)	-0.00004447	-0.1101	—	—
Travel expenses fixed costs (D)	-0.00074776	-1.8506	-0.00061253	-1.5846
Donations (employee) (D)	-0.00001888	-0.0467	-0.00001829	-0.0473
Employer-provided vehicle (D)	-0.00009218	-0.2281	-0.00008516	-0.2203
Commission income expenditures (D)	-0.00009644	-0.2387	-0.00007298	-0.1883
Travel expenses actual costs (D)	-0.00002902	-0.0718	-0.00001978	-0.0512
Home office expenses (D)	-0.00001269	-0.0314	-0.00001027	-0.0266
Accountancy fees (D)	-0.00000247	-0.0061	-0.00000232	-0.0060
Subsistence expenses (D)	-0.00000351	-0.0087	-0.00000222	-0.0058
Donations (employer) (D)	0.00000051	0.0013	0.00000062	0.0016
Depreciation (D)	-0.00000354	-0.0088	-0.00000318	-0.0082
Foreign income (D)	-0.00004590	-0.1136	-0.00001929	-0.0499
Public office (D)	-0.00000216	-0.0054	-0.00000175	-0.0045
Employer-provided vehicle, operating lease (D)	-0.00000283	-0.0070	-0.00000314	-0.0081
VCC (D)	0.00000026	0.0006	-0.00002795	-0.0723
Tax rate	0.04100298	101.4752	0.03981642	103.0013
Total credits	0.00136604	3.3807	0.00188373	4.8731
MTC (C)	-0.00106716	-2.6410	-0.00111076	-2.8734
AMTC (C)	-0.00035997	-0.8909	-0.00033408	-0.8642
Rebate (C)	0.00279317	6.9126	0.00332858	8.6107
Reranking	-0.00013615	-0.3369	-0.00018121	-0.4688
Total	0.04040688	100.0000	0.03865623	100.0000

Note: (A) denotes non-taxable allowances, (E) exemptions, (D) deductions, and (C) credits. Grey rows depict grouped items.

Source: own calculations based on National Treasury and UNU-WIDER (2019).

5.4 The redistributive implications of recent policy reforms

Within our data frame—that is between the tax years 2015 and 2018—South Africa saw a number of reforms to the PIT schedule:

- In March 2016, the pension-related deduction system was reformed to enhance its generosity and harmonization (Redonda and Axelson 2021).
- There were reforms to the marginal tax rate schedule. From tax year 2016 onwards, the marginal tax rates increased by 1 percentage point in all but the lowest tax bracket. From tax year 2018 onwards, the South African government introduced a new top tax bracket at incomes of ZAR1.5 million, above which income was taxed at a rate of 45% (rather than 41% before).
- Tax brackets were adjusted below inflation, inducing bracket creep.

In the following, we will discuss the impact of these policy reforms on the redistributive impact of the PIT system.

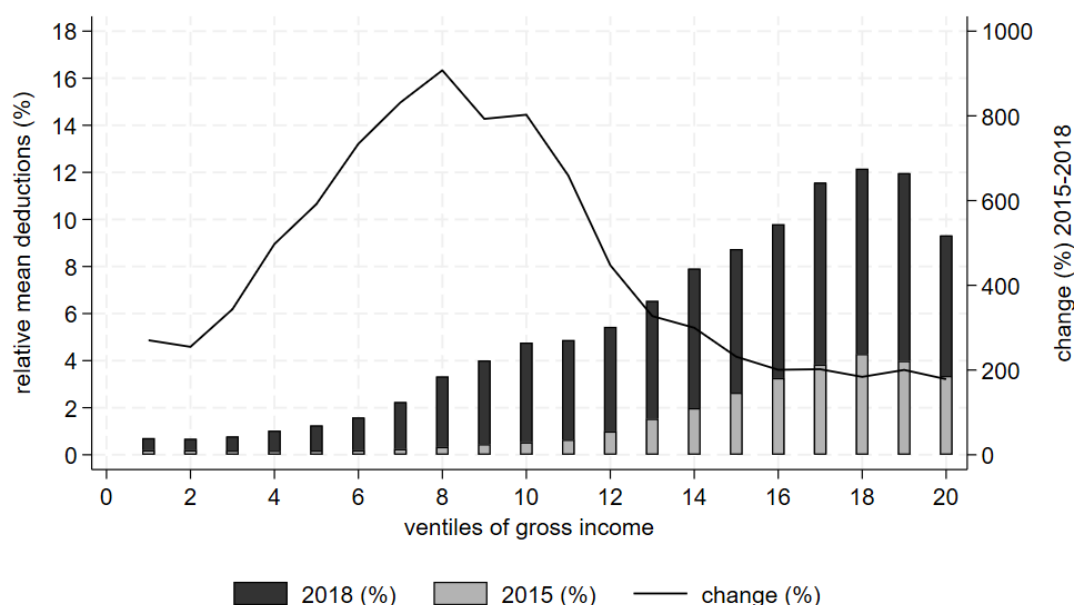
Reform to pension deductions

In line with earlier research by Redonda (2016), the findings of the Pfähler decomposition in Table 4 suggest that the pension deduction reform lowered the redistributive impact of the PIT system. We add to prior insights by additionally showing that the Kakwani index for pension deductions actually did shrink between 2015 and 2018, reflecting that more middle-income taxpayers started claiming pension deductions.

But our analysis also shows that even in tax year 2018, the propensity to claim pension deductions and the deduction amounts still increase relatively steeply across the income distribution (see Figure 4). The reform-induced increase in deduction values hence—in absolute terms—benefited individuals at the upper end of the income distribution.⁸ As the second effect outweighs the first, the overall redistributive capacity of the PIT system is reduced by the 2016 pension deduction reform (see also Table 4).

⁸ The share of taxpayers claiming deductions rises (25.72% in 2015, 48.26% in 2018) as well as the average deduction claimed (ZAR17,124.52 in 2015, ZAR35,105.28 in 2018; see Table 1). This means that pension deductions receive a larger individual weight in the Pfähler decomposition in 2018 compared to 2015 (see Tables E.1 and E.2 in the Appendix).

Figure 4: Mean pension-related deductions as a percentage of mean gross income per gross income ventile in South Africa, 2015 and 2018, and change over time (%)

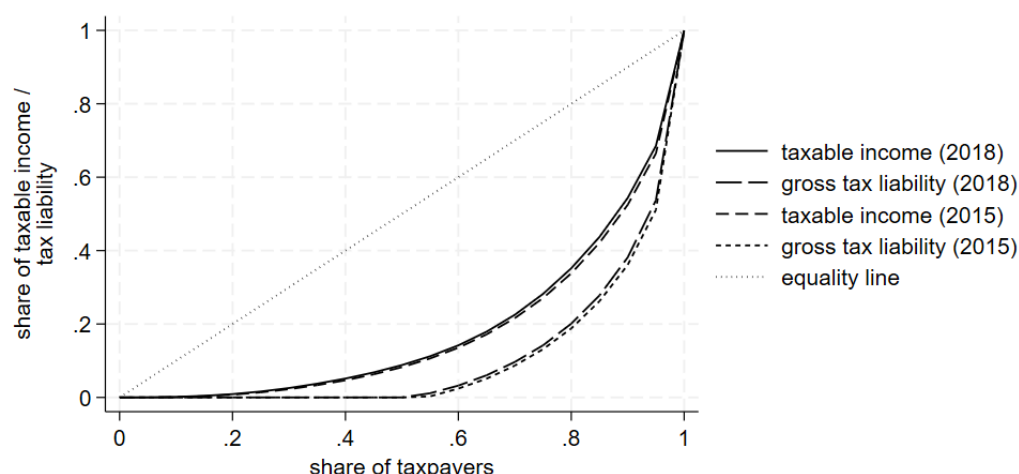


Source: own depiction based on National Treasury and UNU-WIDER (2019).

Reforms to the marginal tax rate schedule

As sketched above, the marginal tax rate schedule was further adjusted: marginal tax rates increased and there were below-inflation adjustments of marginal tax thresholds, inducing bracket creep (see above). Figure 5 and Table 4 illustrate changes in the concentration of tax payments (the concentration index) between 2015 and 2018, as well as the contribution of the marginal tax rate schedule ('tax rate') to the redistributive impact of the PIT system between 2015 and 2018, based on the Pfähler decomposition.

Figure 5: Concentration curves of taxable income and gross tax liability, 2015 and 2018



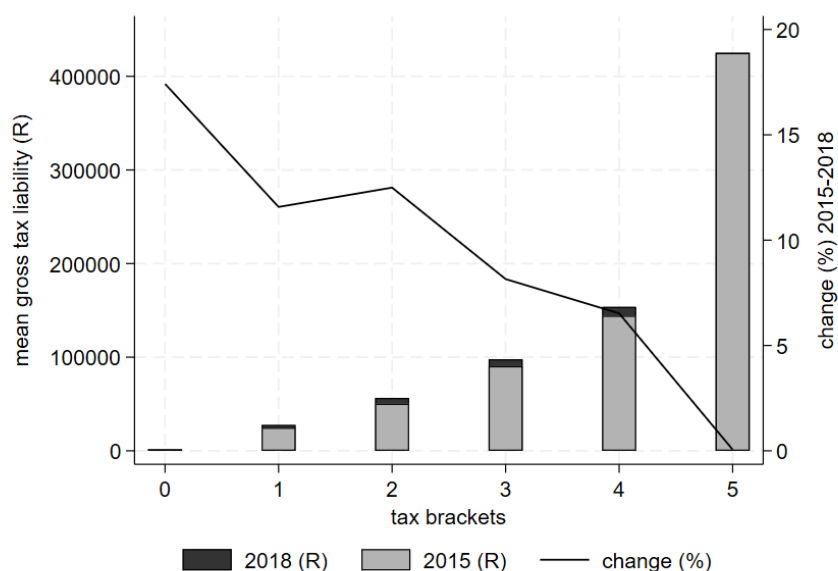
Source: own depiction based on National Treasury and UNU-WIDER (2019).

A priori it is not clear how the distribution of the tax burden changes with these reforms. The marginal tax rate increases within that time frame were centred around higher-income individ-

uals, hence working toward a more progressive tax schedule and higher levels of redistribution *ceteris paribus*. In turn, bracket creep may overproportionally increase the tax burden of taxpayers in the middle of the income distribution, therefore reducing progressivity of the tax schedule and redistribution. Finally, differential trends in gross income may also impact the distribution of the tax burden.

Figure 5 presents the concentration index of the tax liability for tax years 2015 and 2018. The graph shows that tax payments became *less* concentrated in that time frame. Figure 6 adds to the picture, showing that the tax burden of lower-middle-income taxpayers increased—consistent with bracket creep—while the top tax bracket (which includes the top two tax brackets for tax year 2018) experienced no rise in mean gross tax liability, despite the increase in the top marginal tax rate.

Figure 6: Mean gross tax liability by bracket, 2015 and 2018



Note: for comparison, the fifth tax bracket includes the fifth and sixth tax bracket for the 2018 tax year.

Source: own depiction based on National Treasury and UNU-WIDER (2019).

Our results suggest that this pattern, at least in part, is rooted in changes in taxable income: between 2015 and 2018, taxable income became more equally distributed across taxpayers (as indicated by a smaller concentration index for tax year 2018)—see Figure 5. This may reflect differential secular income trends across the income distribution, or, as suggested by recent research, behavioural adjustments to the marginal tax schedule reforms (Axelson et al. 2024): high-income taxpayers might lower their reported taxable income in response to the reform, thus undermining the government’s aim to strengthen the redistributive impact of the PIT system. The Kakwani index still slightly increases between 2015 and 2018 (see Table E.1), as does the relative contribution of the marginal tax rate schedule to overall redistribution in the PIT system.

Bracket creep

While the previous section assessed overall changes of the redistributive impact of the marginal tax schedule, we now, first, isolate the effect of bracket creep and, second, the (mechanical) effect of the adjustments to the marginal tax rates. While the consumer price index had increased by 22% within our sample frame, adjustments in the tax thresholds were significantly smaller, accounting for less than half of this adjustment.

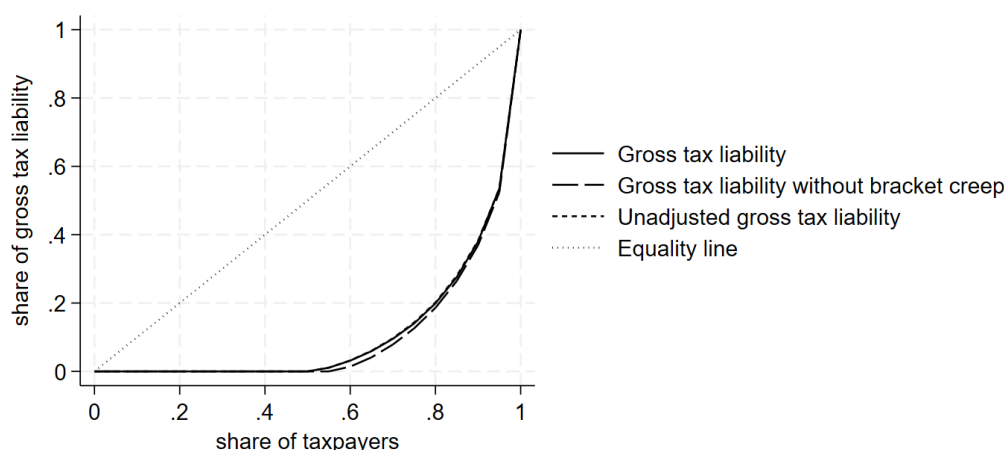
To determine the redistributive impact of bracket creep, we compare the 2018 distribution of tax liabilities across taxpayers, as reflected in the tax concentration curve, with a simulated 2018 distribution, where we—as the only adjustment—change the tax brackets to hypothetical thresholds set to avoid bracket creep and hence higher up than the actual tax thresholds.

Compared to the actual concentration curves of gross tax liability in 2018, the hypothetical gross tax liability without bracket creep has a lower concentration (Figure 7), highlighting that the tax burden on lower- and middle-income households increases overproportionally with bracket creep. The concentration index of the simulated gross tax liability drops from 0.7988 to 0.7861, rendering the tax schedule less progressive. Applying the Pfähler decomposition in 2018 for tax brackets that are fully adjusted for inflation, we illustrate that bracket creep lowers the redistributive effect of the marginal tax rate schedule (see Table F.1 in the Appendix). While the fiscal consequences of bracket creep are well understood in the literature—with bracket creep resulting in higher average tax burdens and higher tax payments—we are, to the best of our knowledge, the first to document that bracket creep also impacts the progressivity of the PIT system and its redistributive impact by posing a higher relative burden on households at the lower end and in the middle of the income distribution.

A concern one may have about the above analysis is that we abstract from potential behavioural changes—that is, changes in income reporting—to bracket creep. We thus rerun the simulation exercise, accounting for related adjustments based on estimates in prior work by Kemp (2019), who studies income adjustments to bracket creep in the South African context. Specifically, we identify individuals who are affected by bracket creep (i.e. those who would have been in a lower tax bracket if marginal tax brackets had been fully adjusted for inflation) and calculate their ‘unadjusted’ taxable income if they had not responded to bracket creep. This changes our findings neither qualitatively nor quantitatively. As the behavioural estimates of Kemp (2019) are small, the simulated tax concentration curve and index hardly changes (see Figure 7).⁹

⁹ As a side note, we see a large drop in the redistributive effect of tax credits when tax brackets are adjusted fully in line with inflation. This reflects that, without bracket creep, fewer taxpayers are liable for PIT and, in consequence, fewer individuals at the lower end of the income distribution benefit from tax credits—highlighting the interdependence of the redistributive role of different tax instruments.

Figure 7: Concentration curves of gross tax liability with and without bracket creep, 2018



Source: own depiction based on National Treasury and UNU-WIDER (2019).

Marginal tax rate increases

We isolate the impact of the increases in the top marginal tax rates—absent behavioural adjustments. For this purpose, we apply the adjusted tax rates and the new top tax bracket to the 2015 income distribution and tax brackets. This isolates the mechanical effect of the reforms without bracket creep and behavioural reactions. Intuitively, the concentration index of gross tax liability rises from 0.7995 to 0.8020 for the simulated tax liability. This translates into a more progressive tax system, a higher effective tax burden, and more redistribution, as illustrated by a Pfähler decomposition (see Table F.2 in the Appendix).¹⁰ In sum, the findings indicate that recent tax reforms in South Africa, in particular the pension deduction reform and the below-inflation adjustment of the tax brackets, by and large lowered the redistributive impact of the PIT system.

6 Further policy options to strengthen the redistributive capacity of the PIT system

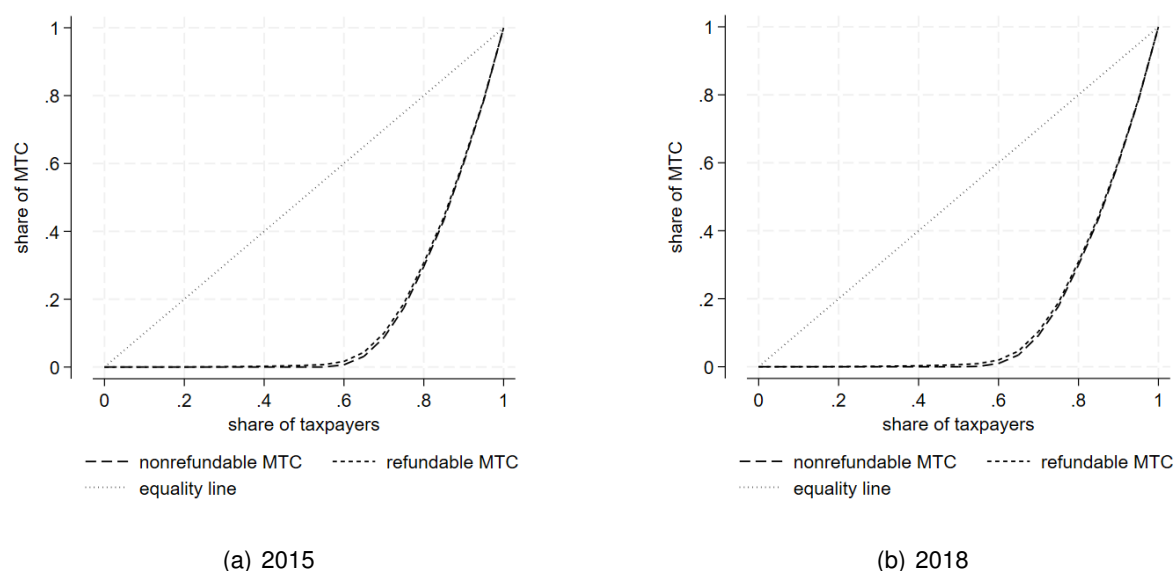
So which reforms might strengthen the redistributive impact of the South African PIT system? One key insight of our analysis is that, in particular, tax deductions and tax credits dampen the redistributive impact of the PIT system as they are, at the extensive and intensive margin, overproportionally claimed by individuals at the upper end of the income distribution. While the granting of these deductions and credits can, as described above, follow valid social goals (e.g. to incentivize certain types of behaviour), tax expenditures can also come with private benefits and—as shown in our study—impact the redistributive effect of the tax system. Countries worldwide have solved the trade-offs around deductions and tax credits differently: their granting widely differs across countries. Our findings highlight that eliminating deductions and cred-

¹⁰ The redistributive effects of other items of the PIT system also change as average tax rates change.

its would strengthen the redistributive capacity of the PIT system, as would restructuring tax deductions into a tax credit, given that the per-rand advantage of tax deductions, in contrast to tax credits, grows in taxpayers' marginal tax rate and hence with taxable income (see, e.g. Jansen et al. 2023).

One straightforward option to raise the PIT's redistribution would hence be to make the tax credits refundable. Figure 8 depicts concentration curves of tax credits in the case that medical tax credits are made refundable or not. In line with intuition, tax credits become less concentrated at the upper end of the income distribution if they are refundable. A Pfähler decomposition simulating a system with refundable medical tax credits (and standard rebates) shows a rise in the redistributive capacity of the PIT system in both considered tax years (see Appendix G.1).

Figure 8: Concentration curves of refundable and non-refundable tax credits, 2015 and 2018



Source: own depiction based on National Treasury and UNU-WIDER (2019).

Another alternative would be to introduce a standardized deduction (or tax credit) option, which is common in many countries around the world. Taxpayers could then choose between the standardized deduction (credit) option and itemizing (the claiming of individual tax deductions and credits). Given that it is, in particular, taxpayers at the upper end of the income distribution who, in the current system, make sizeable use of tax deductions and credits, a respective reform could strengthen the progressivity and redistributive capacity of the South African PIT system. This type of policy reform, moreover, comes with the benefit that it lowers taxpayers' tax compliance costs (related to documenting and claiming certain deductions/credits) and administrative costs (related to administering tax returns and enforcing the tax law). If taxpayers can choose between a standardized deduction/credit and itemizing, all those taxpayers with deductions resulting in tax benefits smaller than the standardized option do not file respective claims. What is more, if taxpayers only handed in tax returns to claim deductions and credits, there might even be a drop in the number of tax filers, further lowering administrative costs for

tax authorities. From a distributional perspective, a standardized tax deduction/credit option can address inequalities related to the take-up of deductions and tax credits for which taxpayers are eligible.

Prior research suggests that taxpayers at the lower end of the income distribution may, because of information frictions or high filing costs, more often fail to claim tax benefits for which they are eligible, compared to their higher-income counterparts, thus leading to potential discrepancies between the actual and the intended impact of deductions and tax credits on the post-tax income distribution (see, e.g. Hauck and Wallossek 2024).¹¹

Finally, our research emphasizes that the design of the tax schedule can decisively impact the redistributive capacity of the South African tax system. Increases at the upper end of the income distribution, intuitively, can *ceteris paribus* enhance the redistributive capacity, but income adjustments by high-income earners may counteract this effect (Axelson et al. 2024). Against the background of these efficiency costs and the top income tax rate in South Africa already being high compared to other countries of comparable development stage, there is likely limited room for further upward adjustments. But as laid out in this paper, our findings make a case for avoiding bracket creep, potentially through a system in which income tax brackets are automatically adjusted upwards at the rate of inflation. Bracket creep does not only—as discussed in prior research—increase the tax-to-GDP ratio without explicit political legitimization, it also reduces the progressivity and redistributive capacity of the PIT system.

7 Conclusion

In this paper, we shed light on the progressivity and redistributive capacity of the South African PIT system and its components, drawing on rich tax administrative data and a Pfähler decomposition. South Africa is one of the most unequal countries in the world. Given the far-reaching social and economic consequences of this inequality, it is crucial to obtain an understanding of the elements that shape the redistributive effects of the country's PIT system and their contribution to lowering after-tax inequality in South Africa.

Key insights include that the PIT system's redistributive capacity largely relates to the design of the marginal tax rate schedule, while most tax expenditures dampen the system's redistributive impact. Recent policy reforms in the country are shown to have reduced the redistributive capacity of the PIT system—most notably changes in pension deductions and the decision to not fully neutralize bracket creep.

¹¹ Hauck and Wallossek (2024) show that taxpayers at the lower end of the income distribution are less likely to file a tax return than their higher-income counterparts, leading to significant overpayment of taxes.

Our findings suggest that policy-makers who intend to strengthen the redistributive capacity of the tax system could revisit tax expenditures in the PIT system. The granting of deductions and tax credits widely varies across countries, reflecting underlying trade-offs. Our results show that deductions and tax credits in South Africa are mainly used at the top of the income distribution. Reforms that constrain these tax expenditures therefore contribute to strengthening the progressivity of the PIT system. Among others, we additionally emphasize that bracket creep lowers the redistributive capacity of the PIT system—automatic inflation adjustments of income tax brackets can thus be a measure to strengthen redistribution in the income tax system.

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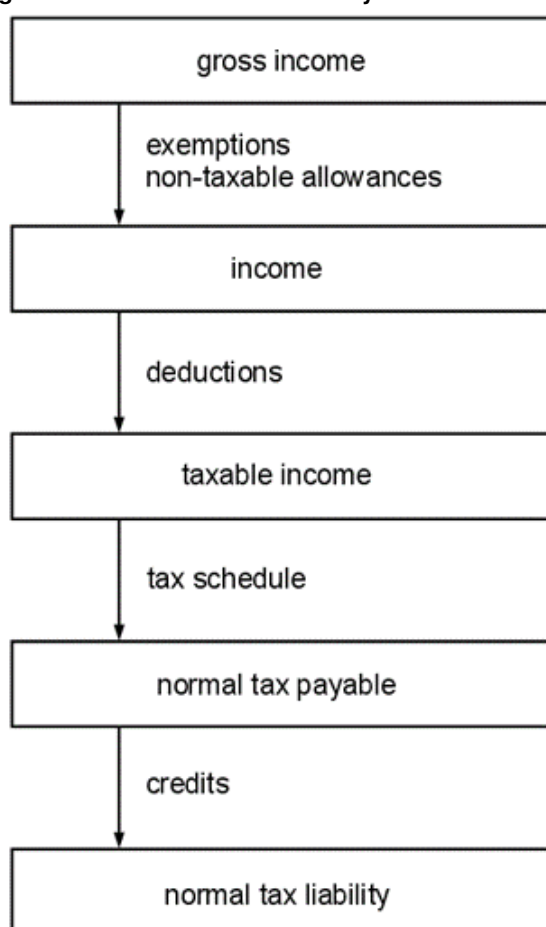
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Appendix A: The South African PIT scheme

Figure A.1 depicts the calculation of taxable income in the South African tax code, which accounts for income exempted from taxation as well as tax deductions and tax credits (South Africa 1962). Gross income includes normal income, business income, allowances, fringe benefits, lump sum income, investment income, and activity income. From gross income, exempted income, non-taxable allowances, and deductions are excluded to derive *taxable income*.¹² The tax schedule is applied and tax credits are deducted.

Figure A.1: Personal income tax system in South Africa



Source: own depiction based on SARS (2021).

¹² In South Africa, all payments of employers to employees in order to meet expenditures incurred to the taxpayer are called allowances. Those allowances are generally included in taxable income, but certain expenses for business purposes are non-taxable. Only non-taxable allowances are tax expenditures (SARS 2021).

Appendix B: Data cleaning

For the Pfähler decomposition analysis, calculated tax liability based on derived taxable income is used instead of tax liability from tax returns. The reason is that there are discrepancies between final tax liability as per IRP5/ITR12 certificates and the tax liability computed based on the income tax procedure and derived taxable income in 50.6% of all observations in 2018 (47.73% in 2015; see Ebrahim et al. 2019). There are some large outliers in the differences between both tax liability concepts (see Figure B.1(a) and (c)). To maintain analytical integrity to implement the Pfähler decomposition, deviations are trimmed at the lowest and highest 1% (see Figure B.1(b) and (d)). We also conduct a robustness test with capping the lowest and highest 5% of differences in both tax liability concepts and find similar results to the 1% cap (see Table B.1 in comparison to Table 4). This procedure ensures that the Pfähler decomposition accurately reflects the redistributive effects of tax credits and tax rate.

The actual amounts claimed for rebates and medical tax credits are computed by assuming an order of the credits. As no order is defined in the Income Tax Act (South Africa 1962), it is assumed that the standard rebate is deducted first, followed by the MTC and AMTC. For a robustness check, we perform the Pfähler decomposition analysis on the same sample, but deduct MTC and AMTC first, and rebate second (see Tables B.2 and B.3 in comparison to Table 4). The results are similar, proving the robustness of the results to the selection of the credits order.

Figure B.1: Distribution of differences in tax liability concepts before and after cap, 2015 and 2018



Source: own depiction based on National Treasury and UNU-WIDER (2019).

Table B.1: Pfähler decomposition in South Africa for dataset with 5% cap, 2015 and 2018

	2018		2015	
	Absolute	Relative	Absolute	Relative
Allowances and exemptions	0.0003	0.6826%	0.0003	0.8213%
Deductions	−0.0031	−8.3954%	−0.0021	−5.3547%
Tax rate	0.0390	105.6777%	0.0406	103.476%
Credits	0.0009	2.5038%	0.0005	1.3833%
Reranking	−0.0002	−0.4687%	−0.0001	−0.3259%
Total redistributive effect	0.0369	100%	0.0393	100%
<i>Gini index gross income</i>	0.6479		0.6652	
<i>Gini index final income</i>	0.5564		0.626	

Note: the table depicts the results of the Pfähler decomposition for capping the differences between final tax liability as per IRP5/ITR12 certificates and the tax liability computed based on the income tax procedure at the lowest and highest 5%.

Source: own calculations based on National Treasury and UNU-WIDER (2019).

Table B.2: Pfähler decomposition with alternative order of tax credits: 2018

Item	Group weight	Individual weight	Kakwani index	Redistributive effect	% of total redistribution
Allowances and exemptions	-0.2869	0.0049	-0.1814	0.0003	0.6569%
Deductions	-0.2869	0.1058	0.1026	-0.0031	-8.0568%
Tax rate	0.2551		0.1561	0.0398	102.9816%
Credits	-1.1838	0.0480	-0.0333	0.0019	4.8867%
Reranking				-0.0002	-0.4684%
Total redistributive effect				0.0387	100%

Note: the table depicts the results of the Pfähler decomposition for a different order of tax credits: first, the MTC is deducted, followed by the AMTC, and finally, the standard rebate.

Source: own calculations based on National Treasury and UNU-WIDER (2019).

Table B.3: Pfähler decomposition with alternative order of tax credits: 2015

Item	Group weight	Individual weight	Kakwani index	Redistributive effect	% of total redistribution
Allowances and exemptions	-0.2786	0.0028	-0.3974	0.0003	0.7800%
Deductions	-0.2786	0.0475	0.1616	-0.0021	-5.2990%
Tax rate	0.2646		0.1550	0.0410	101.4752%
Credits	-1.1862	0.0523	-0.0220	0.0014	3.3807%
Reranking				-0.0001	-0.3369%
Total redistributive effect				0.0404	100%

Note: the table depicts the results of the Pfähler decomposition for a different order of tax credits: first, the MTC is deducted, followed by the AMTC, and finally, the standard rebate.

Source: own calculations based on National Treasury and UNU-WIDER (2019).

Appendix C: Tax expenditures in South Africa

South Africa provides some tax expenditures within its PIT. These can broadly be categorized as (1) non-taxable allowances, (2) exemptions, (3) deductions, and (4) tax credits. Table C.1 lists and briefly describes all relevant tax expenditures in South Africa for the tax years 2014/15 and 2017/18 by category.

Table C.1: Tax expenditures in the South African PIT system, 2015 and 2018

Tax expenditure	2014/15	2017/18	Source
Allowances			
Reimbursive non-taxable travel expenses	Any allowance paid to an employee for travel expenses for business purposes where the reimbursement rate does not exceed the prescribed rate and the employee does not receive any other compensation	Same as 2014/15	PKF 2014, 2017
Exemptions			
Other non-taxable allowances	For example, non-taxable relocation allowance, non-taxable subsistence allowance (not exceeding prescribed rates), or non-taxable uniform allowance	Same as 2014/15	SARS 2014a, 2018b
Non-taxable scholarship for basic education	Non-taxable bursaries and scholarships to a non-disabled person for basic education (grades R to 12)	Same as 2014/15	SARS 2013, 2018b
Non-taxable income	Any non-taxable income (excluding foreign service remuneration, non-taxable allowances and fringe benefits), such as non-taxable pension paid regularly, non-taxable income of capital nature, non-taxable portion of a compulsory annuity from a retirement fund, or non-taxable portion of an arbitration award	Same as 2014/15	PKF 2014; SARS 2013, 2018b
Deductions			

Table C.1—continued from previous page

Tax expenditure	2014/15	2017/18	Source
Pension fund contributions	<i>Pension fund contributions:</i> employee contributions are deductible up to 7.5% of retirement-funding income, employer contributions are no fringe benefit, not part of taxable income; <i>Provident fund contributions:</i> employee contributions were not deductible, employer contributions are no fringe benefit and therefore not part of taxable income; <i>Retirement annuity funds:</i> employee contributions are deductible up to 15% of non-retirement funding income; employer contributions are fringe benefits and taxed accordingly.	<i>Pension fund contributions, provident fund contributions, and retirement annuity fund contributions:</i> employees are allowed to deduct their contributions to any fund up to 27.5% of the higher of taxable income or gross remuneration (cap at ZAR350,000), employer contributions are fringe benefits and taxable (but can be deducted by the employee)	Redonda and Axelson 2021
Donations (employee)	Donations by employee to approved organizations, limited to 10% of individual's taxable income	Same as 2014/15	SARS 2014a, 2017
Home office expenses	Deduction of home office expenses if requirements are met (e.g. if the room is used regularly and exclusively), calculation of deduction based on a specific formula	Same as 2014/15	SARS 2014a, 2017, 2021
VCC	Taxpayers are allowed to deduct 100% of an investment in a venture capital company	Same as 2014/15	PKF 2014, 2017
Travel expenses, fixed costs	A deduction may be claimed based on a log book if the taxpayer did not receive a travel allowance but incurred travel expenses for income production. The deduction may be determined based on deemed cost per kilometre basis.	Same as 2014/15	PKF 2014, 2017
Travel expenses, actual costs	A deduction may be claimed based on a log book if the taxpayer did not receive a travel allowance but incurred travel expenses for income production. The deduction may be determined based on actual expenditure incurred.	Same as 2014/15	PKF 2014, 2017; SARS 2014a, 2018a

Table C.1—continued from previous page

Tax expenditure	2014/15	2017/18	Source
Commission income expenditures	If a taxpayer earns remuneration mainly in the form of commission income and there are expenses apart from travel expenses, they may be deducted.	Same as 2014/15	SARS 2014a, 2018a
Subsistence expenses	If a subsistence allowance is granted, the amount that can be claimed must be determined based on the actual expenses or the amount of deemed expenses.	Same as 2014/15	SARS 2014a, 2018a
Depreciation	A depreciation on the assets may be claimed if a taxpayer owns an asset and is obliged to use the asset regularly to perform tasks related to the profession.	Same as 2014/15	SARS 2014a, 2018a
Donations (employer)	Donations to certain organizations deducted from the employee's remuneration and paid by the employer may be deducted.	Same as 2014/15	SARS 2014a, 2018a
Foreign income	Foreign income taxed on IRP5 certificates can be deducted on ITR12 certificates.	Same as 2014/15	SARS 2014a, 2018a
Accountancy fees	If business income or any other specified income sources are claimed, a deduction for accountancy or administration fees is granted.	Same as 2014/15	SARS 2014a, 2018a
Public office	Any allowance granted to a public office holder for expenses related to the public office may be deducted to the extent that expenses were actually incurred.	Same as 2014/15	SARS 2014a, 2018a
Employer-provided vehicle	Employer-provided vehicles other than operating lease are regarded as a taxable benefit, but the value may be reduced for costs associated with business purposes.	Same as 2014/15	SARS 2014a, 2018a
Employer-provided vehicle, operating lease	Employer-provided vehicles by operating lease are regarded as a taxable benefit, but the value may be reduced for costs associated with business purposes.	Same as 2014/15	SARS 2014a, 2018a
Income insurance	Any premiums paid for the loss of income policies are deductible.	—	SARS 2020

Table C.1—continued from previous page			
Tax expenditure	2014/15	2017/18	Source
Credits			
MTC	Contributions to a registered medical scheme may be deducted: ZAR257/month for the member and the first dependant, ZAR172/month for each additional dependant.	Contributions to a registered medical scheme may be deducted: ZAR303/month for the member and the first dependant, ZAR204/month for each additional dependant.	SARS 2013, 2014b, 2017, 2022
AMTC	All medical expenses not recoverable from medical scheme may be deducted according to a specified formula (depending on age and disability status).	Same as 2014/15	SARS 2013, 2014b, 2017, 2022
Standard rebate	Each individual may deduct a standard rebate depending on age (sum up): ZAR12,726 (primary), ZAR7,110 (secondary), ZAR2,367 (tertiary).	Each individual may deduct a standard rebate depending on age (sum up): ZAR13,635 (primary), ZAR7,479 (secondary), ZAR2,493 (tertiary).	SARS 2014b, 2017

Source: own presentation based on sources indicated in the right column.

Appendix D: Pfähler decomposition method

The Pfähler decomposition is a method first developed by Pfähler (1990) to disentangle how and to what extent the different tools contribute to the redistribution by the PIT. The method relies on the Kakwani decomposition, which defines the overall redistributive effect of a tax as a function of its average rate and progressivity (Equation 2; Kakwani 1977). Pfähler (1990) first defines the overall redistributive effect, $G_{NIF} - G_I$, as a function of the income tax level (final tax liability after credits over final income after credits), $\frac{TF}{NIF}$, and of aggregate progressivity. Aggregate progressivity is defined as the difference in Gini indices of final tax liability and gross income:

$$G_{NIF} - G_I = -\frac{TF}{NIF} (G_{TF} - G_I) \quad (6)$$

The effect's sign is negative for a progressive income tax, as a progressive tax reduces the Gini index of final net income below the Gini index of gross income (Pfähler 1990). Reinterpretations of the original version of the Pfähler decomposition use the normal redistributive effect, $G_I - G_{NIF}$, and therefore switch the sign of the decomposition formula (e.g. Barbetta et al. 2018; Onrubia et al. 2014). Pfähler (1990) then expresses the overall redistributive effect as a weighted sum of direct and indirect redistributive effects. The direct redistributive effect isolates the effect of the tax level—that is, the change between the Gini indices of taxable income, G_{TI} and final residual income (taxable income minus gross tax liability), G_{RF} . The indirect redistributive effect, $G_{TI} - G_I$, is determined by the composition of the tax base:

$$G_{NIF} - G_I = \frac{RF}{NIF} (G_{RF} - G_{TI}) - \frac{TF}{NIF} (G_{TI} - G_I) \quad (7)$$

Based on the Kakwani decomposition, as defined in Equation 2, the direct redistributive effect can also be expressed as the product of the total residual tax ratio, $\frac{TF}{RF}$, and direct progressivity: $G_{TF} - G_{TI}$. The indirect effect can be derived by multiplying the ratio of average tax-free income, \bar{F} , and taxable income, \bar{TI} , and the indirect progressivity—that is, the difference in Gini indices of tax-free income and gross income, $G_F - G_I$. The direct and indirect redistributive effects can further be decomposed into their underlying components. The indirect redistributive effect, $G_{TI} - G_I$, is decomposed into the redistributive effect of allowances and exemptions (AI), $G_{AI} - G_I$, and deductions, $G_{TI} - G_{AI}$ (Equation 8) or by using the Kakwani decomposition as the weighted sum of the progressivity effects of the items (Equation 9):

$$G_{TI} - G_I = (G_{AI} - G_I) + (G_{TI} - G_{AI}) \quad (8)$$

$$G_{TI} - G_I = -\frac{\bar{A}}{\bar{AI}} (G_A - G_I) - \frac{\bar{D}}{\bar{TI}} (G_D - G_{AI}) \quad (9)$$

Similarly, the direct redistributive effect, $G_{RF} - G_{TI}$, is determined by the sum of the tax rate's redistributive effect, $G_R - G_{TI}$ (R denotes taxable income minus gross tax liability), and the redistribution by tax credits, $G_{RF} - G_R$ (Equation 10), or as a weighted sum of the respective progressivity effects (Equation 11):

$$G_{RF} - G_{TI} = (G_R - G_{TI}) + (G_{RF} - G_R) \quad (10)$$

$$G_{RF} - G_{TI} = -\frac{TF}{RF} (G_T - G_{TI}) + \frac{\bar{C}}{RF} (G_C - G_R) \quad (11)$$

In sum, the Pfähler decomposition works by following the taxing procedure and partially calculating Gini indices, so the redistributive effect of each component of the PIT is measured by applying the respective component and analysing the change in inequality. Overall, the Pfähler decomposition can be summarized by the following equation, either by expressing the overall redistributive effect as a weighted sum of direct and indirect redistributive

effects (Equation 12), or direct and indirect progressivity effects (Equation 13):

$$G_{NIF} - G_I = \frac{\overline{RF}}{\overline{NIF}} [(G_R - G_{TI}) + (G_{RF} - G_R)] - \frac{\overline{TF}}{\overline{NIF}} [(G_{AI} - G_I) + (G_{TI} - G_{AI})] \quad (12)$$

$$G_{NIF} - G_I = \frac{\overline{RF}}{\overline{NIF}} \left[-\frac{\overline{TF}}{\overline{RF}} (G_T - G_{TI}) + \frac{\overline{C}}{\overline{RF}} (G_C - G_R) \right] - \frac{\overline{TF}}{\overline{NIF}} \left[-\frac{\overline{A}}{\overline{AI}} (G_A - G_I) - \frac{\overline{D}}{\overline{TI}} (G_D - G_{AI}) \right] \quad (13)$$

The original version of the Pfähler decomposition was reinterpreted by Lambert (2001), who calculates the redistributive effects of deductions and allowances against the same benchmark of gross income. Therefore, not only the whole indirect effect but also the individual components of the indirect effect are weighted, while Pfähler (1990) sums up the redistributive effects of the components of the indirect effect and weights the sum. Further, Lambert (2001) uses concentration indices instead of Gini indices to account for reranking. Another difference is that Lambert (2001) does not consider tax credits. The indirect effect, therefore, either summarizes the redistribution by tax rate and credits together or covers the redistribution by tax rate only if there are no tax credits. The overall redistributive effect can also be expressed in a single decomposition formula as a weighted sum of direct and indirect redistributive effects (Onrubia et al. 2014):

$$G_I - G_{NIF} = \frac{\overline{R}}{\overline{NI}} (CI_{TI} - CI_R) - \frac{\overline{T}}{\overline{NI}} \left[\frac{\overline{AI}}{\overline{TI}} (CI_I - CI_{AI}) + \frac{I-D}{\overline{TI}} (CI_I - CI_{I-D}) \right] \quad (14)$$

As defined in Equation 2, the R&S index can also be expressed as a function of the Kakwani index of progressivity. More generally, the R&S index of changing from income X to Y can be expressed as a function of the weighted Kakwani index of progressivity (Kakwani 1977; Onrubia et al. 2014):

$$\Pi_{X,Y}^{RS} = \frac{\overline{X-Y}}{\overline{Y}} \Pi_{X,Y}^K \quad (15)$$

But even the Pfähler–Lambert version of the decomposition of the redistributive effect of a PIT has some pitfalls. Those limitations are summarized and addressed by Onrubia et al. (2014), who develop an extended version of the Pfähler–Lambert decomposition. First, Onrubia et al. (2014) criticize the decomposition by Pfähler (1990) for not being able to cover the complexity of real-world income taxes, as they do not allow considering various tax expenditures of the same type (only all expenditures together). Onrubia et al. (2014) highlight that introducing a sequential order of tax expenditures is not an adequate solution, as it hinges the Pfähler decomposition's results on the ordering choice. Instead, they propose to build on a solution introduced by Lambert (2001) and apply a fixed benchmark. For example, they calculate the redistributive effect of each deduction against gross income. A second problem, closely related to the first, considers tax credits. Pfähler (1990) measures tax credits against residual income, which does not allow for any straightforward interpretation of tax credits. As Onrubia et al. (2014) point out, tax credits can be understood as adjustments of gross tax liability and should therefore be measured against the benchmark of net income. In this way, the redistributive effect of tax credits is isolated by acknowledging the sequential order of first applying the tax rate and second the tax credits. A third problem in the original decomposition by Pfähler (1990) is the ignorance of any reranking effects of income taxes. Lambert (2001) considers reranking by using concentration coefficients instead of Gini indices. Still, he does not include any reranking term. Therefore, his decomposition formula does not cover the total redistribution of a PIT, which is composed of the R&S index and the reranking term (Urban 2006). Onrubia et al. (2014) propose to rely on concentration coefficients and include a reranking term at the end of the decomposition formula, which is the difference in Gini and concentration coefficient of final net income, as first stated by Kakwani (1984). In this way, the relative ex-

tent to which horizontal inequity reduces a tax's redistributive effect can also be measured. Another problem that Onrubia et al. (2014) address is the emergence of dual income taxes with multiple taxable bases and tax schedules. In the case of more than one tax schedule, Onrubia et al. (2014) propose to measure each tax schedule's redistributive effect against the overall tax base. Finally, Onrubia et al. (2014) generalize the Pfähler (1990) decomposition to l tax schedules, m tax credits, and n tax deductions:

$$\begin{aligned}
G_I - G_{NIF} = & \frac{\bar{R}}{\bar{NI}} \sum_{i=1}^l \frac{\bar{T}_I - \bar{T}_i}{\bar{R}} (CI_{T_I} - CI_{T_I - T_i}) \\
& + \sum_{i=1}^m \frac{\bar{NI} + \bar{C}_i}{\bar{NIF}} (CI_{N_I} - CI_{N_I + C_i}) \\
& - \frac{\bar{T}}{\bar{NI}} \sum_{i=1}^n \frac{\bar{T} - \bar{D}_i}{\bar{T}_I} (CI_I - CI_{I - D_i}) - RR
\end{aligned} \tag{16}$$

The overall redistributive effect of all l tax schedules is, as proposed by Lambert (2001), weighted by the share of income redistribution attributable to gross tax liability relative to gross income. Each tax schedule is measured against taxable income, TI , and weighted by the share of gross tax liability attributable to a specific schedule T_i . The redistribution of deductions, allowances, and exemptions is calculated by using gross income as a benchmark for each item and weighting the individual items by the share of the tax base that remains after applying a deduction i . The sum of all individual effects of deductions is then weighted by the importance of the tax base relative to gross income redistribution. As explained above, the redistributive effect of tax credits is calculated against net income, NI . The redistribution of all m tax credits is weighted by the share of net income that remains after applying a specific tax credit C_i , relative to final income. Importantly, tax credits lack a group weight because their redistributive effect is measured directly and independently of the tax base adjustments from tax rates and deductions. Finally, the reranking effect, as defined in Equation 3, is deducted. The general version of the Kakwani decomposition (Equation 15) allows expressing the total redistributive effect of a tax as a weighted sum of the partial progressivity effects of all items:

$$\begin{aligned}
G_I - G_{NIF} = & \frac{\bar{T}_I}{\bar{NI}} \sum_{i=1}^l \frac{\bar{T}_i}{\bar{T}_I} (CI_{T_i} - CI_{T_I}) \\
& - \frac{\bar{T}}{\bar{NIF}} \sum_{i=1}^m \frac{\bar{C}_i}{\bar{T}} (CI_{C_i} - CI_{N_I}) \\
& - \frac{\bar{T} \cdot \bar{T}}{\bar{T}_I \cdot \bar{NI}} \sum_{i=1}^n \frac{\bar{D}_i}{\bar{T}} (CI_{D_i} - CI_I) - RR
\end{aligned} \tag{17}$$

Each component's progressivity is determined by its Kakwani index and weighted by its share in pre-item base (note that tax credits are measures against gross income so its redistributive effect is measured independently of other tax components). Finally, each group of items is weighted with a group weight that reflects the components' overall importance relative to net income (or final income for tax credits). For example, tax rates are weighted by the average taxable income relative to average net income. The group weight of deductions is scaled by the relation of gross income pre-deductions and taxable income post-deductions, but also by the relation of gross tax liability and net income, as deductions also affect redistribution via their effect on the tax rate schedule. It has to be noted that only the redistributive effect of the tax rate has a positive weight, while credits and deductions have a negative weight. This compensates for negative Kakwani indices, as negative Kakwani indices of tax expenditures indicate a regressive distribution. It implies that tax expenditures are more concentrated among lower-income households, so the overall contribution to redistribution is positive.

Appendix E: Pfähler decomposition results

Tables E.1 and E.2 provide the detailed Pfähler decomposition results based on Equation 5 for tax years 2018 and 2015. For each category and individual item, we depict the group weight, the individual weight, and the Kakwani index, which result in the redistributive effect (R&S index) of each item. Further, we calculate the relative redistributive effect of each item, compared to the total PIT's redistributive capacity (RE).

Table E.1: Pfähler decomposition in South Africa in tax year 2017/18

Item	Group weight	Individual weight	Kakwani index	Redistributive effect	% of total redistribution
Reimbursive travel expenses (A)	−0.2868	0.0002	−0.1606	0.00000865	0.0224
Other allowances (A)		0.0010	−0.1570	0.00004356	0.1127
Basic education bursaries (E)		0.0	−0.6366	0.00000866	0.0224
Non-taxable income (E)		0.0037	−0.1831	0.00019324	0.4999
Total allowances and exemptions		0.0049	−0.1814	0.00025409	0.6573
Pension contributions (D)		0.0933	0.0836	−0.00223567	−5.7835
Donations (employee) (D)		0.0003	0.2394	−0.00001829	−0.0473
Home office expenses (D)		0.0002	0.2117	−0.00001027	−0.0266
VCC (D)		0.0003	0.3528	−0.00002795	−0.0723
Travel expenses fixed costs (D)		0.0086	0.2495	−0.00061253	−1.5846
Travel expenses actual costs (D)		0.0004	0.1560	−0.00001978	−0.0512
Commission income (D)		0.0010	0.2515	−0.00007298	−0.1883
Subsistence expenses (D)		0.0001	0.1214	−0.00000222	−0.0058
Depreciation (D)		0.0001	0.2035	−0.00000318	−0.0082
Donations (employer) (D)		0.0	−0.6253	0.00000062	0.0016
Foreign income (D)		0.0002	0.2776	−0.00001929	−0.0499
Accountancy fees (D)		0.0	0.1776	−0.00000232	−0.0060
Public office (D)		0.0	0.2865	−0.00000175	−0.0045
Employer-provided vehicle (D)		0.0013	0.2251	−0.00008516	−0.2203
Employer-provided vehicle, operating lease (D)		0.0	0.2457	−0.00000314	−0.0081
Total deductions		0.1058	0.1027	−0.00311681	−8.0629
Total deductions, allowances, and exemptions		0.1107	0.0902	−0.00286272	−7.4056
Tax rate	0.2550		0.1561	0.03981642	103.0013
MTC (C)	−1.1837	0.0095	0.0985	−0.00111076	−2.8734
AMTC (C)		0.0021	0.1330	−0.00033408	−0.8642
Rebate (C)		0.0364	−0.0773	0.00332858	8.6107
Total credits		0.0480	−0.0331	0.00188373	4.8731
Reranking				−0.00018121	−0.4688
Total				0.03865623	100

Note: (A) denotes non-taxable allowances, (E) exemptions, (D) deductions, and (C) credits. Uncoloured rows depict the individual items. Light grey rows depict total exemptions and non-taxable allowances and total deductions. Dark grey rows depict the final groups of items summarized to the overall redistributive effect.

Source: own calculations based on National Treasury and UNU-WIDER (2019).

Table E.2: Pfähler decomposition in South Africa in tax year 2014/15

Item	Group weight	Individual weight	Kakwani index	Redistributive effect	% of total redistribution
Reimbursive travel allowance (A)	−0.2786	0.0001	−0.2867	0.00001051	0.0260
Other allowances (A)		0.0008	−0.2202	0.00004620	0.1153
Basic education bursaries (E)		0.0	−0.5881	0.00000376	0.0093
Non-taxable income (E)		0.0019	−0.4726	0.00025422	0.6292
Total allowances and exemptions		0.0028	−0.3974	0.00031517	0.7800
Pension contributions (D)		0.0304	0.1224	−0.00103749	−2.5676
Donations (employee) (D)		0.0004	0.1541	−0.00001888	−0.0467
Home office expenses (D)		0.0002	0.2251	−0.00001269	−0.0314
VCC (D)		0.0	−0.0250	0.00000026	0.0006
Travel expenses fixed costs (D)		0.0109	0.2452	−0.00074776	−1.8506
Travel expenses actual costs (D)		0.0007	0.1580	−0.00002902	−0.0718
Commission income (D)		0.0013	0.2620	−0.00009644	−0.2387
Subsistence expenses (D)		0.0001	0.1418	−0.00000351	−0.0087
Depreciation (D)		0.0001	0.2210	−0.00000354	−0.0088
Donations (employer) (D)		0.0	−0.5987	0.00000051	0.0013
Foreign income (D)		0.0006	0.2770	−0.00004590	−0.1136
Accountancy fees (D)		0.0	0.2116	−0.00000247	−0.0061
Public office (D)		0.0	0.2566	−0.00000216	−0.0054
Employer-provided vehicle (D)		0.0015	0.2208	−0.00009218	−0.2281
Employer-provided vehicle, operating lease (D)		0.0	0.2468	−0.00000283	−0.0070
Income insurance (D)		0.0011	0.1408	−0.00004447	−0.1101
Total deductions		0.0475	0.1616	−0.00214116	−5.2990
Total deductions, allowances, and exemptions		0.0504	0.1301	−0.00182599	−4.5190
Tax rate	0.2646		0.1550	0.04100298	101.4752
MTC (C)	−1.1862	0.0102	0.0885	−0.00106716	−2.6410
AMTC (C)		0.0020	0.1515	−0.00035997	−0.8909
Rebate (C)		0.0401	−0.0587	0.00279317	6.9126
Total credits		0.0523	−0.0220	0.00136604	3.3807
Reranking				−0.00013615	−0.3369
Total				0.04040688	100.0000

Note: (A) denotes non-taxable allowances, (E) exemptions, (D) deductions, and (C) credits. Uncoloured rows depict the individual items. Light grey rows depict total exemptions and non-taxable allowances and total deductions. Dark grey rows depict the final groups of items summarized to the overall redistributive effect.

Source: own calculations based on National Treasury and UNU-WIDER (2019).

Appendix F: Simulation—Isolate tax rate reforms

Between 2015 and 2018, some reforms to the tax rate schedule were implemented in South Africa: the marginal tax rates were increased, a new top marginal tax rate was introduced, and tax brackets were adjusted below inflation. However, we still find a decline in the redistributive effect of the tax rate from 2015 to 2018. We explore two explanations for this pattern: first, bracket creep puts a relatively higher burden on lower-income taxpayers, disproportionally increasing their tax liability. We therefore examine how tax liability would be distributed in 2018 if tax brackets were fully adjusted for inflation. We scale the 2015 tax brackets to the 2018 level based on inflation levels, and calculate a hypothetical tax liability based on adjusted tax brackets. Table F.1 depicts the Pfähler decomposition results for this simulation. We argue that taxpayers react to tax rate changes, impeding the redistributive potential of recent tax rate reforms. We therefore isolate the mechanical effect of the adjustment of tax rates and the introduction of the new top tax bracket and apply the 2018 tax rates to the 2015 income distribution and tax brackets. Results for the Pfähler decomposition based on this simulation are depicted in Table F.2.

Table F.1: Simulation bracket creep: Pfähler decomposition with full adjustment for inflation in 2018

Item	Group weight	Individual weight	Kakwani index	Redistributive effect	% of total redistribution
Allowances and exemptions	-0.2660	0.0049	-0.1814	0.0002	0.6418%
Deductions	-0.2660	0.1058	0.1026	-0.0029	-7.2294%
Tax rate	0.2365		0.1689	0.0399	108.8415%
Credits	-1.1727	0.0440	0.0083	-0.0004	-1.1650%
Reranking				-0.0002	-0.4471%
Total redistributive effect				0.0418	100%

Note: the table depicts the results of the simulated Pfähler decomposition applied to the 2018 tax year data with 2015 tax brackets fully adjusted for inflation.

Source: own calculations based on National Treasury and UNU-WIDER (2019).

Table F.2: Simulation tax rate reforms: Pfähler decomposition for 2015 data with 2018 tax rates

Item	Group weight	Individual weight	Kakwani index	Redistributive effect	% of total redistribution
Allowances and exemptions	-0.2845	0.0028	-0.3974	0.0003	0.7698%
Deductions	-0.2845	0.0475	0.1616	-0.0022	-5.2229%
Tax rate	0.2701		0.1574	0.0425	101.7296%
Credits	-1.1910	0.0523	-0.0205	0.0013	3.0606%
Reranking				-0.0001	-0.3301%
Total redistributive effect				0.0418	100%

Note: the table depicts the results of the simulated Pfähler decomposition applied to the 2015 tax year data with the 2018 tax year tax rates (marginal tax rates).

Source: own calculations based on National Treasury and UNU-WIDER (2019).

Appendix G: Simulation—refundable tax credits

We simulate the redistributive consequences of a hypothetical PIT system with refundable medical tax credits (MTC and AMTC). Table G.1 depicts the Pfähler decomposition results under the assumption that credits are fully refunded to the taxpayer.

Table G.1: Pfähler decomposition in South Africa for refundable medical tax credits, 2015 and 2018

	2018		2015	
	Absolute	Relative	Absolute	Relative
Allowances and exemptions	0.0003	0.6551%	0.0003	0.7778%
Deductions	−0.0031	−8.0344%	−0.0021	−5.2840%
Tax rate	0.0398	102.6953%	0.0410	101.1878%
Credits	0.0020	5.1652%	0.0015	3.6729%
Reranking	−0.0001	−0.4812%	−0.0001	−0.3545%
Total redistributive effect	0.0388	100%	0.0405	100%
<i>Gini index gross income</i>	0.6411		0.6514	
<i>Gini index final income</i>	0.6024		0.6109	

Note: the table depicts the absolute and relative redistributive effects of the South African PIT in 2015 and 2018 for a Pfähler decomposition with refundable MTC and AMTC, and non-refundable standard rebates.

Source: own calculations based on National Treasury and UNU-WIDER (2019).