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Inclusive Growth in South Africa? Inequality Dynamics and the Role of Trade Openness vs Tax Policies

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Abstract

Market forces, and notably the role of trade openness, contribute to shaping inequality in South Africa and may limit the inclusiveness of its growth path. Recently, policy reforms may have helped to mitigate these effects. To better understand these developments, we analyze trends in post-tax income inequality using matched employer-employee administrative data from 2012 to 2021 and an original decomposition based on counterfactual tax microsimulations. Our results show that the benefits of increased trade openness during this period has benefited top earners essentially, while other workers—particularly those in the middle class—were adversely affected. This inequality-enhancing impact was partially offset by the automatic stabilizing response of the personal income tax system and by reforms that increased its progressivity. Overall, the analysis highlights the critical role of fiscal policy in counteracting inequality arising from labor-market disparities linked to globalization.

JEL classification

F16, F6, H24, I3

Keywords

trade, inequality, taxation, decomposition

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1. Introduction

Globalization has been identified as a significant driver of within-country earnings inequality (Pavcnik, 2011). Trade openness induces wage dispersion through firm-level heterogeneity and worker sorting. According to theoretical development by Helpman et al. (2004, 2017) and supported by empirical studies (e.g., Schank et al., 2007), trade integration leads to an environment where only the most productive firms engage in export markets.[2] Taxation may play a mitigating role in this process. Countries with more progressive tax systems often experience lower post-tax inequality, even under strong globalization pressures. This compensation mechanism is discussed in international policy reports and theoretical literature (e.g., IMF, 2017; Bourguignon, 2015; Egger & Kreickemeier, 2009) and is reflected in comparative analyses of inequality across welfare regimes (Milanovic, 2016).

However, empirical evidence capturing the joint impact of trade openness and tax progressivity remains limited, especially using micro-level data. Most findings rely on cross-country variation to document both the inequality-enhancing effects of trade and the inequality-reducing effects of progressive taxation (e.g., Dorn et al., 2021). Microdata-based research directly measuring and comparing these dual forces within countries over time is scarce. The present paper contributes new evidence along these lines by exploiting South African administrative microdata from 2012 to 2021 to assess how changes in firm-level trade exposure and shifts in tax progressivity have jointly shaped income inequality within a single-country context.

Focusing on South Africa for the recent period is particularly relevant for several reasons. *First*, it remains the most unequal country in the world.[3] Over the longer run, labor market earnings have been identified as the main driver of inequality (Leibbrandt et al., 2012; Hundenborn et al., 2018) and despite governmental efforts with the introduction of a progressive tax-benefit system, inequality has remained persistently high.[4] It is therefore important to take stock of how inequality has changed over the more recent period, which includes economic stagnation, the impact of the COVID pandemic and wage dynamics due to openness and other market forces. *Second*, South Africa has long been an open country, with its integration into the global economy intensifying over the last 15 years.[5] The trade-to-GDP ratio fluctuated around 40–50% from the 1960s to the 2000s, before increasing significantly in the late 2010s to reach 65%

[2] As emphasized in the Melitz (2003) model, these exporting firms tend to adopt superior technologies, employ more skilled workers, and offer higher wages, reinforcing inequality within the labor market.
[3] In particular, wage inequality increased substantially between 1995 and 2015, the Gini coefficient rising from 58 to 69 and ranking highest among 164 countries (World Bank, 2022).
[4] The pronounced tax progressivity in South Africa distinguishes the country from many other sub-Saharan African countries, as characterized in Bargain et al. (2022) and Lustig et al. (2017).
[5] This growth in trade openness partly coincides with positive economic growth, albeit sometimes affected by global shocks (e.g., 2008 financial crisis and COVID-19 pandemic).

by 2022 (World Bank, 2023). Evidence shows that the benefits of trade integration were not equally distributed, trade openness having heterogeneous effects on wages (Rankin & Schoer, 2013a; Bezuidenhout et al., 2021).[6] Thus, it seems particularly important to examine how both changes in firms' trade exposure and trade intensity have influenced earnings dynamics and, as a result, net wage inequality. *Third*, the South African context offers an ideal setting for this analysis due to the recent availability of administrative records. Matched employer–employee data remain scarce in low- and middle-income countries,[7] yet in South Africa, their availability—and the possibility to combine them with detailed tax microsimulations—provides a unique opportunity to examine, in a comprehensive and integrated way, the joint roles of firm-level trade exposure and tax policy in shaping income inequality.

Our analysis proceeds as follows. We first exploit the employer–employee links to model the relationship between earnings and trade openness, and to examine how trade-related wage premia have reshaped labor income inequality in a context where the degree of openness fluctuated and affected workers unevenly across sectors and skill levels. We then assess the mitigating role of tax policies and their evolution over time by combining updated tax microsimulations with administrative data. These simulations generate novel counterfactual scenarios that illuminate how income inequality would have evolved without the mitigating effect of progressive taxation and in the absence of the recent policy changes. Finally, we bring these components together to construct a decomposition of changes in post-tax income inequality. This decomposition aims to disentangle the role of labor earnings dynamics—particularly the influence of firms' openness, a likely driver of top-end inequality—from the dual role of fiscal policy, namely how the initial degree of progressivity cushions market-driven inequality and the additional role of new reforms reinforcing progressivity over the period. This decomposition is applied to a flexible and non-parametric characterization of the change in inequality, namely to the *growth incidence curve* (GIC), which depicts net wage growth rates by quantile. Decomposing the role of different factors such as trade and tax reform at quantile level thus allows for specific interpretations at any point of the distribution.

Our results reveal that changes in trade openness between 2012 and 2021 had unequal effects across the South African income distribution. While the share of trade-open firms declined overall, the intensity of trade among the remaining open firms increased, disproportionately

[6] Productivity and wage growth have been experienced at the top of the distribution mainly, while other parts have generally been stagnant (Bassier and Woolard, 2021).

[7] Among published material based on administration data, we can cite evidence for Argentina (Lustig & Pessino, 2014; Alvaredo 2010), Colombia (Alvaredo and Londoño Velez 2014), Chile (Fairfield and Jorratt De Luis 2016; Flores et al. 2019), Uruguay (Burdín et al. 2014; De Rosa and Vilá 2017), Ecuador (Bargain et al., 2025), Uganda (Jäntti et al., 2022). Using matched employer-employee data specifically, evidence is even more limited, including studies on Chile (Alvarez & López, 2008), Ethiopia (Abebe et al., 2022), Brazil (Dix-Carneiro & Kovak, 2017), Ecuador (Bargain et al., 2025; Oliva et al., 2021) and South Africa (Rankin & Schoer, 2013a/b; Bassier, 2023; Bassier & Gautham, 2025).

benefiting high earners. Workers at the top of the distribution gained from this deepening of trade integration, whereas those in the lower and especially middle deciles experienced relative income losses. This trade-driven widening of inequality was partly offset by the personal income tax system. Both the automatic stabilizing effects of progressive taxation and discretionary policy reforms—which increased progressivity during the period—helped mitigate the concentration of gains at the top. Importantly, these findings are robust to alternative specifications of the trade–earnings relationship, including different measures of trade intensity, confirming that the inequality-enhancing effects of trade openness persist across estimation approaches. We also demonstrate that the main conclusions are not dependent on pandemic-related distortions and hold when introducing behavioral responses of top earners to higher progressivity (e.g., reduced tax base). Overall, globalization pressures amplified earnings disparities, but fiscal policy played a crucial compensatory role in containing the rise of post-tax income inequality.

The remainder of this paper is structured as follows. Section 2 provides some institutional background and an overview of the related literature. Section 3 presents the data, the estimation of firms' trade openness to gross earnings inequality, and the decomposition approach used in the analysis. Section 4 discusses the results while Section 5 concludes.

2. Policy Background and Relevant Literature

The last few decades have seen significant changes in how firms' openness has affected the distribution of primary incomes, alongside tax reforms shaping the distribution of net income. Our review therefore covers both the literature on tax reforms and trade dynamics, focusing on South Africa and relevant points of comparison.

2.1 Inequality in South Africa

Many studies have examined the factors underpinning South Africa's high levels of inequality using household surveys. Some have profiled inequality by demographic and socio-economic characteristics for earlier periods. In particular, Leibbrandt et al. (2012) identify the labor market as a key driver of inequality over 1993-2008. Wittenberg (2017) also emphasizes the central role of wage inequality in explaining income inequality over 1994-2011. Hundenborn et al. (2018) decompose changes in overall inequality and highlight the contribution of labor incomes for 1993-2014, noting that labor income became less disequalizing over 2008-2014, partly due to changes in household demographics.[8] Friderichs et al. (2023) focus specifically on the role of education over 2008-2017, while Finn and Leibbrandt (2018) propose a

[8] Tregenna and Tsela (2012) also suggest this type of decomposition by income sources and an analysis of the changes over 2001-2007. They review older studies, which include Leibbrandt et al. (2004), Hoogeveen & Özler (2005), Van der Berg et al. (2005), Ardington et al. (2006) and Pauw & Mncube (2007), among others.

decomposition that emphasizes changes in the returns to education and potential experience. While these studies mainly focus on the post-apartheid era, we concentrate on a more recent period, from the post-financial crisis up to the pandemic years (2012-2021). This focus is policy-relevant not only due to its recency, but also because this period is characterized — as we will see — by the heterogeneous integration of South African firms into global trade, both at the extensive and intensive margins.

2.2 Firms' Dynamics and Inequality

South African studies of wage inequality have disproportionately focused on supply-side factors (worker characteristics), rather than demand-side (firm-level) factors, due to limited data availability (see Bhorat et al., 2017).[9] More recently, survey data (Rankin and Schoer, 2013a) and employee-employer matched tax data (Bassier, 2023) have been used to show that firms contribute significantly to wage inequality through their heterogeneity in productivity and openness, particularly in a context of high unemployment. Firms engaged in international trade pay higher wages than closed firms, while substantial within-firm heterogeneity exists among open firms (Rankin and Schoer, 2013a; Bezuidenhout et al., 2021). Although these studies highlight the important role of firm characteristics in wage determination, few have examined how firm dynamics — and in particular changes in trade openness, which is especially relevant as discussed above — contribute to changes in earnings inequality.

2.3 The Role of Tax Policies

The opportunities offered by individual-level tax data to study income inequality in South Africa have recently expanded (see Kerr, 2021, and many other applications cited below).[10] Another important dimension is the possibility to apply tax microsimulation methods, which allow for a detailed assessment of how tax and transfer policies affect income distribution by simulating policy changes and generating counterfactual scenarios. Some studies have examined the effects of South Africa's tax system on inequality using single cross-sections, for instance decomposing inequality differences with other countries to extract the contribution of tax policy differences (Bargain et al., 2022; Gasior et al., 2021). While these studies highlight the inequality-reducing effect of South Africa's tax-benefit system, they do not document its evolution over time. Other research has assessed the redistributive effects of the tax-benefit

[9] More generally, the relationship between trade openness and wage inequality in Africa is rarely studied. See for instance Görg and Strobl (2001) for Ghana and Bigsten and Durevall (2006) for Kenya.

[10] Recent work illustrates this potential for South Africa with new research for instance on the responsiveness to marginal tax changes (Bell, 2020) and employment response to tax incentives (Ebrahim et al., 2017). Several studies focus on top income dynamics: Hundenborn et al. (2019) combining administrative and survey data for 2011-2014; de la Vega, 2025, using administrative data to decompose top incomes by income sources (addressing sectoral and firm heterogeneity); and on-going work by UNU-WIDER exploiting panel information to study top income mobility for 2011-2018.

system using incidence-based methods; however, these approaches do not allow for simulation-based counterfactuals, as implemented in our decompositions below.[11]

3. Data and Empirical Approach

3.1 Data and Selection

While previous studies have relied on household surveys, the literature has increasingly turned to administrative data, which offers more reliable income information, broader population coverage, and thus better representativeness at the country level. In particular, tax data provides superior coverage of top incomes (Card et al., 2010) and is increasingly used in inequality research. The ability to precisely track wage dynamics across the income distribution is especially important for our study, as workers at the top may benefit differently from trade openness compared to the rest of the distribution.

We use a long administrative panel drawn from South African tax records, containing matched employer-employee information. This dataset is the result of a collaboration between the National Treasury, the South African Revenue Service (SARS), and UNU-WIDER.[12] It combines data from multiple administrative sources (CIT forms, IRP5 certificates, ITR12 returns, customs declaration forms, etc.) and enables the study of earnings dynamics both within and across firms (Ebrahim and Axelson, 2019; Ebrahim et al., 2021). Covering the period from 2009 to 2022, the panel includes detailed firm-level characteristics and, through customs data, information on whether firms import and/or export and the corresponding trade levels. This allows us to construct alternative measures of trade openness. Our analysis focuses on private sector workers over the period 2012 to 2021: this selection reflects both the availability of all necessary variables (key variables were missing for data prior to 2012) and the improved data quality after 2011.

3.2 Empirical Approach: Overview

As reviewed, previous studies have typically examined either the role of firms (e.g., open firm premia) or the mitigating effect of the tax-benefit system in shaping income inequality in middle-income countries, and in South Africa in particular. Moreover, they have often done so using a cross-sectional perspective, analyzing a single point in time rather than considering the evolution of inequality over time. In contrast, we propose to integrate these dimensions for a more comprehensive understanding of earnings dynamics. Our approach unfolds in

[11] We refer here to the CEQ approach, used for instance in Inchauste (2017), Goldman and Woolard (2020), Higgins and Lustig (2016), Lustig (2017), and Maboshe and Woolard (2018).

[12] The data are available for research use at the National Treasury Secure Data Facility (NT-SDF) in Pretoria, in the context of the Southern Africa– Towards Inclusive Economic Development (SA-TIED) programme, supported by the National Treasury of South Africa, the South African Revenue Service (SARS), and UNU-WIDER.

three steps. First, we estimate the trade-openness earnings premium and isolate the contribution of trade openness to earnings. Second, we perform tax microsimulations to generate baseline and counterfactual post-tax income distributions in order to extract the role of tax reforms. Finally, we represent the evolution of net income inequality in a flexible, non-parametric way using *growth incidence curves* (GICs), and propose an original decomposition of the GIC that, at each quantile, identifies how net wage growth has been driven by changes in firms' openness, tax progressivity, and other factors.

3.3 Estimating the contribution of firm trade openness to individual earnings dynamics

We begin by estimating the contribution of firms' trade openness to gross earnings inequality. Previous research for South Africa has documented cross-sectional associations between exporting firms and inequality (Rankin and Schoer, 2013a; Bassier, 2023), as well as provided detailed estimates of the export wage premium (Bezuidenhout et al., 2018). In contrast, our objective is to isolate the changes in gross earnings that can be attributed to firms' dynamics, and specifically to changes in their trade openness status. To this end, we first propose a simple model of the form:

$$y_{ijt} = \alpha + \beta' x_{it} + \gamma' z_{jt} + \delta \tau_{jt} + \theta_t + \varepsilon_{ijt} \quad (1)$$

estimated on pooled data for 2012 to 2021. In this model, y_{ijt} is the log gross earnings of individual *i* in firm *j* in year *t* while x_{it} is the vector of workers' individual characteristics (such as age and gender); z_{jt} the vector of firm-specific characteristics, comprising log firm size (in full-time equivalents), log capital intensity (capital/firm size) and industry type); τ_{jt} represents alternative measures of trade openness and θ_t denotes year fixed effects. Note that firm-invariant characteristics could be controlled for using firm fixed effects, as in Bassier (2023). However, this approach would absorb much of the openness premium, since it captures persistent firm-level differences such as export propensity, import dependency, and production structure.[13] In such a model, the effect of openness would be identified only through a "within" variation (i.e. through change in firms' export/import status or the entry/exit of open firms during this period). While arguably more causal, this model would reduce the representativeness of the estimates and underestimate the trade component in our inequality analysis, which is primarily driven by "between" variation, namely the wage differences across workers due to their firms' degrees of exposure to international trade.

[13] In this model, the effect of openness would be identified only through firms that change their export/import status—or through the entry and exit of open firms in the sample—during this period. While arguably more causal, this would reduce the representativeness of the estimates. As we shall see, the trade premium indeed decreases with specification but remains significant and the contribution to changes in post-tax income is similar.

Since the trade premium is identified through firm variation, we can use the equivalent estimation at *firm* level (weighted by firm size)[14] and written as:

$$y_{jt} = \alpha + \beta' x_{jt} + \gamma' z_{jt} + \delta\tau_{jt} + \theta_t + \varepsilon_{jt} \quad (2)$$

where y_{jt} is the log gross average earnings of the workers of firm j in year t, x_{jt} is the vector of mean characteristics of these workers and, as before, z_{jt} is the vector of firm-specific characteristics, τ_{jt} the openness variables, and θ_t the year fixed effects. Note that the trade premium is characterized by a single overall coefficient δ for the period, as our main interest lies in the differential changes in τ_{jt} across workers at different deciles of the earnings distribution.[15]

For the trade openness variables in vector τ_{jt}, we implement the following sensitivity analysis. We first estimate a model (M1) without openness variables to assess the stability of our model regarding the role of other firms' characteristics. Then, we introduce openness variables in models M2-M4 in a way that capture different trade dimensions. Specifically, M2 incorporates a simple trade openness dummy equal to 1 if a firm's export or import values are strictly positive and 0 otherwise. Specification M3 augments M2 by adding *degrees* of trade openness, namely, namely the sum of export and imports values over gross sales. In this way, we shall capture the way both extensive and intensive trade margins may have changed over the period. M4 expands the specification by distinguishing if the firm is an exporter, and importer or both, and M5 adds the degree of trade openness, in each case, to the latter specification.

For each of the alternative specifications M2-M5, we calculate the contribution of trade openness to earnings growth as follows. We retrieve the set of estimates $\tilde{\delta}$ corresponding to trade-related variables and, for both base year (t=2012) and end year (t=2021), we compute trade contribution to earnings for each worker i in firm j in year t as $contrib_{ijt} = \tilde{\delta}\tau_{ijt}$. For instance, for M2, this is simply the coefficient on trade openness multiplied by the value of the openness dummy for a worker's firm. For M3, this is the coefficient on trade openness x openness dummy plus the coefficient on trade openness degree x openness degree, etc. Then, for each earnings decile at time t, denoted y_{dt}, we calculate the average contribution of firm trade openness to earnings: $\overline{contrib}_{d,t} = \mathrm{N}_{\mathrm{d,t}}^{-1} \sum_{\mathrm{i}\in\mathrm{d,f(i)=j}} \tilde{\delta}\tau_{jt}$. We then compute changes in the

[14] Note that, under our specification, the effect of trade is the same for all workers in trade-open firms. However, within firms, the effect of trade might vary among workers, for instance in terms of skills. Unfortunately, the data contains limited information about workers' characteristics. In particular, no information about occupations or skills is available.

[15] While our model exploits cross-sectional variation in firm openness — not just time variation — to identify this coefficient, allowing δ to vary over time would reduce the role of the arguably more exogenous variation coming from firms' changes in openness. Moreover, the trade effect in our final decomposition would depend on changes in both τ_{jt} (firms' trade characteristics) and δ_t (wage returns to trade) over time, which would complicate the interpretation of the results.

contribution of trade openness to earnings i.e., $\Delta\overline{contrib}_d = (\overline{contrib}_{2021,d} - \overline{contrib}_{2012,d})$ for use in our counterfactual income distributions.

3.4 Simulation of Post-tax Actual and Counterfactual Income Distributions

The levels of post-tax income in a country at a given point in time reflect the combined influence of multiple factors, including the characteristics of the working population, the distribution of gross earnings, and the structure of tax policies. Our final decomposition will reflect our changes post-tax earnings depend on the contribution of key factors: (i) firm trade dynamics, (ii) tax policy, due to tax reforms and the role of personal income tax as an automatic stabilizer, and (iii) other factors (including other market wage dynamics not related to trade). A central element is therefore the way tax policy shape earnings growth at each quantile of the distribution.

To extract the relevant components of the decomposition, we make use of 2012 and 2021 personal income tax simulations to produce actual and counterfactual post-tax income distributions. In this step, we build on recent efforts to apply tax microsimulation models to administrative data for analyzing policy reforms in South Africa.[16] To cross-validate our simulations, we present baseline tax-simulation results in Tables A3 and A4 in comparison to SARS-reports. We note that simulated personal income tax (PIT) is very close to the official reports, 1.04% above (0.41% below) the administrative figure in 2012 (2021).

Tax simulations are used as follows. Let $y_t(x_t, \tau_t)$ describes the gross income distribution of workers at time t, which depends on trade openness (τ_t) and other factors (x_t), as estimated in the first step estimation. Let d_t denote the function that transforms individual gross income into post-tax income in year t, based on a set of monetary parameters p_t (e.g., tax bracket thresholds). Post-tax income can therefore be written as $d_t\big(p_t, y_t(x_t, \tau_t)\big) = y_t(x_t, \tau_t) - f_t\big(y_t(x_t, \tau_t)\big)$, capturing the combined effect of market income and the tax system in place at time t, where $f_t\big(p_t, y_t(x_t, \tau_t)\big)$ represents tax payments. Microsimulation models also allow the computation of counterfactual income distributions by isolating the effect of one factor while holding others constant (see Bargain, 2012). For example, $d_s(p_s, y_t(x_t, \tau_t))$ describes the post-tax income distribution that would result if the gross incomes from year t were taxed under the system and parameters of year s. Comparing this counterfactual with the actual distribution $d_t(p_t, y_t(x_t, \tau_t))$ reveals the pure effect of tax policy changes between years t and

[16] Our simulations draw on PITMOD, a tax microsimulation model calculating in detail the South African personal income tax policy rules (e.g., deductions, tax credits, lump sums, and tax liability), described in detail in Table A2 (see also Steyn et al. 2021). PITMOD is plugged to the administrative data compiled by SARS, which combines information from the IRP5/IT3a and ITR12 forms. At the time of writing, PITMOD was not yet available for research use. In our analysis, we translated the 2021 tax code from PITMOD into Stata code for our simulations and we implemented the tax code for 2012. We are grateful to Gemma Wright and Michael Noble for sharing the PITMOD code with us. See: https://www.saspri.org/SASPRI/SASPRI/research/micro-simulation/pitmod

s (i.e., holding gross earnings constant). Traditional approaches based on factor decompositions, where factors are simply different income concept, are problematic. Indeed, comparing post-tax incomes calculated using actual taxes paid in years 1 versus 2 captures two effects: the pure effect of tax reforms but also the fact that tax levels change mechanically in response to a change in gross income, which reflects tax schedule progressivity (automatic stabilizers effect).

We can also extract the impact of a change in gross earnings (which will precisely incorporate changes in taxes paid due to this automatic stabilizers' effect as described in section 3.5) or be more refined and decompose the latter into the specific role of trade openness and the rest. Precisely, the comparison between $d_t(p_t, y_t(x_t, \tau_s))$ and $d_t(p_t, y_t(x_t, \tau_t))$ isolates the impact of changes in firms' trade openness on post-tax earnings, holding the tax system and other market wage determinants constant, with counterfactual gross earnings simply written as:

$$y_{jt}(x_t, \tau_s) = y_{jt}(x_t, \tau_t) + \tilde{\delta}(\tau_{js} - \tau_{jt}) \qquad (3)$$

for all the workers of characteristics x_t in firm j. The different types of counterfactual distributions described so far shall we used hereafter to complete an original decomposition of the GIC.

3.5 Enhanced GIC decomposition

We generate five distributions of post-tax income, used as components of the decomposition and described in the summary Table 1. **Scenarios 1 and 5** correspond to $d_1\big(p_1, y_1(x_1, \tau_1)\big)$ and $d_2\big(p_2, y_2(x_2, \tau_2)\big)$, i.e. base and end years, respectively. More precisely, they represent the *actual* distributions of post-tax incomes in 2012 (year t=1) and 2021 (year t=2). Since policies are specific to the income levels at a certain point in time, we consider a counterfactual distribution, **scenario 2**, written as $d_1\big(\alpha p_1, \alpha y_1(x_1, \tau_1)\big)$ and where both gross income and the monetary tax parameters of year 1 (e.g., tax thresholds) have been nominally adjusted to year 2's levels using a factor α which in our analysis is the Consumer Price Index (CPI). Given the homogeneity of the tax system, this scenario 2 should be equivalent to scenario 1 in terms of distribution and simply shift it by the multiplicative factor α.

To isolate the effect of changes in trade openness, a **scenario 3**, written $d_1\big(\alpha p_1, \alpha y_1(x_1, \tau_2)\big)$, reflects the gross earnings impact of moving to trade openness conditions of year 2. Comparing scenarios 2 and 3 characterize two effects: the contribution of changes in trade openness and the role of progressive tax as an automatic stabilizer that mitigate potential gains from trade at the top. To disentangle these two effects, we will compare, on the one hand, changes in the distribution of pre-tax incomes $\alpha y_1(x_1, \tau_1)$ and $\alpha y_1(x_1, \tau_2)$, and, on the other hand, changes in tax liabilities $f_1\big(\alpha p_1, \alpha y_1(x_1, \tau_1)\big)$ and $f_2\big(\alpha p_1, \alpha y_1(x_1, \tau_2)\big)$. Then, to assess the role of fiscal policy, we define a **scenario 4** where the personal income tax rules of year 2 are applied to the distribution of nominally adjusted gross income in year 1 under the trade

situation in year 2, denoted $d_2\left(p_2, \alpha y_1(x_1, \tau_2)\right)$. The end year situation, **scenario 5**, is denoted $d_2\left(p_2, y_2(x_2, \tau_2)\right)$. Moving from scenario 4 to scenario 5 should characterize the impact of "other factors" affecting gross earnings, i.e. all the earnings dynamics not related to trade.

Table 1: Counterfactual post-tax income distributions

Scenarios	Data year	Nominal uprating (2021) of:		Trade situation year	Predicted earnings	Tax code year
		Incomes	Monetary tax parameters			
1*	**2012**	no		2012	no	2012
2	2012	**yes**	**yes**	2012	no	2012
3	2012	yes	yes	**2021**	**yes**	2012
4	2012	yes		2021	yes	**2021**
5*	**2021**			2021	no	2021

Description of the different counterfactual scenarios used in the decomposition, in addition to base and end years, indicated by *. Compoenents in bold highlight the main changes at each step.

These scenarios are building blocks to produce an enhanced-GIC decomposition. This approach is a contribution of the paper since previous research has focused only on the time decomposition of single-value inequality indices (e.g., Bargain 2012, Bargain and Callan 2010, Paulus and Tasseva 2020). By contrast, we propose here a more flexible version where the simulation-based decomposition is applied to the variation in post-tax income at different quantiles (we retain a GIC based on deciles). This is also a contribution to the literature using GICs. They usually represent differential growth rates at different points of the income distribution, used to assess whether growth was 'inclusive' or pro-poor over a certain period of time in specific country (e.g., Bhorat et al. 2014, and Bassier and Woolard 2021, for South Africa). Our approach expands GIC in two ways. *First*, we characterize more precisely the pure tax effect, compared to when different income concepts—e.g., pre-tax income vs. post-tax income—are used for time comparison (as in Belfield et al. 2017, Cribb et al. 2023). Indeed, as highlighted above, the latter approach falls short of extracting the pure policy effect because of automatic stabilization effects. Second, changes in gross income dynamics can themselves be decomposed to isolate the effect of trade openness, as explained above.

Formally, we can write the growth in post-tax income for each quantile q of the GIC as:

$$\Delta_q = \frac{d_{\mathrm{q2}}\left(p_2, y_{\mathrm{q2}}(x_2, \tau_2)\right) - d_{\mathrm{q1}}\left(p_1, y_{\mathrm{q1}}(x_1, \tau_1)\right)}{d_{\mathrm{q1}}\left(p_1, y_{\mathrm{q1}}(x_1, \tau_1)\right)} \qquad (4)$$

and decompose it as follows (reporting in bracket the difference in scenarios as previously numbered):

$$\Delta_c = \left\{\frac{d_{q2}\left(p_2, y_{q2}(x_2,\tau_2)\right) - d_{q2}\left(p_2, \alpha y_{q1}(x_1,\tau_2)\right)}{d_{q1}\left(p_1, y_{q1}(x_1,\tau_1)\right)}\right\} \quad \text{(other effects: 5-4)} \quad (5)$$

$$+\left\{\frac{d_{q2}\left(p_2, \alpha y_{q1}(x_1,\tau_2)\right) - d_{q1}\left(\alpha p_1, \alpha y_{q1}(x_1,\tau_2)\right)}{d_{q1}\left(p_1, y_{q1}(x_1,\tau_1)\right)}\right\} \quad \text{(tax policy effect : 4-3)}$$

$$+\left\{\frac{\alpha y_{q1}(x_1,\tau_2) - \alpha y_{q1}(x_1,\tau_1)}{d_{q1}\left(p_1, y_{q1}(x_1,\tau_1)\right)}\right\} \quad \text{(trade effect : 3-2)}$$

$$+\left\{\frac{\{f_{q1}\left(\alpha p_1, \alpha y_{q1}(x_1,\tau_1)\right) - f_{q1}\left(\alpha p_1, \alpha y_{q1}(x_1,\tau_2)\right)}{d_{q1}\left(p_1, y_{q1}(x_1,\tau_1)\right)}\right\} \quad \text{(automatic stabilizers: 3-2)}$$

$$+\left\{\frac{d_{q1}\left(\alpha p_1, \alpha y_{q1}(x_1,\tau_1)\right) - d_{q1}\left(p_1, y_{q1}(x_1,\tau_1)\right)}{d_{q1}\left(p_1, y_{q1}(x_1,\tau_1)\right)}\right\} \quad \text{(nominal adjustment:2-1)}$$

For quantile q, the first difference ("other effects") captures the effect of shifts in the gross income distribution unrelated to trade openness. The second term ("tax policy effect") represents the contribution of tax reforms under a scenario where the effect of trade openness in year 2 has been applied to the gross income distribution of year 1 $\alpha y_{q1}(x_1,\tau_2)$. The third term ("trade effect") isolates the contribution of changes in firms' trade openness to pre-tax income growth. The fourth component captures the automatic response of tax policy in year 1 to the changes in pre-tax income due to changes in trade openness. The fifth component is common to all quantiles and is therefore neutral since the GIC's focus is on the relative growth rates of the different quantiles.[17]

3.6 Descriptive Statistics

Our analysis of the trade-openness earnings premium in Step 1 relies on an administrative dataset covering 1,183,714 private sector firms observed over the period 2012 to 2021, as summarized in Table 2. Trade-open firms represent 15.5% of all firms in the sample. Among them, the majority (60.1%) are involved in both exporting and importing, while 24.9% specialize in imports and 15% in exports. These firms exhibit 15% higher capital intensity and significantly larger gross sales compared to closed firms, suggesting greater investment in capital per worker and substantially higher revenue generation. Trade intensity is also notable: on average, 28.1% of gross sales in open firms stems from international trade (combined exports and imports), with exports alone accounting for 12.6%.

[17] A symmetrical decomposition can be performed to obtain the policy effect characterized by a change in policy (from 1 to 2) evaluated on the basis of (nominally adjusted) year 1 data, followed by a change in underlying data (from 1 to 2) conditional on the policy of year 2. The average policy effect (resp. market effect) can be computed, which corresponds to a Shapley value of this component (see Bargain, 2012).

Table 2: Descriptive statistics (2012 to 2021)

	Overall		Trade Open		Closed	
	Mean	SD	Mean	SD	Mean	SD
A. Trade openness						
Closed firm	0.845	0.362	0.000	0.000	1.000	0.000
Trade open*	0.155	0.362	1.000	0.000	0.000	0.000
Exporter only	0.023	0.151	0.150	0.357	0.000	0.000
Importer only	0.039	0.193	0.249	0.432	0.000	0.000
Exporter & Importer	0.093	0.291	0.601	0.490	0.000	0.000
Exporter [exports > 0]	0.117	0.321	0.751	0.432	0.000	0.000
Importer [imports > 0]	0.132	0.338	0.850	0.357	0.000	0.000
Trade openness degree (b)	0.044	0.143	0.281	0.255	0.000	0.000
Export intensity (c)	0.015	0.079	0.095	0.179	0.000	0.000
B. Earnings						
Log daily earnings (d)	5.943	0.771	6.125	0.659	5.880	0.765
C. Other characteristics						
Average age of workers	38.703	6.872	38.955	5.912	38.657	7.033
Female workers (%)	43.042	31.266	39.461	26.035	43.700	32.092
Firm size (fulltime equivalents):						
0 - 20	0.757	0.429	0.598	0.490	0.787	0.410
21 - 50	0.136	0.342	0.184	0.388	0.127	0.333
51 - 100	0.050	0.218	0.089	0.284	0.043	0.203
101 - 250	0.030	0.170	0.066	0.247	0.023	0.151
251 - 500	0.009	0.093	0.025	0.155	0.006	0.076
500 - 1000	0.004	0.060	0.012	0.107	0.002	0.047
1001 - 2000	0.002	0.040	0.006	0.077	0.001	0.028
>2000	0.001	0.036	0.006	0.075	0.000	0.022
Log capital intensity	11.286	1.609	11.406	1.457	11.264	1.634
Log gross sales	15.840	1.652	17.094	1.717	15.610	1.531
Industry:						
Agriculture	0.054	0.226	0.039	0.193	0.057	0.231
Mining	0.011	0.103	0.014	0.118	0.010	0.099
Manufacturing	0.121	0.326	0.325	0.468	0.084	0.277
Utilities	0.015	0.122	0.017	0.129	0.015	0.121
Construction	0.104	0.305	0.045	0.207	0.115	0.319
Wholesale & retail	0.211	0.408	0.322	0.467	0.190	0.393
Transport & communication	0.081	0.273	0.058	0.234	0.086	0.280
Finance	0.078	0.269	0.012	0.107	0.091	0.287
Community & social services	0.322	0.467	0.167	0.373	0.351	0.477
Other services	0.002	0.044	0.002	0.041	0.002	0.044
N	1,183,714.00		183,837		999,877	

Notes: Own elaboration based on administrative tax records from 2012 to 2021. Firm size is number of full-time worker equivalents. (a) A firm is trade open if exports > 0 or imports > 0. (b) Trade openness degree is ratio of total value of exports and imports to total gross sales. (c) Export intensity is total exports value/gross sales. (d) Daily earnings is a sum of salary, allowances, fringe benefits, overtime, bonus, commission earned locally divided by days worked in a year.

The average log of real daily earnings across all firms during the period was 5.943, corresponding to approximately R380.08 (around USD 24). However, workers employed in trade-open firms earn significantly more than those in closed firms. On average, the earnings gap is 0.403 log points, which translates to an additional R177.58 per day (about USD 11), highlighting a strong positive association between trade openness and worker remuneration. In terms of other characteristics, there are no significant differences in average age of workers (39 years); however, trade-open firms have a lower share of female workers (39.5%) relative to closed firms (43.7%). Firm size, measured in full-time equivalent workers, reveals that closed firms are more prevalent among smaller size categories. For instance, 78.7% of closed firms employ 0–20 workers, compared to 59.8% of trade-open firms. Conversely, 20.4% of trade-open firms employ over 100 workers, compared to only 7.5% of closed firms, indicating that trade-open firms tend to be larger. As for sectoral composition, trade-open firms are more concentrated in manufacturing, wholesale, and retail trade, whereas closed firms are more dominant in community and personal services.

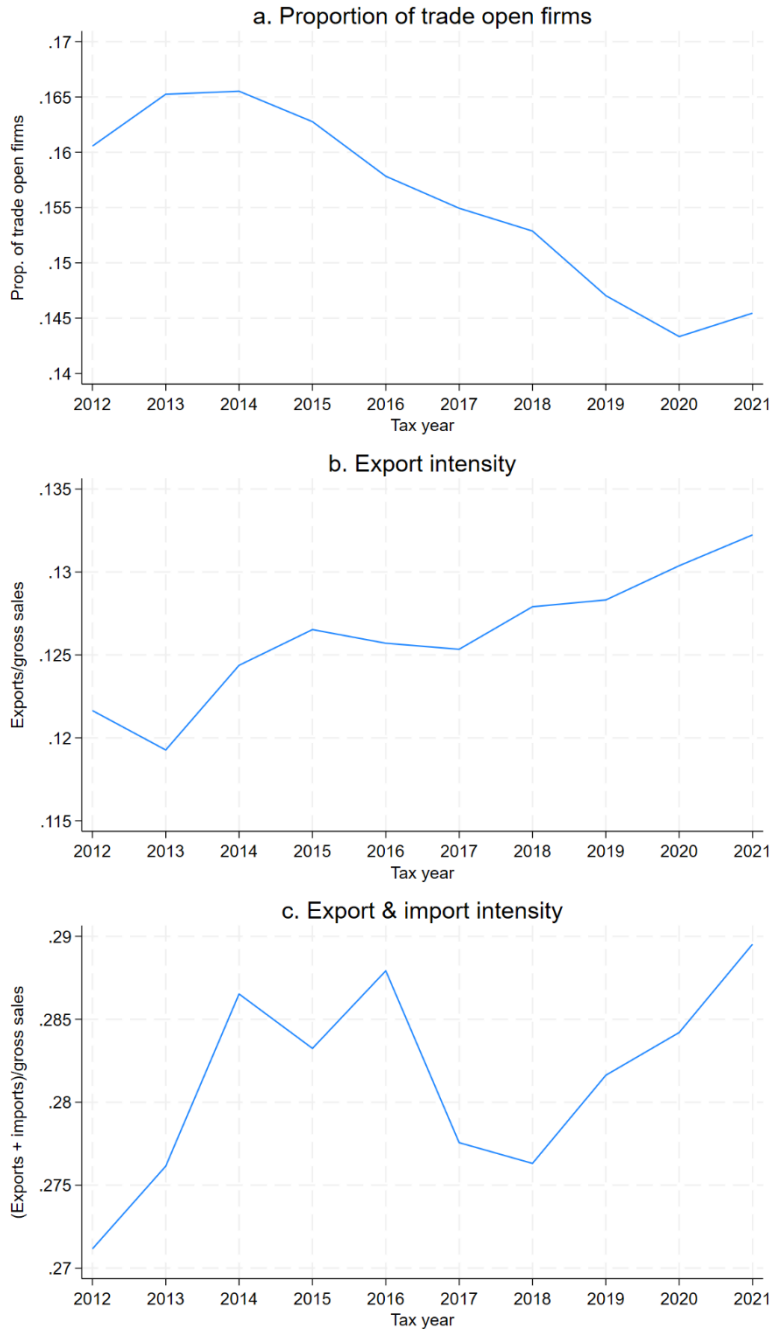
4. Results

We first explore Mincerian earnings function aimed to estimate trade openness premium and the contribution of trade openness to earnings at different points of the distribution for various definitions of trade openness. We then present the main results for the enhanced GIC decomposition.

4.1 Trade Openness Premium

Trade Dynamics at the Extensive and Intensive Margins. We begin with an illustration of trends in trade openness across both the extensive and intensive margins over the period 2012 to 2022. In Figure 1, Panel A depicts the extensive margin, measured by the proportion of trade-open firms, while Panels B and C present the intensive margin, captured by export intensity and combined export-import intensity, respectively. Panel A reveals a gradual decline in trade openness at the extensive margin beginning in 2014. This trend appears to be driven, at least in part, by a slower rate of growth in the number of trade-open firms (+28.7%) relative to closed firms (+35.4%). In contrast, trade openness at the intensive margin has exhibited an upward trajectory. Export intensity increased since 2013, fluctuating between 12% and 13.2%. Similarly, the combined export and import intensity has shown a general upward trend, despite a temporary decline between 2016 and 2018. These patterns suggest that the gains from globalization have been more pronounced at the intensive margin than at the extensive margin.

Figure 1: Trends in trade openness



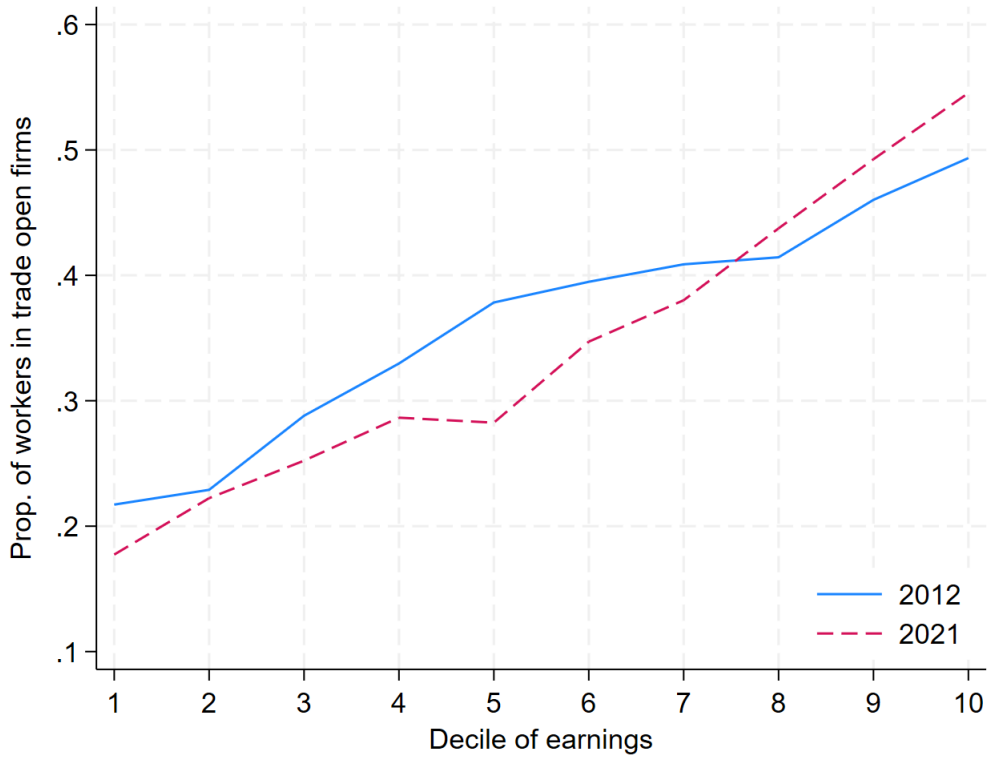
Notes: Own elaboration based on administrative tax records from 2012 to 2021.

Estimates of Trade-openness Earnings Premium. We estimate trade-openness premium using Mincer equations earnings function (equation 2) for the different alternative concepts of openness. For each regression, we pool data over the period 2012-2021. Table A1 in the Appendix presents the complete set of estimates. Model 1 (M1) serves as a comparison point for the role of other covariates while excluding trade-related variables. Models 2 to 5 (M2–M5) introduce alternative definitions of trade openness to assess the sensitivity of the estimated effects. M1 and all models M2-M5 present very similar results regarding the role of the

different covariates, which is reassuring: firms' characteristics, in particular, are not strongly correlated with trade behaviors.

In M2, trade openness is captured using a binary indicator equal to one if the firm engages in either exports or imports. Results indicate that workers employed in trade-open firms earn approximately 45% more than their counterparts in closed firms, which is close to raw gaps descriptive earlier. Next, M3 extends M2 specification by incorporating the degree of trade openness, defined as the ratio of exports plus imports value to gross sales. The estimated earnings premium associated with the trade openness dummy remains sizeable at approximately 37.8%, while a 10%-point increase in the degree of trade openness is associated with a 3.15% increase in earnings. Specification in M4 disaggregates the trade openness dummy into three mutually exclusive categories: (i) firms engaging in both exports and imports, (ii) exporters only, and (iii) importers only. The results indicate that workers in these firms earn significantly more than those in closed firms, with estimated premia of approximately 51.9%, 13.4%, and 13.4%, respectively. Finally, M5 extends M4 to introduce trade intensity measures for each category of trade activity. The estimates continue to provide robust evidence of positive and statistically significant earnings premia associated with all forms of trade openness.

Figure 2: Proportion of workers in open firms

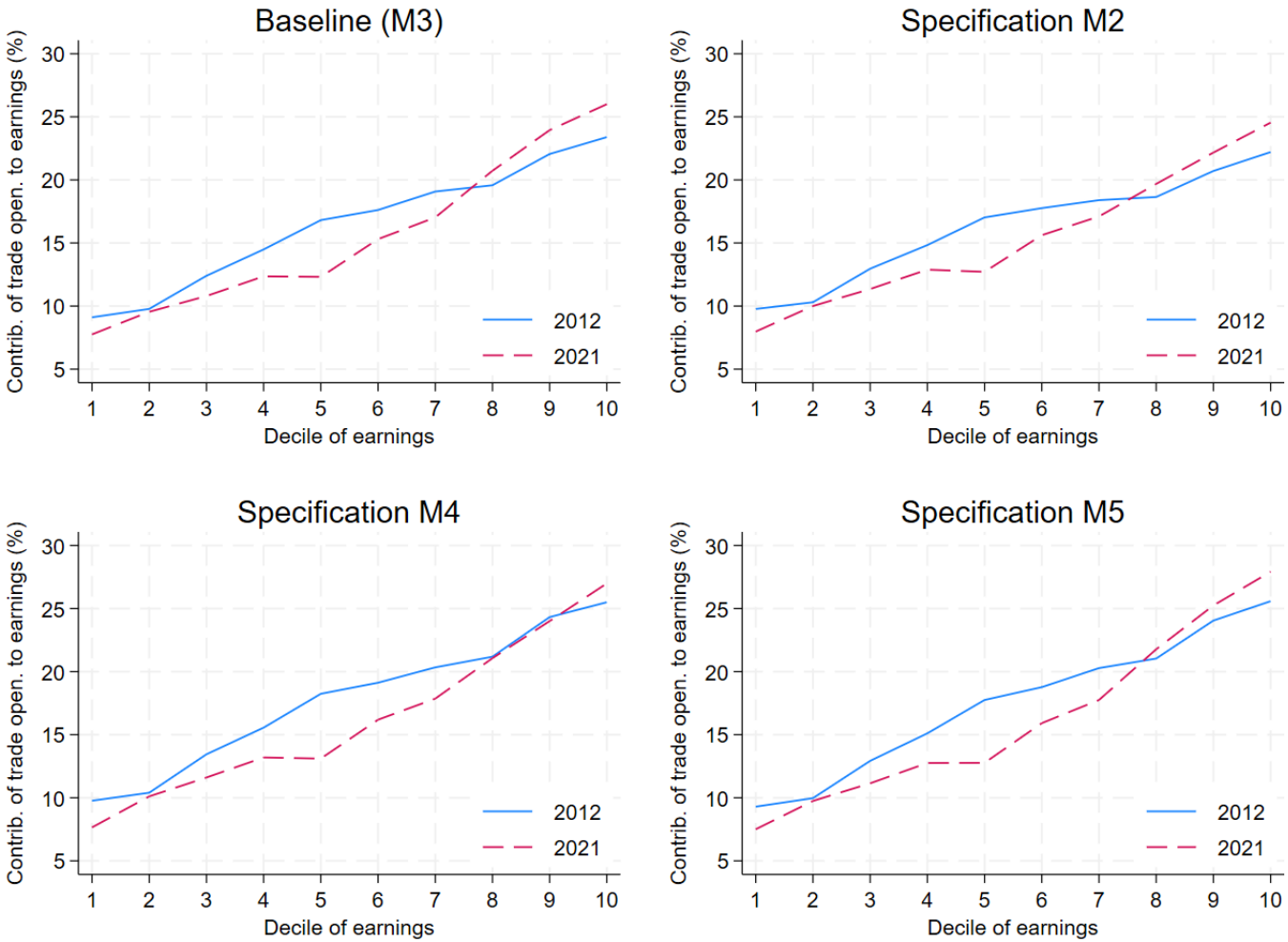


Notes: Own elaboration based on administrative tax records from 2012 and 2021.

Contribution of Trade Openness to Earnings. To characterize the contribution of trade-openness to earnings over time, we focus on start and endpoints of our period of analysis i.e., 2012 and 2021. As discussed in the methodology, the contribution of trade-openness to earnings is derived from two combining the trade openness coefficients and the associated firms' openness characteristics. Figure 2 presents the proportion of (private sector) workers employed in trade-open firms across deciles of (daily) earnings in 2012 and 2021. In both years, the share of workers in trade-open firms increases monotonically across the distribution of earnings. However, there is notable heterogeneity. Specifically, there is a decline in the proportion of workers in trade-open firms within deciles 1 to 7, corresponding to the lower and middle segments of the earnings distribution. In contrast, this trend is reversed in the upper-deciles (8 to 10), where the proportion of workers in trade-open firms increased in 2021 relative to 2012.

Combining trade-premium estimates and the structure of employment in open firms across deciles, we compute $\overline{contrib}_{a,t}$. Results of this exercise are presented in Figure 3 which shows contribution of trade openness for our various Mincerian earnings function model specifications (M2–M5). Figure 3 closely mirrors the structure of Figure 2, which depicts the share of workers employed in trade-open firms across earnings deciles. This parallel arises from the assumption that the estimated trade openness coefficient remains constant across both years. Consequently, the observed variation in the contribution of trade openness to earnings between 2012 and 2021 is primarily driven by the temporal shift in the distribution of workers across trade-open firms.

Figure 3: Contribution of trade openness to earnings



Notes: Own elaboration based on administrative tax records from 2012 and 2021.

Across all definitions of trade openness, the contribution of trade openness to earnings declined for workers in the lower to middle parts of the earnings distribution (deciles 1 to 7) between 2012 and 2021, whereas workers in the upper deciles (8 to 10) experienced a relative gain. Despite some variation in the magnitude of trade openness's contribution to earnings across models M2 to M5, the relative gains observed for top earners may reflect their greater concentration in firms that maintained a high likelihood of being open and benefited from changes along the intensive margin of trade openness.

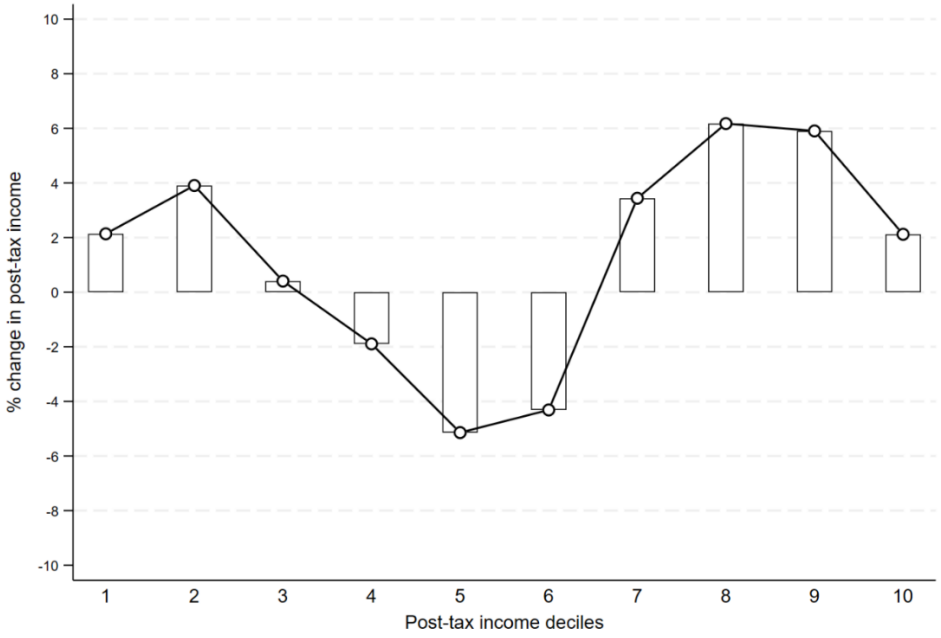
4.2 Main result: Enhanced *Growth Incidence Curve* Decomposition

This section presents our main results, namely a flexible characterization of changes in income inequality between 2012 and 2021 by means of a GIC decomposition. It provides a detailed view of the contribution of trade-openness and tax policy at different points of the distribution.[18] While local earnings from labor were employed in the Mincerian earnings function, the GIC analysis is based on all income (labor and non-labor) earned from local/foreign based firms which is subject to personal income tax, to assess the contribution of this policy instrument to changes in income over time. We focus on workers in the private sector and our analysis is based on 6,070,849 observations in 2012 while the corresponding number of observations is 7,637,563 in 2021. Figure 4 presents the overall GIC while Figure 5 presents the overall GIC decomposed to show the role of trade-openness and tax policy in shaping changes in the income distribution. In both cases, 2012 incomes have been nominally adjusted to 2021 levels using the CPI.

The GIC in Figure 4 shows that the benefits of the (gross) income growth for 2012-2021 were not equally shared by all workers in the private sector. Workers at the bottom (deciles 1 and 2) and top (deciles 7-10) of the income distribution benefited from the growth dividend while those in the middle were penalized (deciles 4 - 6). For instance, gross income increased by 4% and 6% in deciles 2 and 9 (respectively) and decreased by 5% at the median. Changes in minimum wage regulations could have contributed to income growth at the bottom of the distribution while improved engagement in non-labor income sources potentially explains changes at the top. We also highlight that although the period 2021 has been affected by COVID-19 shocks, the shape of our GIC is comparable to that for 2012 and 2018 (see Figure A1). Income growth was registered at all points of the distribution between 2012 and 2018; however, the middle was growing at a lower rate. Comparing GIC before and after the COVID-19 shocks, we observe that income growth slowed down post COVID-19 for all parts of the distribution, however, incomes in the middle were disproportionately affected.

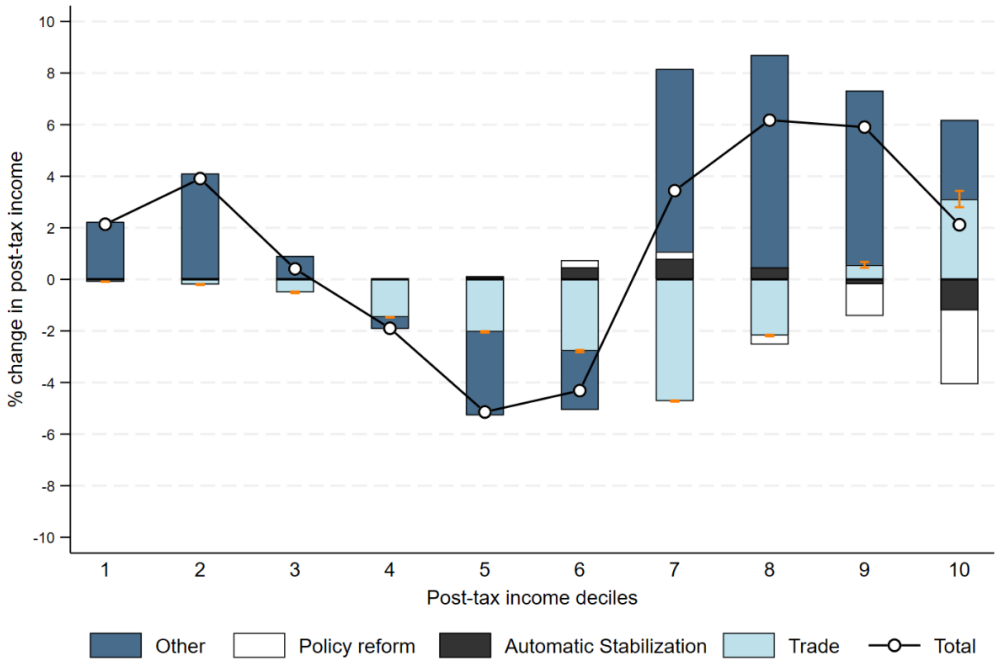
[18] The same decomposition can be applied to any inequality index, e.g., Gini coefficient, top income shares, etc (see Bargain, 2012; Bargain and Callan, 2010; Bargain et al., 2022).

Figure 4: Growth Incidence Curve (2012-2021)



Notes: Own elaboration based on administrative tax records from 2012 and 2021.

Figure 5: GIC decomposition



Notes: Own elaboration based on administrative tax records from 2012 and 2021. 95% confidence intervals for the trade component are depicted by the orange vertical lines.

Figure 5 presents results from the enhanced GIC decomposition where, in addition to total changes in real post-tax income (white circles), we depict the contributions of changes in trade openness (light blue bars), the automatic stabilization of taxes (black bars), discretionary tax reforms (white bars), and other factors (dark blue bars) including population changes and changes in the distribution of gross income.

The enhanced GIC decomposition provides several interesting findings. First, the structural shift in firm *trade openness* exerted a negative effect on workers situated in income deciles 1 to 8. An exception is observed among workers at the top (deciles 9 and 10), for whom trade openness contributed to an increase in post-fiscal income between 2012 and 2022 (a 3.16% contribution in the top decile). This reflects the patterns observed in the first step estimations (see Figure 3) and highlights that dividends from globalization are not equally shared among workers leading to an inequality-enhancing effect.

Second, the contribution of *'other effects'* – capturing changes in the population and the distribution of pre-tax income (excluding the effect of trade) – determine broadly the shape of the GIC. However, they are not always the main contributor to total changes in post-tax income. In fact, trade openness is the main contributor to changes in post-tax incomes in deciles 4 and 6 where it accentuates the negative role of 'other effects', and in decile 10 where it reinforces the positive role of 'other effects'.

Finally, *fiscal policy* plays an important role. On the one hand, the contribution of *tax policy reforms* has an inequality reducing effect, as the benefits from trade accruing to workers at the top (deciles 9 and 10) were offset by the increased progressivity of personal income tax in 2021. On the other hand, the *automatic stabilization* role of personal income tax also contributes to cushioning the effects of trade openness on top income inequality. It contributes (although marginally) to an increase in post-tax income in deciles 6 to 8, where the contribution of trade openness is negative, and to a partial reduction of the income-increasing effect of trade at the top, particularly in decile 10. These results highlight the key role of fiscal policy to mitigate within-country inequality driven by globalization in developing countries like South Africa.

4.3 Sensitivity Analyses

Alternative Trade Specifications. As robustness checks, Figure A1 in the appendix provides our enhanced GIC decomposition for alternative specifications of trade openness in our first step estimations. More precisely, we present the GIC decomposition for models M2 which includes only a trade openness dummy; M4 which includes dummies for firms which are exporters, importers or both; and M5, which extends M4 by including the degree of trade openness in each case. Our results are consistent throughout the different specifications with only small changes in the contribution of the different decomposition components.

Behavioral Responses. Changes in tax policy—particularly increases in marginal tax rates and progressivity—may reduce the taxable income base, either through lower productive effort or through greater tax optimization and income shifting by top earners. Formally, for top earners $i \in D_0$, their actual (observed) gross income y_i^{obs} can be written as a function of change in their effective tax rate over the period:

$$y_i^{obs} = y_i^{no\ behav}(1 + \eta \frac{\Delta(1-t)}{1-t}) \quad (5)$$

with $\eta < 0$ the elasticity of taxable income (ETI hereafter). A higher ETI implies a stronger contraction of the tax base in response to increased progressivity. To gauge the potential magnitude of such behavioral responses, we rely on recent South African estimates by Axelson et al. (2024), Kemp (2020), and Bell (2020), who report ETI values around 0.5, 0.3, and 0.1, respectively. We use three alternative levels—high (0.5), moderate (0.2) and null—in Figure A2, where we reproduce the GIC decomposition for market income growth ("other") and the subsequent policy effects under counterfactual scenarios that exclude behavioral responses. Specifically, in each scenario, counterfactual gross income without behavioral effects, i.e. $y_i^{no\ behav}$, is retrieved by inverting equation (5). With positive ETIs, eliminating behavioral responses mechanically raises "other" income growth at the top of the distribution, while the policy effect increases since the larger tax base amplifies the redistributive impact of progressive tax reforms.[19] The total effect leads to larger gains at the top, but the difference with a no-response scenario (which coincides with our baseline) is not very large. Regardless of the assumed ETI, the direction of our findings remains unchanged: tax policy continues to play a critical compensatory role, albeit more modestly so in the baseline scenario.

Time Frame. We also assess the sensitivity of our results to the choice of time frame. Figure A3 presents the GIC decomposition using 2018 as the end period, thereby capturing income changes prior to the COVID-19 pandemic. Compared with our baseline (2012–2021), income growth was positive across the entire distribution between 2012 and 2018, though relatively weaker in the middle deciles. Despite these differences, the contributions of trade openness, automatic stabilization, and tax policy reforms remain broadly consistent with the baseline results, confirming the robustness of our main findings.

5. Conclusions

Integration in the global economy has been found to be a significant driver of within-country earnings inequality while taxation may play an important role in reducing resultant disparities. This study exploits administrative data (SARS-NT 2012-2021) and tax simulations

[19] The trade component is assumed to remain unaffected (as a first approximation, we ignore potential responses by firms, or incidence effects, that are trade-related). As a result, the automatic stabilization effect corresponding to the bracket creep due to change in trade premia is also unchanged.

to conduct a joint analysis of the role of trade openness and tax policy in shaping the evolution of post-tax earnings inequality in South Africa. We employ an innovative combination of Mincerian earnings function, tax microsimulation and enhanced GIC decomposition to disentangle the inequality enhancing effect of globalization and the mitigating role of tax-policy.

Results show that the benefits from changes in trade-openness which accrued in the period 2012-2021 were unequally shared. Specifically, trade-openness benefited those at the top while other workers were penalized. This first result combines the mixture of changes in declining openness for many firms (or the exit of firms that used to trade), especially those employing workers at intermediary earnings levels, and an increased intensity in exports for open firms, where top earners are predominantly located. The second finding is that trade-driven wage inequality at the top was mitigated by tax reforms owing to increased progressivity. Our results highlight the importance of the South African government in curbing rising inequality due to from market forces through tax policies. Beyond tax reforms, however, fostering the job-creating capacity of open firms is essential for improving incomes for the majority of workers, particularly those in the bottom-to-middle segments of the wage distribution.

Our study is not without limitations and suggestions for future work. First, the data do not capture informal sector workers, thus excluding workers at the very bottom of the income distribution. Second, the study omits social benefits, which are outside the scope of the administrative SARS-NT data. These limitations can be addressed in future research as more comprehensive data sources become available. Although our analysis aimed at assessing the role of different factors on income changes across distribution, administrative tax records offers the advantage of zooming into the dynamics at the top. Future research could extend the analysis focusing more closely on the role of trade and tax policy at the very top of the income distribution (e.g., top 1%, 0.1%). Finally, our approach opens the door to investigating whether reforms in tax progressivity reflect a shift in social preferences or a reassessment of efficiency constraints in light of changing market conditions. Embedding optimal nonlinear income taxation in a context that accounts for trade—thus explicitly addressing the equity-efficiency tradeoff, as in Antràs et al. (2017)—allows for a richer interpretation of tax policy changes. Moreover, by extracting the pure policy effect as suggested in the present paper, it may be possible to improve the characterization of potential changes in underlying social preferences, following the logic of the inverse optimal taxation approach (Bargain et al., 2014; Lockwood and Weinzierl, 2016).

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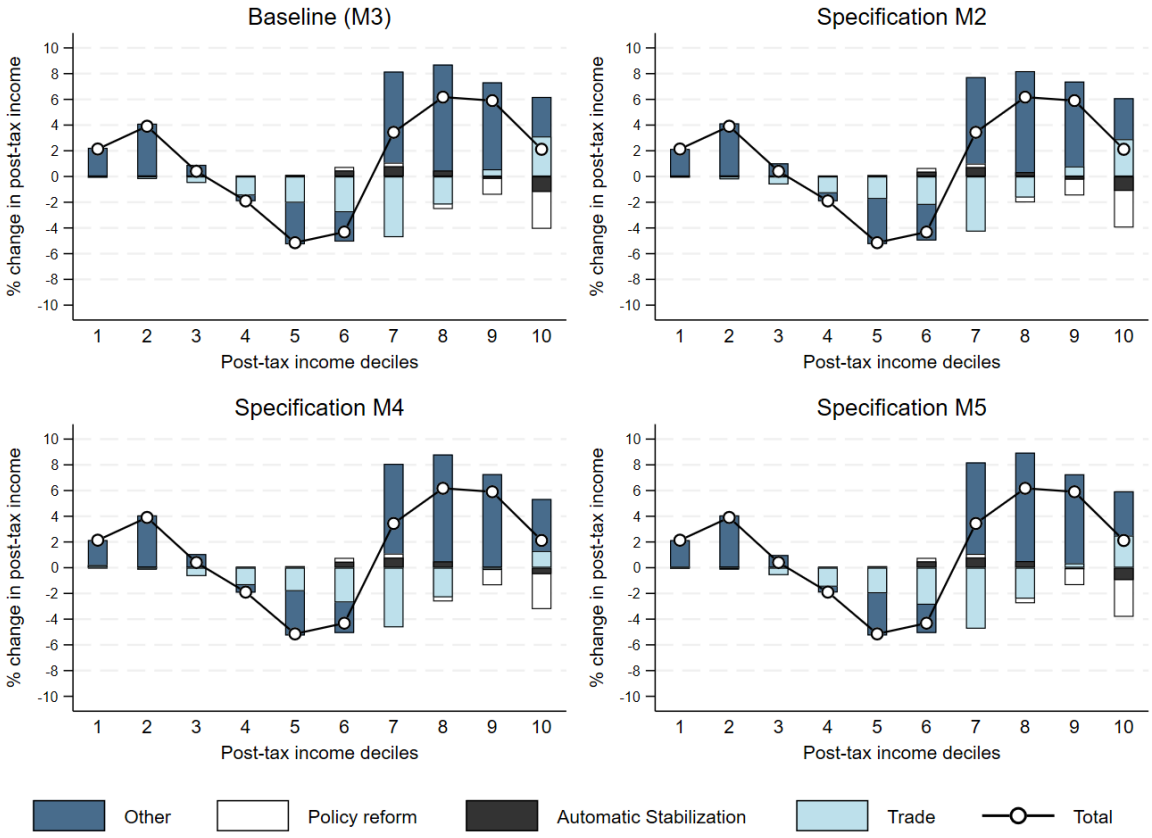
Appendix. Additional Figures and Tables

Figure A1: GIC decomposition: alternative trade specifications



Notes: Own elaboration based on administrative tax records from 2012 and 2021.

Figure A2: GIC Accounting for Behavioral Responses (alternative levels of ETI)

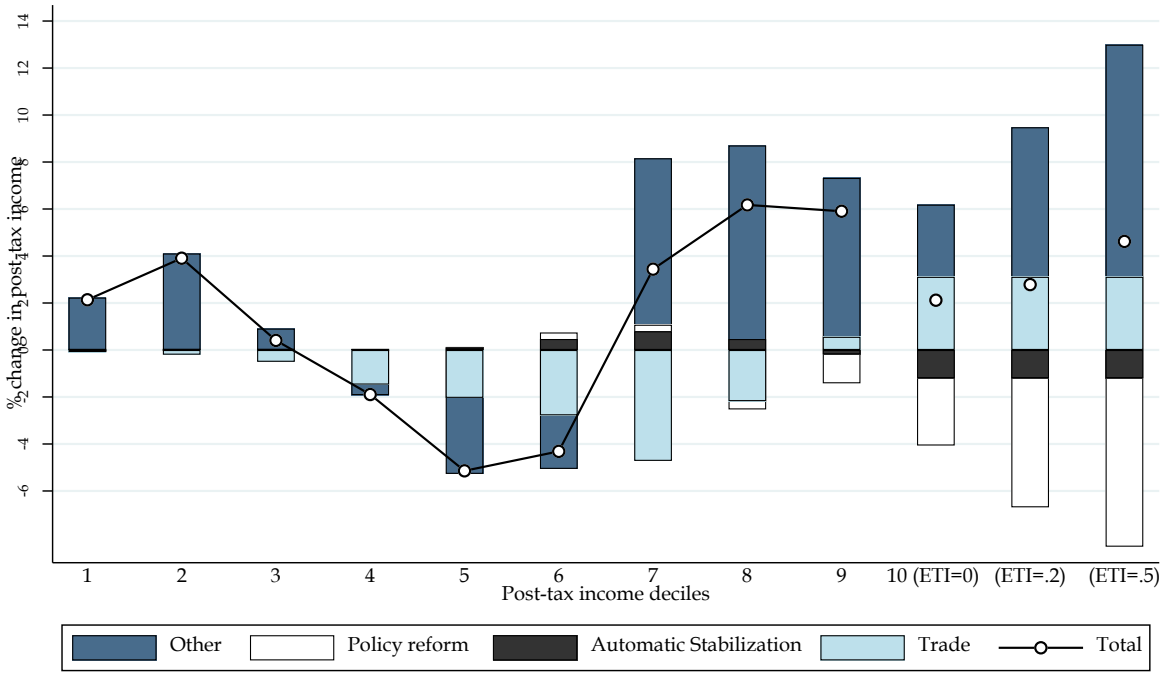
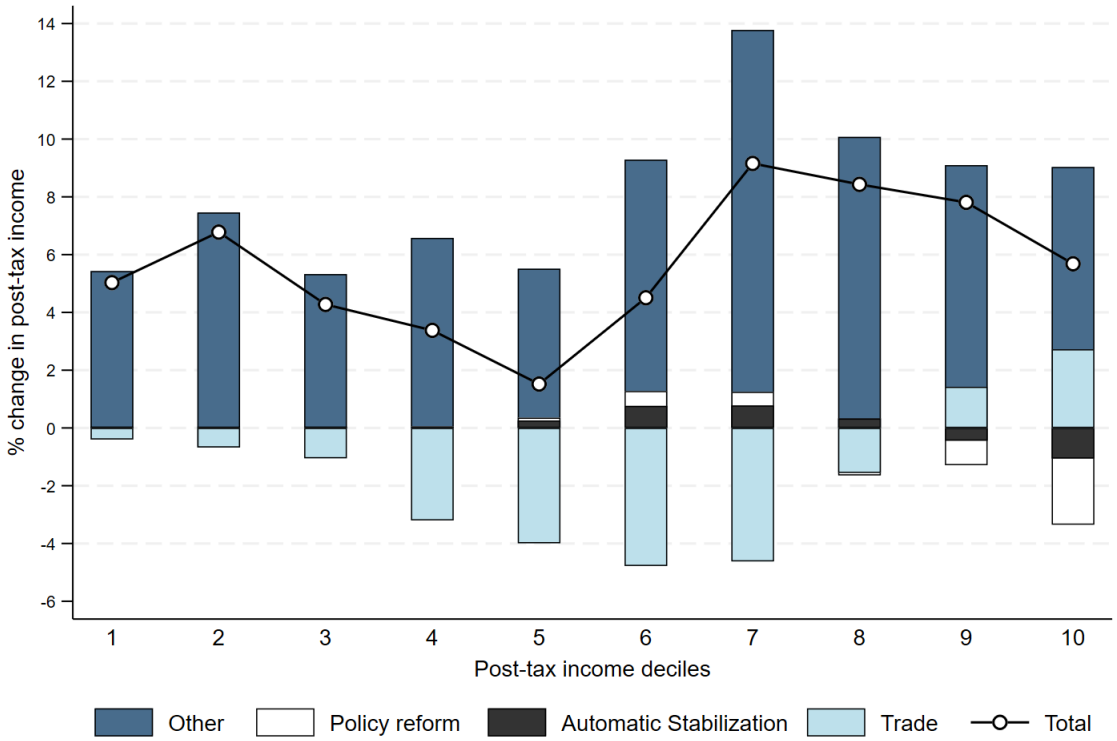


Figure A3: GIC Decomposition: Alternative period (2012-2018)



Notes: Own elaboration based on administrative tax records from 2012 and 2018.

Table A1: Mincerian earnings function

	M1	M2	M3	M4	M5
Av. age worker	0.038***	0.038***	0.037***	0.037***	0.037***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Female workers (%)	-0.002***	-0.003***	-0.003***	-0.003***	-0.003***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Log cap. Intensity	0.154***	0.128***	0.125***	0.123***	0.121***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Firm size	0.112***	0.015***	0.025***	-0.008***	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Firm size 2	-0.015***	-0.008***	-0.008***	-0.006***	-0.007***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Trade openness (a)		0.450***	0.378***		
		(0.001)	(0.002)		
Trade openness degree			0.315***		
			(0.003)		
Exporter & importer				0.519***	0.457***
				(0.001)	(0.002)
Exporter only				0.134***	0.124***
				(0.004)	(0.005)
Importer only				0.134***	0.125***
				(0.003)	(0.004)
(Export + imports) / gross sales (b)					0.247***
					(0.004)
Export intensity (c)					0.104***
					(0.017)
Import intensity (c)					0.098***
					(0.020)
N	1,183,714	1,183,714	1,183,714	1,183,714	1,183,714

Notes: All models control for time & industry fixed effects and are weighted by firm size. (a) Trade open firm = exporter/importer. (b Applicable for firms that both export and import. (c) Applicable to firms that export only or import only. Standard errors in parentheses. Significance: * p<0.10, ** p<0.05, *** p<0.01

Table A2: South Africa Tax Rules

Category	2011/12	2020/21
Tax Bracket 1	R0 – R150,000: 18%	R0 – R205,900: 18%
Tax Bracket 2	R150,001 – R235,000: 27 000 + 25% of taxable income above 150 000	R205,901 – R321,600: R37,062 + 26% of taxable income above 205900
Tax Bracket 3	R235,001 – R325,000: 48 250 + 30% of taxable income above 235 000	R321,601 – R445,100: R67,144 + 31% of taxable income above 321600
Tax Bracket 4	R325,001 – R455,000: 75 250 +35% of taxable income above 325 000	R445,101 – R584,200: R105,429 + 36% of taxable income above 445100
Tax Bracket 5	R455,001 – R580,000: 120 750 + 38% of taxable income above 455 000	R584,201 – R744,800: R155,505 + 39% of taxable income above 584200
Tax Bracket 6	≥R580, 001: 168 250 + 40% of taxable income above 580 000	R744,801 – R1,577,300: R218,139 + 41% of taxable income above 744800
Tax Bracket 7		≥R1,577,301: R559,464 + 45% of taxable income above 1577300
Interest Threshold (<65)	R22,800	R23,800
Interest Threshold (65+)	R33,000	R34,500
Capital Gains Exclusion	R20,000	R40,000
Retirement Deduction Limit	R200,000	R350,000
Primary Rebate (<65)	R10,755	R14,958
Secondary Rebate (65-74)	R6,012	R8,199
Tertiary Rebate (75+)	R2,000	R2,736
Tax-Free Threshold (<65)	R59,750	R83,100
Tax-Free Threshold (65-74)	R93150	R128,650
Tax-Free Threshold (75+)	R104,261	R143,850
Medical Tax Credits	Not Applicable	Applicable – Monthly amounts for taxpayer and dependents
Inclusion rate for capital gain	25%	40%
General income tax deduction threshold	22.50%	27.50%

Notes: Own elaboration. Deductions are based on the following amount source codes: 4011, 4014, 4015, 4016, 4017, 4019, 4027, 4028, 4030, 4031, 4033, 4041, 4042, 4043, 4044, 4045, 4047, 4048, 4050, 4051, 4053, 4054, 4585, and 4586.

Table A3: Personal Income Tax Simulations
vs SARS National Aggregate Totals for the 2012 Tax Year

National level comparisons of Aggregate totals for PIT	
SARS report	250.4 billion
Input data amount*	200 billion
Difference	20.13%
Input data amount**	212 billion
Difference	15.34%
PIT simulation	253 billion
Difference	1.04%
National level comparisons of Aggregate totals for number of taxpayers	
SARS report	
Assessed	5,108,207
Expected to submit	5,881,019
Difference	13.14%
PIT simulation	5,020,535
Difference	-1.72%
National level comparisons of Aggregate totals for taxable income	
SARS report	1 trillion
Input data amount	1.07 trillion
Difference	7%
PIT simulation	1.02 trillion
Difference	2%

Notes: Own elaboration based on administrative tax records. *This amount is directly drawn from IRP5/ITR12 forms, where both information is available; ITR12 information is used. ** The larger of IRP5 and ITR12 tax liability.

Table A4: Personal Income Tax Simulations
vs SARS National Aggregate Totals for the 2021 Tax Year

A. National level comparisons of Aggregate totals for personal income tax	
SARS report	488 billion
Input data amount*	409 billion
Difference	-16.19%
Input data amount**	432 billion
Difference	-11.48%
PIT simulation	487 billion
Difference	-0.41%
B. National level comparisons of Aggregate totals for number of taxpayers	
SARS report	
Expected to submit	5,418,820
Assessed	5,213,796
	-3.78%
PIT simulation	5,465,573
Difference	0.86%
C. National level comparisons of Aggregate of taxable income	
SARS report	1.8 trillion
Input data amount	1.98 trillion
Difference	10.00%
PIT simulation	2.10 trillion
Difference	16.67%

Notes: Own elaboration based on administrative tax records. * This amount is directly drawn from IRP5/ITR12 forms, where both information is available; ITR12 information is used. ** The larger of IRP5 and ITR12 tax liability.