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Lucas Menescal

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Rua Miguel Lúpi 20,
1249-078 Lisboa,
Portugal

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Rua Miguel Lupi, 20
1249-078 LISBOA
Portugal

Telephone: +351 - 213 925 912
E-mail: rem@iseg.ulisboa.pt

https://rem.rc.iseg.ulisboa.pt/

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Breaking down inequality: Can taxes be the great equalizer?*

Lucas Menescal†

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Abstract

Given the contrasting evidence on the redistributive role of taxation, this study seeks to isolate the redistribution process performed through the tax and transfers system and address the effects of several taxes on the difference between pre- and post-tax and transfers Gini coefficients, commonly referred as the Reynolds-Smolensky Index (RSI), in a panel of 107 advanced and developing economies for the period between 1990 to 2020. Contrary to previous evidence, obtained results showed little evidence that direct taxation had significant redistributive effects, whereas indirect taxation only presented negative impacts on developed economies. Still, robust redistributive effects of social security contributions were observed for both groups, while property taxes seem to be associated with higher redistribution in the long run. Finally, the importance of investment and employment levels is underlined and policy recommendations for higher income redistribution are proposed.

JEL: C23, C26, H23, H55
Keywords: Taxation; Income redistribution; Reynolds-Smolensky Index; Panel Data

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† ISEG – Lisbon School of Economics and Management; REM – Research in Economics and Mathematics, UECE – Research Unit on Complexity and Economics; University of Lisbon, Lisbon, Portugal. email: lucasmenescal@iseg.ulisboa.pt (Corresponding author). https://orcid.org/0000-0003-1975-0867

1. Introduction

Historically, the process to determine a country's income distribution among its citizens was often seen as something almost naturally shaped and which could not be directly influenced by public policies or regulations. This was particularly the case in most autocratic societies before the 20th century. Nevertheless, as economic development and democratic societies expanded, a subsequent downturn on the political role played by previous dominant classes took place along with enhanced public institutions and increased civil participation. Consequently, larger attention seems to have been brought to the different aspects of income distributions across countries and how it could be influenced through governments' interventions. In this sense, although social and political pressures may always be observed, the democratic system supposedly allows these demands to be systematically expressed through the political participation of the civil society and by pressing policy makers to adopt measures seen as more or less income redistributive.

Accordingly, the idea that income distribution can be influenced through governments actions led to fundamental discussions regarding its connection with other macroeconomic variables, especially with economic growth. The first main aspect of this discussion lies on the direction of this relationship, whether economic growth affects income distribution or if it is income distribution which determines economic growth, as different theoretical hypotheses were raised in both cases. Empirical evidence, however, has pointed different features with respect each hypothesis, highlighting other identified determinant factors of income distributions and the interconnected effects of fiscal policy on inequality and growth (Odedokun and Round, 2001; Muinelo-Gallo and Roca-Sagalés, 2011). Thus, results seem to suggest that economic growth may be classified as "distributional neutral", not necessarily leading to worst or better income distributions and possibly being consistent with both cases (Isagiller, 2007).

Besides the several theoretical arguments which have been proposed, empirical literature seems to highlight some commonly observed facts. At first, evidence indicates that public policies can significantly affect income distributions through social spending and enhanced human capital (Afonso et al., 2010). Second, public investment seems to reduce income inequality without harming economic growth (Muinelo-Gallo and Roca-Sagalés, 2012). Third, although direct taxation has an alleged more redistributive effect than indirect taxes, the process of income redistribution seems to be performed mainly by social transfers and

benefits (O'Donoghue et al., 2004; Wang et al. 2012). Lastly, the progressivity level of income tax systems seems to play a significant role on income redistribution (Slavov and Viard, 2016).

It may be observed, however, that apart from studies which focus on specific countries, there has been little investigation on the cross-country redistributive effects of taxation to support its theoretical claims and suggestions. Therefore, the focus of this paper is to examine the effects of the tax structure composition on income inequality by isolating the redistribution process performed through the tax and transfers system and addressing the impacts of several taxes on the difference between pre- and post-tax and transfers Gini coefficients, commonly referred as the Reynolds-Smolensky Index (RSI).

This represents a novelty contribution to the literature as studies commonly consider either pre- or post-tax and transfers Gini coefficients as dependent variables or examine results for each country separately in particular years. To this matter, a large set of 107 countries is initially considered for the period between 1990 to 2020. However, given the intrinsic heterogeneity between countries, the sample is divided between developed and developing economies to address the policy effects in detail for each group. Moreover, tax coefficients are evaluated according to each pre-tax and transfers Gini quartiles, while the long-run effects are further analyzed. Ultimately, results are contrasted with previous evidence and policy recommendations for higher income redistribution are proposed.

Contrary to analytical literature, which claim that the naturally higher progressivity levels of direct taxation would necessarily lead to more income redistribution, results obtained showed little evidence that direct taxes had significant redistributive effects. In fact, personal income taxes only showed positive effects for redistribution in developed countries, while property taxation only seems able to increase RSI in the long run. Nevertheless, results obtained reaffirm the robust and positive redistributive effects of social security systems in both groups. Lastly, evidence also points to the importance of employment and investment levels as determinants of income redistribution, reinforcing their roles as mechanisms to avoid the trade-off between economic growth and inequality.

The remainder of the paper is structured as follows: Section 2 reviews the related literature and the empirical evidence. Section 3 explains the methodology adopted and data considered. Section 4 presents and discuss the results. Section 5 brings the final conclusions and policy recommendations.

2. Literature Review

The first major aspect analyzed by the literature on income distributions relates to its determinants and the relationship with economic growth. In this sense, there are two main propositions on how economic growth could affect income distribution. The first hypothesis is derived from the seminal Kuznet's curve, which suggests that as income per capita rises, income inequality also rises until a certain maximum point, to which past that, it starts to decline as higher income levels are reached. The second hypothesis is derived from classical theory economists which claimed that economic growth in market economies will always lead to increases in income inequality, as wealth and assets are historically owned by richer households, which are the ones who are able to continually save and invest.

These theoretical claims raised an important debate regarding the existence of a possible trade-off between more economic growth or more income equality, suggesting that both cannot increase simultaneously and that governments often face a choice between the two processes. Even so, the first aspect raised by the literature is the fact that there are weak empirical results in support of the Kuznets curve and several contrasting evidence on the relationship between economic growth and inequality. This led to the conclusion that economic growth is not a necessary or sufficient condition for more equally distributed income and that further investigation needed to be performed (Isagiller, 2007).

Oppositely, some hypotheses were developed pointing to the reverse direction and suggesting that income distributions could help to determine economic growth. In this case, authors have established explanations for both positive and negative effects of income inequality on economic performance. The positive effects of income inequality on economic growth were first discussed in the dual-Sector model developed by Lewis (1954), showing how differences in savings propensities according to income levels could influence economic growth. It is argued that more unequal income distributions would lead to higher economic growth through increased savings, particularly of richer households, and that more income redistribution would diminish capital accumulation and consequently harm economic growth.

Contrary to this argument, part of the literature has suggested different mechanisms through which decreased inequality could lead to higher growth rates. One argument claims this would be given by the fact that the average productivity of investments tends to increase

in countries with less income inequality, as financial assets are more equally distributed and transacted between agents. Another assumed negative effect of inequality is given by increased social conflicts and political instability, which may boost poverty rates, informal activities, crimes, generalized uncertainty, and the need for government interventions. In turn, this creates unproductive distortions on the economy which can reduce investment rates, asset returns, capital accumulation and ultimately hamper economic growth. At last, possible positive effects of lower income inequality can also be derived from greater economies of scale based on amplified domestic markets, as well as through increases in educational levels which lead to higher human capital and economic development.

In this sense, empirical studies commonly point to economic growth, economic development and investment rates as the main determinants of income distributions across countries (Sarel, 1997; Odedokun and Round, 2001). Still, Škare and Saša (2014) and Shao (2021) observed that inflation, unemployment, trade openness and labor income shares are also important determinants of inequality in large samples of countries. In addition, Cornia and Martorano (2012) argued that public policies can help to reduce inequality if a given set of macroeconomic and social policies are adopted by governments. These policies could shape the pattern of economic growth as capital or employment-intensive, as well as agriculture or industry-driven, which would help to determine the final effect on income distribution.

Besides the factors which determine income distributions across countries, its connection with fiscal policies and public interventions represents the second most explored topic on this theme. Advancing on this analysis, Afonso et al. (2010) found that public policies affect income distributions in OECD countries directly through social spending and indirectly via higher human capital and sound economic institutions. Thus, the authors recommended countries to keep spending as low and well-targeted as possible, improve education performance and strengthen the institutional framework of the public administration. Muinelo-Gallo and Roca-Sagalés (2011, 2012) also showed that larger current expenditures and greater direct taxation may reduce income inequality but tends to diminish economic growth, while public investment seems to reduce inequality without harming growth rates,

suggesting that the trade-off between growth and equity could be avoided through public investment.[3]

On this framework, Martínez-Vazquez et al. (2012) addressed the impacts of public expenditures and revenues on income distributions in a large sample of 150 countries. The authors found that progressive personal and corporate income taxes can reduce income inequality, while general consumption taxes seem to intensify it. On the other hand, higher expenditures-to-GDP ratios on areas such as social welfare, education, health and housing sectors had significant positive effects on income levels. [4]

As a matter of fact, Johansson (2016) and Isiaka et al. (2023) made large literature reviews on the evidence concerning the effects of public spending and taxation on economic growth and inequality, respectively. According to the authors, evidence suggests that the overall size of governments may negatively impact long-run growth, but that a reallocation of public spending towards infrastructure, education and social welfare could raise income levels and reduce income inequality, particularly in middle-income countries. The authors also claim that even though results are likely to vary across countries, shifting income taxes towards consumption taxes may have negative equity implications, as income taxes are generally more progressive and would make post-tax income more equally distributed. In this matter, Afonso and Alves (2019) computed threshold values for different taxes to reduce income inequality and increase aggregate consumption.

Another relevant aspect on discussions about the determinants of income distributions comes from the adoption of either pre- or post-tax and transfers Gini coefficients. As suggested, the former is calculated before the incidence of taxes and public transfers, reflecting the 'natural' income distribution before government intervention, while the latter is calculated after taxes and transfers are considered and reflects income distribution after government intervention. The difference between the two indicators is often referred to as the Reynolds-Smolensky Index (RSI), as a reference to Reynolds and Smolensky (1977), and has been used in different studies to assess the redistributive effects of the fiscal policy.

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[3] Fournier and Johansson (2016) also found that public spending reforms which shift expenditures to public investment are associated with higher growth and less inequality, and that government effectiveness is crucial for inclusive growth.

[4] Although Malla and Pathranarakul (2022) obtained no evidence that taxes on goods and services significantly affect inequality, the authors found similar results regarding expenditures on social welfare, health and education.

For instance, O'Donoghue et al. (2004) used both the RSI and the Kakwani Index to analyze the effects of the tax-benefit system in 12 European countries by decomposing the impacts of direct and indirect taxes, as well as of social security contributions, for each country. Besides outlining the progressivity features of each type of tax, the authors showed that the tax-benefit system is responsible for an average reduction of 40% in post-tax and transfers inequality, with the largest impact coming from pensions and benefits, followed by direct taxation and lastly by indirect taxes, which tend to be naturally regressive and have a lower redistributive effect. Wang et al. (2012) also assessed the redistributive effects of taxes for OECD countries in 2004 through household income microdata. The authors found that the redistributive pattern varies between countries, but that there is an average reduction of 35 per cent in Gini coefficients after taxes and transfers are considered. They also confirmed that about 85 per cent of total redistribution comes from social transfers, while only about 15 per cent comes from taxes.[5]

At last, besides describing the changes in tax policy which took place in Latin American countries since the 1980s, Cornia et al. (2011) computed the effects of both direct and indirect taxes on disposable Gini coefficients and found that direct taxation had significant negative effects on income inequality. Moreover, the authors were the first to consider the Reynolds-Smolensky Index (RSI) as the dependent variable in a panel specification to address the cross-country redistributive effects of taxation. In this case, the authors obtained significant positive effects of direct taxation and social security contributions on RSI, confirming their previous results regarding its negative impacts on inequality. Furthermore, trade taxes and taxes on goods and services presented significant negative coefficients suggesting that the regressive nature of these taxes may indeed have harmed redistribution.[6]

As this type of analysis follows a distinct approach to isolate and assess the cross-country effects of taxation on the redistribution process performed by the tax-benefit system, which has not been fully explored, it represents an important gap on the empirical literature to be studied in detail for larger sets of countries and longer periods.

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[5] Slavov and Viard (2016) make a detailed description of both Reynolds-Smolensky and Kakwani indexes as instruments to examine how taxes and transfers can be redistributive and highlight the importance of both their size and progressivity to the final outcome.

[6] Coelho and Alves (2024) also considered RSI in a panel specification and found that pre-tax (market) Gini is associated with higher income redistribution, while post-tax (disposable) Gini is negatively associated with redistribution.

3. Methodology and Data

In the first stage, the Reynolds-Smolensky Index (RSI) is constructed for a set of 107 advanced and developing countries from 1990 to 2020. The RSI is defined as the difference between the pre-tax and transfers (market) Gini coefficient and the post-tax and transfers (disposable) Gini coefficient, as shown below:

$$RSI_{i,t} = Gini_{i,t}^{pre\ tax} - Gini_{i,t}^{post\ tax} \qquad (1)$$

such that if RSI > 0, income inequality decreased after taxes and transfers were considered and there was income redistribution performed by the tax policy. If RSI = 0, it means that tax policy had no effects on inequality, while RSI < 0 suggests that tax policy increased inequality, leading to more income concentration.[7] The data on both pre-tax (market) and post-tax (disposable) income Gini coefficients was retrieved from the Standardized World Income Inequality Database (SWIID), which incorporates data from different sources to maximize the coverage and comparability of cross-national income inequality databases.

Thus, we proceed to investigate the main determinants of the RSI, with a particular focus on the effects of the tax system composition and the level of government expenditures. To this matter, the RSI is considered as dependent variable in a panel regression specification as described below:

$$RSI_{i,t} = \beta_0 + \beta_1 RSI_{i,t-1} + \beta_n FP_{n,i,t} + \beta_q X_{q,i,t} + \delta_i + \mu_t + \varepsilon_{i,t} \qquad (2)$$

where i and t represent country and time periods, respectively; $RSI_{i,t}$ is the Reynolds-Smolensky Index; $FP_{n,i,t}$ is the vector of the n fiscal policy variables, notably tax revenues and public expenditures; $X_{q,i,t}$ is the vector of the q socio-economic and demographic control variables; δ_i denotes country fixed effects; μ_t represents time (year) effects and $\varepsilon_{i,t}$ is the disturbance term satisfying the standard assumptions.

[7] All countries considered presented positive values for the Reynolds-Smolensky Index (RSI).

The variables included in vector $FP_{n,i,t}$ are represented as percentages of GDP and refer to different tax revenues and government expenditures. For instance, tax revenue variables were collected at the UNU-WIDER Government Revenue Dataset and include: i) Direct taxes; ii) Taxes on income, profit and capital gains; iii) Taxes on income, profit and capital gains of individuals (PIT); iv) Taxes on income, profit and capital gains of corporations (CIT); v) Taxes on property; vi) Social security contributions (SSC); vii) Indirect taxes. Total government expenditures were collected at the World Economic Outlook (WEO) of the IMF. Due to data availability, data for government social protection expenditures is retrieved from two different sources. For developed countries, data comes from the IMF Government Finance Statistics (GFS) by Functional Expenditures (COFOG), while for developing countries it was collected at the Statistics on Public Expenditures for Economic Development (SPEED) database.[8]

Moreover, the variables included in vector $X_{q,i,t}$ are: i) unemployment, as a percentage of the labor force; ii) the gross fixed capital formation, as a percentage of GDP; iii) the old-age dependency ratio, defined as the ratio between people older than 64 and the working age population (ages 15 to 64). These were selected according to the literature and collected at the World Development Indicators (WDI) database of the World Bank. In fact, empirical literature suggests that unemployment and investment rates are the main determinants of income distributions, while theoretical arguments claim that saving propensities and demographic characteristics may also help to determine inequality (Škare and Saša, 2014; Shao, 2021). Essentially, unemployment rates may affect the revenue collection capacity of the government and, ultimately, the ability to tax and transfer to the population, while investment rates could improve economic activity and public revenues. The list and definition of all variables are displayed at Table 1 in Appendix, while the summary statistics is displayed at Table 2.

The sample is further divided between developed and developing countries to perform a detailed discussion on the evidence obtained for each group. To this matter, the World Bank classification of 2020 is adopted, and countries classified as "high income" are considered as

[8] As regressions for the two groups of countries are examined separately, the different data sources should not pose a problem.

developed economies, while countries classified and "upper-middle" and "lower-middle" income are considered as developing economies.

Finally, regression estimation is performed through OLS-Fixed-Effects to account for unobserved heterogeneity and by the Two-Stage Least Squares (IV-2SLS) using instrumental variables to consider for possible endogeneity on results. In this case, the validity of the instruments is tested with the Sargan-Hansen test, which analyses the appropriateness of the instrument set. High p-values for the tests in regressions indicate that the group of instruments is exogenous and adequate, as the number of instruments is also considered. Further, results for tax coefficients are evaluated according to each quartile of pre-tax Gini indexes to assess the sensitivity and robustness of results under different levels of inequality, while the Dynamic Fixed Effects (DFE) estimator based on Pesaran et. al (1999) is lastly used to evaluate the long run effects of taxation.

3.1. Income inequality and taxation

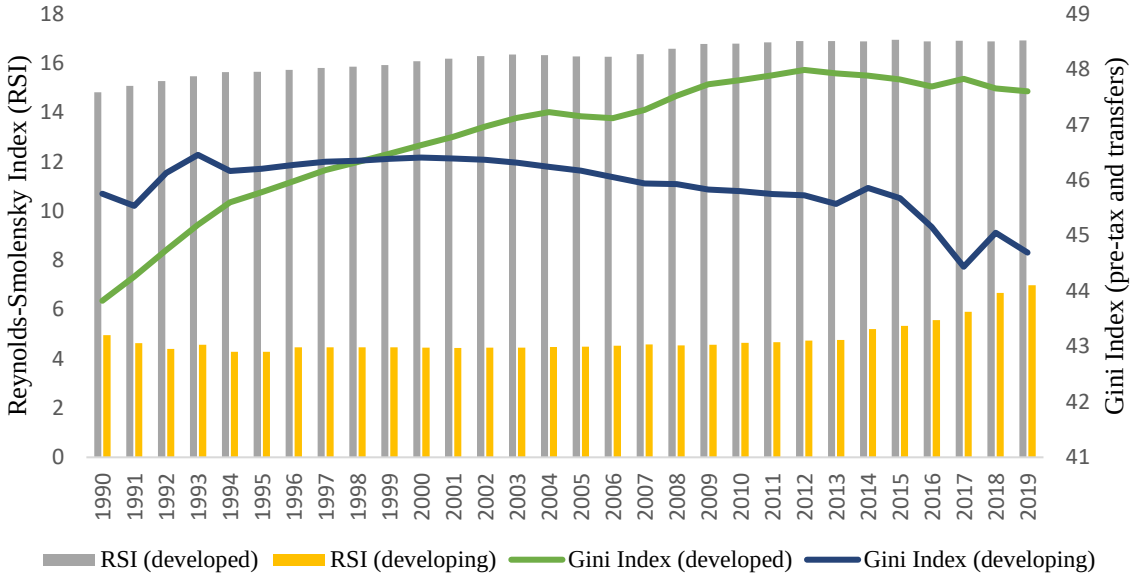
In Graph 1, we can observe that the first tendency of income inequality during the period analyzed is the increase in pre-tax Gini coefficients for advanced economies. In fact, it was below developing countries in the beginning of the period but increased during the 1990's to overcome it in the turn of the 20th century. Moreover, it continued increasing during the first decade until a certain stabilization point after 2010, when it started to present a relative decline. With respect to inequality in developing economies, we may observe that after an increase during the 1990's, it started to decrease consistently after the year 2000, with a couple temporary increases after the financial crisis and during its aftermath in the following years. Nevertheless, it continued to present a downward trend until the end of the period considered.[9]

The intriguing point, however, is that even with this significant increase in pre-tax income inequality for developed countries, their redistributive power, represented by the RSI, essentially increased during the whole period, as observed in the grey columns. On the other hand, even though inequality had been falling since the 2000's for developing economies, their RSI only started to present robust increases after 2013. Therefore, given these changes in pre-tax and transfers inequality, the focus of this research is to investigate the role of the

[9] Years after 2020 were not considered as the pandemic crises may have had significant impacts on income distributions which are not directly related to the tax policy (Narayan et al., 2022).

tax structure in explaining the behavior of the redistribution process performed by the tax policy for each group of countries, considering different levels of inequality and for the long run perspective.

Graph 1 – RSI and pre-tax Gini Index (Developed and Developing countries)



Source: SWIID and author´s calculation

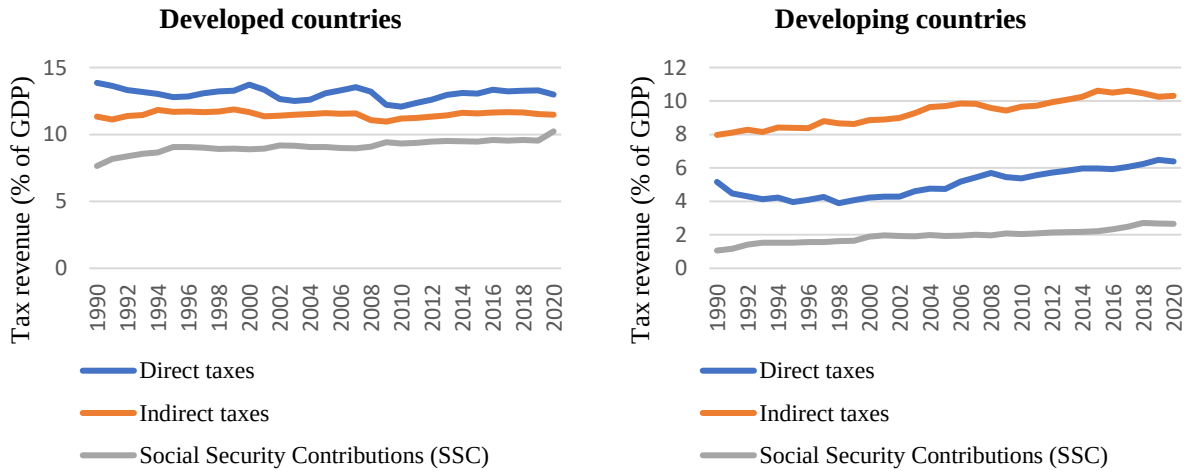
When tax revenues are observed for each group of countries in Graph 2, it is noticed that developed countries tend to have higher public revenues, as a percentage of GDP, than developing ones and that direct taxes are their main source of revenues, while for developing countries indirect taxation seems to represent the main revenue source. Moreover, although revenues from social security contributions in advanced economies are quite higher, it seems to have increased during the whole period in both groups. As theory suggests, these distinctions may represent important issues for redistribution, as direct taxes are presumed to have higher progressivity levels, while indirect taxes are often seen as the most regressive type of tax, and social security contributions usually tend to be directly related to the level of social transfers and benefits distributed to the population, possibly leading to the significant differences on observed RSI.

In this sense, as progressivity may be studied using different measures according to median income shares, marginal taxation and top tax rates, Gerber et al. (2018) used and compared different income tax progressivity indicators to analyze its behavior through time

and evaluate its effects on economic growth. [10] Besides finding no evidence that progressivity significantly affects growth, the authors document a robust decline in progressivity in both developed and developing economies over the last decades, but particularly during the 1990 decade.

For developing countries, it may also be observed a constant increase in indirect taxation and social security contributions over the whole period considered, but a distinct decline in direct tax revenues during the 1990's, with significant increases after 2002. On this matter, Cornia and Martorano (2011) discussed the tax reforms which happened in Latin America during the 1980's and 1990's and argued that by promoting a wider tax base, implementing tax simplifications and a reduction of personal income tax rates, these reforms were mainly focused on horizontal equity, instead of vertical equity, which led to subsequent decreases in revenues from direct taxation and increases in inequality. These results are reinforced by Chu et al. (2004) for a panel of developing countries, where the authors showed evidence that the reduction in the share of direct tax revenues led to a fall in tax progressivity and a successive increase in inequality during the 1990's.

Graph 2 – Tax revenues (% of GDP)



Source: UNU-WIDER Government Revenue Dataset

[10] The authors used the indicators developed by Sabirianova et al. (2010) for a large sample of countries to compare with their own results based on the OECD Taxing Wages database. The main setback of the former is that data only ranges until 2005, while the latter is only available for OECD countries. Nevertheless, authors showed that a decrease in progressivity was observed in all cases and called attention to the challenges of measuring progressivity, particularly if considering the entire tax system, and not only direct income taxes.

Ultimately, Vellutini and Benitez (2021) presented a new technique to compare the redistributive capacity of tax policies and discuss their role on inequality.[11] Even though redistribution coefficients presented differences when considering their approach, the effects on inequality were very similar in all cases. The authors argue that there are multiple ways of achieving a given redistributive capacity, such that wide variations on progressivity levels and tax rates may lead to similar redistribution. This underlines the importance of a clear diagnostic on the drivers of the redistributive role of taxes and the specific distinction of their effects, either through progressivity or through the tax size. In accordance with the literature, the authors also observed a robust decline in the progressive capacities of both advanced and developing economies through time and showed that the size of income tax revenues seems more relevant for redistribution than their progressivity levels, suggesting that the right evaluation of tax effects is crucial for policy designs.

4. Results

The first results for the entire sample of countries are reported at Table 3. Furthermore, Tables 4 and 5 display results for developed and developing countries, respectively. Each table shows results using different tax variables and indicates the estimation method adopted in each column.

Initially, significant coefficients for the lagged value of RSI and market Gini coefficients are observed. This suggests that more unequal countries tend to have greater income redistribution performed by the tax and transfers system, a result also observed by Alves and Coelho (2024) for European countries. The significant positive effects of government expenditures and unemployment rates may reinforce this aspect by highlighting the importance of public intervention and social assistance for redistribution. Moreover, although negative effects of direct income taxes are initially observed, its detrimental effects seem to derive specifically from corporate income taxes, as results suggest that a one per cent of GDP increase in its revenues could decrease RSI in almost 4 points. Conversely, personal income taxes did not present significant coefficients.

[11] The authors assess the existence of a “Robin-Hood paradox” in which more unequal countries would tend to redistribute less but found no significant results. In fact, authors found evidence that more unequal countries tend to redistribute more, supporting a “Robin-Hood effect”.

These results do not fully support the theoretical and analytical literature on the redistributive effects of direct taxation which claim that its progressive nature would necessarily lead to higher redistribution. As its overall effect is derived from the collection of both personal and corporate income taxes, as well as of property taxes, different redistributive patterns seem to be observed when these are disentangled, as progressivity levels may also represent important aspects to be considered for each one of these taxes (Slavov and Viard, 2016; Enami et al., 2022). On the other hand, social security contributions presented significant positive effects for redistribution suggesting that an increase of one per cent of GDP in its revenues could improve RSI by up to 3 points, while indirect taxes showed little evidence to have significant effects.

Table 3 – Regression results for the whole sample (1990-2019)

VARIABLES	OLS-FE	IV-2SLS	OLS-FE	IV-2SLS	OLS-FE	IV-2SLS
RSI_{t-1}	0.896***	0.852***	0.893***	0.851***	0.892***	0.848***
	(0.016)	(0.016)	(0.016)	(0.007)	(0.016)	(0.017)
$Gini_t^{pre}$	0.013**	0.024***	0.013*	0.024***	0.014*	0.028***
	(0.006)	(0.007)	(0.007)	(0.004)	(0.008)	(0.009)
Direct taxes$_t$	-0.014***	-0.013**				
	(0.005)	(0.005)				
Income taxes$_t$			-0.018***	-0.016***		
			(0.006)	(0.004)		
PIT_t					-0.003	-0.001
					(0.013)	(0.014)
CIT_t					-0.039***	-0.037**
					(0.013)	(0.015)
Property taxes$_t$			-0.002	0.001	-0.001	0.002
			(0.009)	(0.013)	(0.009)	(0.010)
Indirect taxes$_t$	-0.008	-0.013*	-0.008	-0.012	-0.009	-0.014
	(0.006)	(0.007)	(0.007)	(0.005)	(0.008)	(0.009)
SSC_t	0.025**	0.031***	0.024**	0.026***	0.024**	0.028***
	(0.010)	(0.011)	(0.010)	(0.007)	(0.010)	(0.012)
Unemployment$_t$	0.005	0.006	0.008*	0.009**	0.007	0.008
	(0.004)	(0.005)	(0.004)	(0.002)	(0.005)	(0.005)
$GFKF_t$	0.001	0.001	0.001	0.001	0.002	0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Gov. Exp.$_t$	0.011***	0.013***	0.013***	0.016***	0.013**	0.016***
	(0.004)	(0.004)	(0.004)	(0.001)	(0.005)	(0.005)
Age Dep. Ratio$_t$	-0.002	-0.002	-0.003	-0.003	-0.004	-0.004
	(0.002)	(0.002)	(0.002)	(0.001)	(0.003)	(0.003)
Observations	2226	2120	1941	1835	1809	1712
R-squared	0.945	0.936	0.948	0.940	0.949	0.941
Countries	98	98	92	92	88	88
Instruments		17		19		21
Sargan-Hansen (P-value)		0.145		0.135		0.110

Notes: Constant term, country and time fixed effects estimated and omitted for reasons of parsimony. Robust standard errors in parenthesis. *, **, *** represent statistical significance at levels of 10%, 5% and 1%, respectively. The Sargan-Hansen test is a test of overidentification of restrictions. Under the null hypothesis,

the test statistic is distributed as a chi-squared in the number of restrictions and the p-values are presented. The instrumental variables used in the 2SLS estimation are the two lags of the RSI and explanatory variables.

Table 4 – Regression results for developed countries (1990-2019)

VARIABLES	OLS-FE	IV-2SLS	OLS-FE	IV-2SLS	OLS-FE	IV-2SLS
RSI_{t-1}	0.887***	0.835***	0.887***	0.835***	0.888***	0.828***
	(0.016)	(0.018)	(0.016)	(0.019)	(0.016)	(0.018)
$Gini_t^{pre}$	0.035**	0.062***	0.036**	0.063***	0.036**	0.063***
	(0.014)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
Direct taxes$_t$	-0.015*	-0.014				
	(0.007)	(0.008)				
Income taxes$_t$			-0.016*	-0.015		
			(0.010)	(0.011)		
PIT_t					-0.006	-0.002
					(0.016)	(0.018)
CIT_t					-0.034*	-0.028*
					(0.019)	(0.023)
Property taxes$_t$			-0.002	0.005	-0.001	0.006
			(0.010)	(0.010)	(0.010)	(0.009)
Indirect taxes$_t$	-0.012	-0.020*	-0.013	-0.020*	-0.016	-0.024*
	(0.020)	(0.017)	(0.020)	(0.017)	(0.021)	(0.019)
SSC_t	0.016	0.033*	0.018	0.034*	0.018	0.032*
	(0.020)	(0.020)	(0.020)	(0.023)	(0.020)	(0.022)
Unemployment$_t$	0.008*	0.008	0.007*	0.007	0.006	0.006
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
$GFKF_t$	0.005	0.003	0.005	0.002	0.006	0.003
	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Gov. Exp.$_t$	0.025***	0.027***	0.025***	0.027***	0.024***	0.026***
	(0.007)	(0.006)	(0.007)	(0.006)	(0.007)	(0.006)
Age Dep. Ratio$_t$	0.000	-0.002	0.000	-0.002	0.002	-0.001
	(0.008)	(0.007)	(0.008)	(0.007)	(0.009)	(0.008)
Observations	1020	903	1016	977	994	956
R-squared	0.956	0.942	0.956	0.949	0.957	0.952
Countries	38	38	38	38	38	38
Instruments		17		19		21
Sargan-Hansen (P-value)		0.138		0.148		0.129

Notes: Constant term, country and time fixed effects estimated and omitted for reasons of parsimony. Robust standard errors in parenthesis. *, **, *** represent statistical significance at levels of 10%, 5% and 1%, respectively. The Sargan-Hansen test is a test of overidentification restrictions. Under the null hypothesis, the test statistic is distributed as a chi-squared in the number of restrictions and the p-values are presented. The instrumental variables used in the 2SLS estimation are the two lags of RSI and explanatory variables.

Advancing on the analysis by countries' income levels, Table 4 shows the results for the group of developed economies. Similar positive coefficients for the lagged RSI and market Gini coefficients are still obtained. The same is true for government expenditures, although notably higher coefficients are observed. In addition, the detrimental effect of direct taxation still seems to come particularly from corporate income taxes, while personal income taxes did not show statistically significant impacts. Moreover, social security contributions presented similar positive coefficients and indirect taxation showed stronger evidence

regarding its negative impacts on redistribution suggesting that a one per cent of GDP increase in indirect tax revenues could decrease RSI by around 2 points. Lastly, unemployment rates still seem to be associated with higher redistribution. This may be given by the fact that employment levels tend to be naturally related to the total amount of social and unemployment benefits distributed to the population and may ultimately affect the redistribution process.

Table 5 – Regression results for the developing countries (1990-2019)

VARIABLES	OLS-FE	IV-2SLS	OLS-FE	IV-2SLS	OLS-FE	IV-2SLS
RSI_{t-1}	0.843***	0.800***	0.833***	0.792***	0.831***	0.791***
	(0.025)	(0.035)	(0.023)	(0.034)	(0.022)	(0.034)
$Gini_t^{pre}$	0.002	0.001	-0.002	-0.005	-0.003	-0.005
	(0.006)	(0.007)	(0.007)	(0.008)	(0.009)	(0.009)
Direct taxes$_t$	-0.008*	-0.009*				
	(0.004)	(0.005)				
Income taxes$_t$			-0.008	-0.004		
			(0.007)	(0.007)		
PIT_t					-0.018	-0.009
					(0.013)	(0.016)
CIT_t					-0.011	-0.002
					(0.013)	(0.011)
Property taxes$_t$			0.054	0.061	0.120**	0.097
			(0.039)	(0.047)	(0.060)	(0.074)
Indirect taxes$_t$	-0.004	-0.006	-0.001	-0.001	0.000	-0.001
	(0.004)	(0.005)	(0.005)	(0.006)	(0.006)	(0.007)
SSC_t	0.016*	0.017	0.017**	0.020***	0.017*	0.023**
	(0.009)	(0.010)	(0.007)	(0.007)	(0.009)	(0.009)
Unemployment$_t$	-0.010*	-0.014**	-0.007*	-0.008*	-0.008*	-0.008*
	(0.005)	(0.007)	(0.004)	(0.004)	(0.004)	(0.004)
$GFKF_t$	0.003**	0.003**	0.002	0.002	0.003*	0.003
	(0.001)	(0.001)	(0.002)	(0.003)	(0.001)	(0.003)
Gov. Exp.$_t$	-0.002	-0.002	-0.004	-0.005	-0.004	-0.006
	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.004)
Age Dep. Ratio$_t$	-0.001	-0.001	-0.003	-0.003	-0.004	-0.004*
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Observations	1206	1075	925	794	815	698
R-squared	0.921	0.879	0.934	0.891	0.938	0.895
Countries	60	60	54	53	50	49
Instruments		17		19		21
Sargan-Hansen (P-value)		0.184		0.377		0.190

Notes: Constant term, country and time fixed effects estimated and omitted for reasons of parsimony. Robust standard errors in parenthesis. *, **, *** represent statistical significance at levels of 10%, 5% and 1%, respectively. The Sargan-Hansen test is a test of overidentification restrictions. Under the null hypothesis, the test statistic is distributed as a chi-squared in the number of restrictions and the p-values are presented. The instrumental variables used in the 2SLS estimation are the two lags of RSI and explanatory variables.

Table 5 displays the results for the set of developing countries. Even though significant positive coefficients of lagged RSI are also obtained, market Gini coefficients and

government expenditures are not statistically significant in this case. This shows that developing countries may in fact present different redistributive patterns than developed ones and that splitting the sample according to income levels appears adequate. Additionally, even though direct taxation presented negative coefficients, its effects do not seem robust as either personal income taxes or corporate income taxes showed significant results. Weak results for property taxes being associated with increases in redistribution are also observed, while no significant coefficients for indirect taxation were obtained. These results diverge from the evidence presented by Cornia et al. (2011) for Latin American countries suggesting that increases in direct taxation could improve RSI by up to 3 points. Nevertheless, similar positive effects of social security contributions are also observed, as a one per cent increase in its revenues could potentially improve RSI around 1.5 to 2.5 points.

Apart from advanced economies, results suggested that unemployment rates in developing countries may decrease the redistributive capacity of the tax policy, while investment rates presented positive effects indicating that increases in the gross fixed capital formation could help to improve the RSI. As previously discussed, this evidence reinforces the importance of economic activity to income redistribution by stressing the role of investment rates and employment levels as mechanisms to avoid the trade-off between economic growth and income inequality, especially in developing economies (Muinelo-Gallo and Roca-Sagalés, 2011, 2012).

4.1. The role of social protection expenditures

In this section, government social protection expenditures are considered, as studies suggest that income redistribution is performed mainly by social benefits and transfers (Wang et al., 2012). However, as previously mentioned, data on social protection expenditures could not be retrieved from the same source for all countries, such that data for developed countries was retrieved from the IMF Government Finance Statistics (GFS) by Functional Expenditures (COFOG), while data for developing economies was collected at the Statistics on Public Expenditures for Economic Development (SPEED) database. Results are examined for each group separately and presented at Tables 6 and 7, respectively.

At first, similar results are observed with respect the lagged values of RSI and market Gini coefficients in developed economies. In addition, even though there is relative evidence pointing to negative impacts of property and corporate income taxes, the effects of direct

taxation are not statistically different from zero, whereas indirect taxation continues presenting significant detrimental effects to redistribution. In this case, however, social protection expenditures seem to be the most important determinant of redistribution in these economies, indicating that a one per cent of GDP increase in social expenditures could improve RSI in at least 7 points. This evidence corroborates analytical studies which indicate social transfers as the main determinant of redistribution, particularly in high income countries.

Table 6 - Regression results for developed countries (1990-2019)

VARIABLES	OLS-FE	IV-2SLS	OLS-FE	IV-2SLS	OLS-FE	IV-2SLS
RSI_{t-1}	0.858***	0.793***	0.860***	0.793***	0.861***	0.794***
	(0.021)	(0.028)	(0.021)	(0.028)	(0.021)	(0.028)
$Gini_t^{pre}$	0.060***	0.094***	0.060***	0.095***	0.058***	0.092***
	(0.019)	(0.022)	(0.019)	(0.023)	(0.019)	(0.023)
Direct taxes$_t$	-0.016	-0.013				
	(0.010)	(0.011)				
Income taxes$_t$			-0.016	-0.017		
			(0.014)	(0.017)		
PIT_t					-0.013	-0.011
					(0.026)	(0.031)
CIT_t					-0.023*	-0.023
					(0.012)	(0.016)
Property taxes$_t$			-0.018*	-0.007	-0.017*	-0.006
			(0.010)	(0.009)	(0.010)	(0.009)
Indirect taxes$_t$	-0.027	-0.041*	-0.027	-0.041*	-0.027	-0.042*
	(0.024)	(0.023)	(0.024)	(0.02)	(0.024)	(0.023)
SSC_t	-0.002	0.028	-0.001	0.031	-0.001	0.028
	(0.036)	(0.041)	(0.036)	(0.042)	(0.036)	(0.042)
Unemployment$_t$	-0.004	-0.002	-0.004	-0.003	-0.004	-0.004
	(0.008)	(0.007)	(0.008)	(0.007)	(0.008)	(0.007)
$GFKF_t$	0.010***	0.006**	0.009***	0.006*	0.009***	0.005*
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Soc. Prot. Exp.$_t$	0.084***	0.079***	0.084***	0.078***	0.083***	0.078***
	(0.020)	(0.017)	(0.021)	(0.018)	(0.022)	(0.018)
Age Dep. Ratio$_t$	0.006	0.005	0.006	0.005	0.006	0.005
	(0.014)	(0.012)	(0.014)	(0.012)	(0.014)	(0.012)
Observations	677	623	677	623	676	622
R-squared	0.955	0.947	0.955	0.948	0.955	0.948
Countries	27	27	27	27	27	27
Instruments		17		19		21
Sargan-Hansen (P-value)		0.230		0.137		0.162

Notes: Constant term, country and time fixed effects estimated and omitted for reasons of parsimony. Robust standard errors in parenthesis. *, **, *** represent statistical significance at levels of 10%, 5% and 1%, respectively. The Sargan-Hansen test is a test of overidentification restrictions. Under the null hypothesis, the test statistic is distributed as a chi-squared in the number of restrictions and the p-values are presented. The instrumental variables used in the 2SLS estimation are the two lags of RSI and explanatory variables.

On top of that, investment rates now seem to be significant determinants to improve redistribution, while unemployment rates do not present significant effects. These results reaffirm the weak robustness of evidence regarding the redistributive effects of direct taxation and suggests that the interconnected relationship between unemployment rates, total investment and social protection expenditures could represent a relevant factor for affecting income redistribution in developed economies.

Table 7 - Regression results for developing countries (1990-2019)

VARIABLES	OLS-FE	IV-2SLS	OLS-FE	IV-2SLS	OLS-FE	IV-2SLS
RSI_{t-1}	0.904***	0.884***	0.896***	0.870***	0.897***	0.878***
	(0.024)	(0.028)	(0.025)	(0.027)	(0.029)	(0.033)
$Gini_t^{pre}$	0.004	0.004	0.003	0.005	-0.001	0.003
	(0.007)	(0.007)	(0.009)	(0.008)	(0.012)	(0.011)
$Direct\ taxes_t$	-0.006	-0.004				
	(0.004)	(0.004)				
$Income\ taxes_t$			-0.007	-0.001		
			(0.010)	(0.010)		
PIT_t					-0.023	-0.004
					(0.014)	(0.016)
CIT_t					-0.001	0.001
					(0.016)	(0.01)
$Property\ taxes_t$			0.010	0.009	0.039	-0.004
			(0.045)	(0.042)	(0.062)	(0.056)
$Indirect\ taxes_t$	0.001	0.002	0.001	0.003	0.004	0.001
	(0.003)	(0.003)	(0.005)	(0.005)	(0.005)	(0.006)
SSC_t	0.014*	0.019**	0.012	0.018**	0.005	0.018*
	(0.010)	(0.009)	(0.014)	(0.008)	(0.014)	(0.010)
$Unemployment_t$	-0.011**	-0.011***	-0.009*	-0.010**	-0.010*	-0.011**
	(0.004)	(0.003)	(0.004)	(0.004)	(0.005)	(0.004)
$GFKF_t$	0.002**	0.002*	0.002	0.001	0.002**	0.001
	(0.000)	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)
$Soc.\ Prot.\ Exp._t$	-0.001	-0.001	-0.001	-0.002	-0.001	-0.002
	(0.001)	(0.001)	(0.002)	(0.003)	(0.002)	(0.003)
$Age\ Dep.\ Ratio_t$	-0.001	-0.001	-0.002	-0.003	-0.003	-0.004
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)
Observations	839	728	685	578	597	496
R-squared	0.880	0.855	0.886	0.854	0.889	0.861
Countries	51	50	45	44	43	42
Instruments		17		19		21
Sargan-Hansen (P-value)		0.439		0.618		0.402

Notes: Constant term, country and time fixed effects estimated and omitted for reasons of parsimony. Robust standard errors in parenthesis. *, **, *** represent statistical significance at levels of 10%, 5% and 1%, respectively. The Sargan-Hansen test is a test of overidentification restrictions. Under the null hypothesis, the test statistic is distributed as a chi-squared in the number of restrictions and the p-values are presented. The instrumental variables used in the 2SLS estimation are the two lags of RSI and explanatory variables.

For developing economies, even though lagged RSI still presents significant coefficients, market Gini coefficients and direct taxation continue not being statistically significant.

Moreover, positive effects of social security contributions are still obtained, while indirect taxation showed no significant effects. Lastly, even though social protection expenditures are not statistically significant, unemployment rates continue to significantly reduce the redistributive effects of the fiscal policy, while investment rate still seems to improve it.

4.2. Gini quartiles

In this section, results are evaluated according to each pre-tax and transfers (market) Gini quartiles for the total sample of countries, as well as for both groups of developed and developing economies. This approach allows us to assess and compare the effects of taxation under different inequality levels for each group. Results are displayed at Table 8 below.[12]

For the total set of countries, it is observed that personal income taxes still do not present significant coefficients, while corporate income taxes have significant negative coefficients from the second quartile onwards, as its effects increase for higher inequality levels. Moreover, social security contributions showed significant results in all quartiles, with the largest coefficients in the last quarter suggesting that its positive effects are enhanced in countries with higher pre-tax Gini coefficients.

On the other hand, for advanced economies, it is observed that personal income taxes may have significant redistributive effects only in the third and fourth Gini quartiles, while corporate income taxes now present robust and significant negative effects in all quartiles with coefficients being particularly stronger for the two last quarters of the distribution. This result seems to suggest that taxing corporate income may harm the redistributive process performed through economic activity or that a possible shift of taxable revenues from personal income to corporate income could decrease the redistributive capacity of tax systems. In addition, robust negative effects of indirect taxes are also obtained, although in similar magnitudes for all Gini levels. Lastly, social security contributions still present consistent redistributive effects on all quartiles, with coefficients improving for higher levels of inequality, and suggesting that increases in social security contributions could improve RSI by up to 7 points in more unequal developed economies.

[12] For each group of countries, quartiles were calculated for every year and are not cumulative.

Table 8 – Regression results for pre-tax Gini quartiles (1990-2019)

	Total		Developed		Developing	
VARIABLES	**OLS-FE**	**IV-2SLS**	**OLS-FE**	**IV-2SLS**	**OLS-FE**	**IV-2SLS**
PIT_t – 1st Quartile	-0.004	-0.007	-0.008	-0.007	-0.045***	-0.039**
	(0.012)	(0.012)	(0.016)	(0.012)	(0.014)	(0.018)
PIT_t – 2nd Quartile	0.003	0.003	0.006	0.007	-0.010	-0.001
	(0.013)	(0.014)	(0.016)	(0.011)	(0.021)	(0.024)
PIT_t – 3rd Quartile	0.014	0.020	0.015	0.025**	-0.019**	-0.015
	(0.013)	(0.014)	(0.016)	(0.011)	(0.009)	(0.010)
PIT_t – 4th Quartile	0.013	0.020	0.016	0.026**	-0.037**	-0.042**
	(0.018)	(0.020)	(0.025)	(0.012)	(0.017)	(0.020)
CIT_t – 1st Quartile	-0.019	-0.019	-0.068***	-0.068***	0.004	0.004
	(0.013)	(0.015)	(0.020)	(0.018)	(0.020)	(0.024)
CIT_t – 2nd Quartile	-0.035***	-0.035***	-0.051**	-0.049***	-0.008	-0.007
	(0.011)	(0.011)	(0.022)	(0.014)	(0.010)	(0.011)
CIT_t – 3rd Quartile	-0.048***	-0.052***	-0.094***	-0.106***	0.002	0.003
	(0.017)	(0.018)	(0.023)	(0.021)	(0.011)	(0.012)
CIT_t – 4th Quartile	-0.060***	-0.067***	-0.114*	-0.117***	-0.028*	-0.027
	(0.019)	(0.022)	(0.062)	(0.030)	(0.016)	(0.019)
Property $taxes_t$ – 1st Quart.	-0.005	-0.006	0.001	-0.006	0.003	0.003
	(0.005)	(0.004)	(0.011)	(0.018)	(0.058)	(0.070)
Property $taxes_t$ – 2nd Quart.	0.017	0.021	-0.043	-0.031	0.017	0.035
	(0.034)	(0.034)	(0.053)	(0.039)	(0.064)	(0.072)
Property $taxes_t$ – 3rd Quart.	-0.024	-0.013	-0.028	-0.017	0.044	0.057
	(0.033)	(0.039)	(0.046)	(0.041)	(0.074)	(0.088)
Property $taxes_t$ – 4th Quart.	0.034	0.073*	0.028	0.063	0.144	0.194
	(0.040)	(0.042)	(0.052)	(0.040)	(0.117)	(0.134)
Indirect $taxes_t$ – 1st Quart.	-0.003	-0.007	-0.022	-0.027*	0.001	0.000
	(0.005)	(0.006)	(0.018)	(0.014)	(0.004)	(0.005)
Indirect $taxes_t$ – 2nd Quart.	-0.002	-0.005	-0.031	-0.041***	0.003	0.001
	(0.005)	(0.006)	(0.019)	(0.013)	(0.004)	(0.005)
Indirect $taxes_t$ – 3rd Quart.	-0.001	-0.007	-0.030	-0.047***	0.004	0.003
	(0.007)	(0.008)	(0.021)	(0.013)	(0.005)	(0.006)
Indirect $taxes_t$ – 4th Quart.	-0.003	-0.009	-0.031	-0.045***	0.011	0.012
	(0.007)	(0.008)	(0.019)	(0.014)	(0.007)	(0.008)
SSC_t – 1st Quartile	0.033***	0.039***	0.049***	0.053***	0.026***	0.029***
	(0.011)	(0.012)	(0.017)	(0.013)	(0.009)	(0.010)
SSC_t – 2nd Quartile	0.043***	0.049***	0.052***	0.061***	0.016*	0.021*
	(0.011)	(0.012)	(0.017)	(0.012)	(0.009)	(0.011)
SSC_t – 3rd Quartile	0.036***	0.046***	0.051***	0.067***	-0.001	0.002
	(0.010)	(0.011)	(0.017)	(0.012)	(0.010)	(0.012)
SSC_t – 4th Quartile	0.044***	0.055***	0.056**	0.070***	-0.001	-0.001
	(0.014)	(0.016)	(0.021)	(0.013)	(0.021)	(0.022)
Observations	2027	1921	1040	1002	987	919
R-squared	0.948	0.941	0.953	0.948	0.935	0.916
Countries	93	93	38	38	55	55
Instruments		21		21		21
Sargan-Hansen (P-value)		0.381		0.161		0.496

Notes: Lagged RSI, constant term, country and time fixed effects estimated and omitted for reasons of parsimony. Robust standard errors in parenthesis. *, **, *** represent statistical significance at levels of 10%, 5% and 1%, respectively. The Sargan-Hansen test is a test of overidentification restrictions. Under the null hypothesis, the test statistic is distributed as a chi-squared in the number of restrictions and the p-values are presented. The instrumental variables used in the 2SLS estimation are the two lags of RSI and explanatory variables.

Ultimately, for developing economies, it is now found that personal income taxes may have had significant negative effects for redistribution, particularly in the first and fourth quartiles, possibly suggesting that this type of tax was not able to reduce inequality in any quarters of the Gini distribution and that the given level of progressivity of income taxes would not be enough to further improve redistribution. Meanwhile, corporate income taxes, property taxes and indirect taxation did not show significant results in any quartile. Lastly, although social security contribution is still relevant, it seems to be case only for lower inequality levels in the first and second quartiles. In this regard, as highly unequal developing countries tend to present underdeveloped social security systems with low revenues and few beneficiaries, these results could be somehow expected.

4.3. Long run effects

Another relevant aspect of the redistribution process performed by the fiscal policy relates to its long-run effects, as changes in the tax structure may have delayed impacts on inequality (Johansson, 2016; Isiaka et al., 2023). Thus, the effects of taxation are decomposed for the long run through the estimation of a Dynamic Fixed Effects (DFE) model based on Pesaran et. al (1999) for both groups of countries.[13] Results are displayed at Table 9.

At first, even though direct taxation in developed countries do not have significant coefficients on the long run, its negative effects continue to be given particularly by corporate income taxes, as personal income taxes were also not significant. Nevertheless, property taxation and social security contributions presented robust positive effects for redistribution in the long run, bringing new evidence on the effects of property taxes and reinforcing the importance of the social contributions in the long run perspective as well. Indirect taxation, however, showed no significant effects.

On the other hand, contrary to developed economies, the long run negative effects of direct taxation in developing countries seem to come particularly from personal income taxes. This indicates that keeping the progressivity levels currently observed in personal income taxes may in fact decrease the redistributive capacity of these economies in the long run. Still, likewise developed economies, property taxes and social security contributions also

[13] Apart from the Mean Group (MG) estimators, the DFE estimator assumes that all coefficients and error variances are the same across countries and do not require a completely balanced panel.

presented significant long run redistributive effects in developing countries, while indirect taxation showed no significant results. It is also observed that the magnitude of coefficients for developed economies is stronger than in developing ones, indicating that the former tend to have a higher redistributive power than the latter. Finally, these results reinforce the redistributive role of social security contributions, as well as the non-robust evidence regarding the redistributive effects of direct taxation, while points to property taxes as an important potential tool to higher income redistribution in the long run for both groups of countries.

Table 9 – Long-run coefficients (Dynamic Fixed Effects - DFE)

VARIABLES	Developed			Developing		
Direct taxes$_t$	-0.067			-0.039*		
	(0.118)			(0.021)		
Income taxes$_t$		-0.197			-0.029	
		(0.138)			(0.027)	
PIT$_t$			0.202			-0.158***
			(0.175)			(0.058)
CIT$_t$			-0.822***			0.015
			(0.224)			(0.045)
Property taxes$_t$		0.889**	0.814**		0.293*	0.540**
		(0.406)	(0.404)		(0.178)	(0.245)
Indirect taxes$_t$	-0.114	-0.123	-0.211	-0.028	-0.009	0.002
	(0.190)	(0.193)	(0.192)	(0.021)	(0.022)	(0.025)
SSC$_t$	0.506**	0.455**	0.337*	0.095**	0.105***	0.097**
	(0.198)	(0.202)	(0.199)	(0.039)	(0.036)	(0.040)
(Mean) convergence rate	-0.059***	-0.058***	-0.060***	-0.161***	-0.185***	-0.190***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.009)	(0.010)
Observations	1185	908	803	1206	925	815
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: All equations include short-run dynamics, but only long-run coefficient estimates are reported. Equations estimated are the same as in Tables 3, 4 and 5. Constant term, country and time fixed effects estimated and omitted for reasons of parsimony. Robust standard errors in parenthesis. *, **, *** represent statistical significance at levels of 10%, 5% and 1%, respectively.

5. Conclusions

This study sought to analyze the redistributive effects of taxation by isolating the changes in income inequality through the adoption of the Reynolds-Smolensky Index (RSI) as dependent variable in a panel of 107 countries from 1990 to 2020. This approach allowed us to separate the effects of taxation on income distributions by specifically addressing the redistribution process performed by the tax and transfers system in a large set of countries. Besides representing a novelty contribution to fill a gap in the literature, results were analyzed

according to countries' income levels and for different inequality magnitudes, as well as for the long-run perspective.

Contrary to theoretical and analytical literature which suggest that, given its intrinsic progressivity levels, direct taxation presents naturally alleged larger redistributive effects, the results of this research do not bring robust evidence on this aspect and indicate that this type of taxation may have not yet been able to generate significantly higher income redistribution, particularly in developing countries. Although empirical literature also suggests that income taxes are associated with lower inequality levels, results point to the fact that redistribution may have not been performed by direct taxation, as evidence showed its effects are mostly non-significant and, in some cases, negative.

Still, results for developed countries reinforce previous evidence pointing to social protection expenditures as the main determinant of income redistribution in these countries. In fact, it is observed that total government spending and social protection expenditures are only statistically significant in this group. Positive effects for personal income taxes and negative impacts of indirect taxation are also observed only for these economies, while corporate income taxes seem to have relevant detrimental effects to redistribution, particularly in countries with increased inequality.

Conversely, for developing economies, social security contributions presented robust redistributive effects suggesting that these may be the main determinant of the redistribution process performed by the tax-benefit system in these countries. In addition, property taxation also seems to have important redistributive effects, particularly for the long run, while indirect taxes and personal income taxes did not show significant coefficients. Finally, the gross fixed capital formation and employment rates also appears to significantly increase redistribution in these economies.

Therefore, the major conclusion we derive from these results is that public revenues from direct taxation may have not yet been sufficient to undermine income inequality, at least not as much as social security systems, and that economic activity also represents a crucial aspect for income redistribution. In this regard, the main policy recommendations based on these results are summarized as follows: i) Developing countries should pursue higher progressivity levels in direct taxation to assure its redistributive effects, while advanced economies could also increase the size of personal income tax revenues to improve redistribution; ii) Property taxes could be seen as a mechanism of income redistribution in

the long run, particularly for developing countries; iii) Social protection expenditures and social security contributions should be prioritized by governments as the main redistributive channel; iv) Policy makers should foster economic activity which lead to improved employment levels and investment rates, as these showed to be important mechanisms for higher reductions in income inequality.

This study, however, does not come without data limitations, possible methodological improvements, and space for future lines of research. The first data improvement comes from the inclusion of different tax progressivity indicators to account for its redistributive effects, as well as through the adoption of other estimation techniques such as Jordà's (2005) Local Projection (LP) method and of regularized regressions as in Chen et al. (2024). Finally, the specific examination of the interconnected relationship between income and labor taxes with social benefits, pension systems and economic activity could also bring more detailed evidence on the determinants of income redistribution.

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Appendix

Table 1 – List of variables

Variable	Definition	Source
Gini pre-tax and transfers (Market Gini)	Estimate of Gini index of inequality in equivalized (square root scale) household market (pre-tax, pre-transfer) income.	Standardized World Income Inequality Database (SWIID).
Gini post-tax and transfers (Disposable Gini)	Estimate of Gini index of inequality in equivalized (square root scale) household disposable (post-tax, post-transfer) income.	Standardized World Income Inequality Database (SWIID).
Reynolds-Smolensky Index (RSI)	RSI = Market Gini – Disp. Gini	Author's calculation.
Direct taxes (% of GDP)	Taxes on income, profits and capital gains (1000), taxes on payroll and workforce (3000) and taxes on property (4000).	UNU-WIDER: Government Revenue Dataset
Income taxes (% of GDP)	Taxes on income, profits and capital gains (1000).	UNU-WIDER: Government Revenue Dataset
Personal income taxes - PIT (% of GDP)	Taxes on income, profits and capital gains of individuals (1100).	UNU-WIDER: Government Revenue Dataset
Corporate income taxes – CIT (% of GDP)	Taxes on income, profits and capital gains of corporates (1200).	UNU-WIDER: Government Revenue Dataset
Property taxes (% of GDP)	Taxes on property (4000).	UNU-WIDER: Government Revenue Dataset
Social security contributions – SSC (% of GDP)	Social security contributions (2000)	UNU-WIDER: Government Revenue Dataset
Indirect taxes (% of GDP)	Taxes on goods and services (5000), taxes on international trade and other taxes (6000)	UNU-WIDER: Government Revenue Dataset
Government expenditures (% of GDP)	Total expenditure consists of total expense and the net acquisition of nonfinancial assets.	World Economic Outlook (WEO) - IMF
Social protection expenditures (% of GDP)	Percentage of social protection expenditures in total GDP.	IMF - Government Finance Statistics (GFS) by Functional Expenditures (COFOG) for developed countries; Statistics on Public Expenditures for Economic Development (SPEED) database for developing countries
Gross fixed capital formation – GFKF (% of GDP)	Gross capital formation (formerly gross domestic investment) consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories.	World Development Indicators (WDI) database - World Bank
Unemployment rate (% of total labor force)	Unemployment refers to the share of the labor force that is without work but available for and seeking employment.	World Development Indicators (WDI) database - World Bank
Age dependency ratio (% of working-age population)	Age dependency ratio is the ratio of dependents - people younger	World Development Indicators (WDI) database - World Bank

Variable	Definition	Source
	than 15 or older than 64 - to the working-age population – those between 15-64. Data are shown as the proportion of dependents per 100 working-age population.	

Table 2 – Summary statistics (1990-2020)

Variable	Countries	Obs	Mean	Std. Dev.	Min	Max
$Gini^{post}$	All	3054	37.124	8.399	16.800	65.2
	Developed	1171	30.492	5.237	16.800	50.8
	Developing	1883	41.249	7.279	21.200	65.2
$Gini^{pre}$	All	3054	46.245	6.155	30.700	72.3
	Developed	1171	46.693	4.296	32.400	56.4
	Developing	1883	45.967	7.056	30.700	72.3
RSI	All	3054	9.121	7.256	0.000	25.9
	Developed	1171	16.201	5.170	1.000	25.9
	Developing	1883	4.718	4.267	0.000	23.2
Direct taxes	All	2934	8.096	5.695	0.003	34.419
	Developed	1130	13.038	5.455	2.282	34.419
	Developing	1804	5.001	3.038	0.003	19.776
Indirect taxes	All	3022	10.154	3.813	0.305	22.62
	Developed	1123	11.498	3.087	2.569	19.528
	Developing	1899	9.359	3.976	0.305	22.62
Income taxes	All	2955	7.278	4.989	0.003	32.264
	Developed	1130	11.366	4.883	2.282	32.264
	Developing	1825	4.747	2.964	0.003	21.184
PIT	All	2623	4.765	4.411	0.001	26.74
	Developed	1094	8.290	4.493	0.930	26.74
	Developing	1529	2.243	1.920	0.001	13.38
CIT	All	2631	2.689	1.762	0.097	30.491
	Developed	1098	3.001	1.505	0.156	12.588
	Developing	1533	2.466	1.894	0.097	30.491
Property taxes	All	2543	0.872	1.516	0.000	18.846
	Developed	1122	1.320	1.031	0.001	17.026
	Developing	1421	0.518	1.729	0.000	18.846
Soc. Sec. Contrib. (SSC)	All	2975	4.647	5.406	0.001	21.274
	Developed	1123	9.126	5.285	0.001	21.274
	Developing	1852	1.931	3.238	0.001	19.25
Gov. Expenditures	All	2918	31.285	12.415	3.787	67.745
	Developed	1091	41.432	10.753	9.015	67.745
	Developing	1827	25.226	8.885	3.787	60.009
Social Protection Exp.	All	-	-	-	-	-
	Developed	704	16.389	4.194	7.10	27.50
	Developing	1184	4.557	5.923	0.006	77.916
GFKF	All	3087	22.678	6.692	-2.424	93.547
	Developed	1142	23.151	4.372	10.687	54.304
	Developing	1945	22.399	7.724	-2.424	93.547
Unemployment	All	3210	8.148	5.700	0.25	38.8
	Developed	1140	7.670	4.226	1.1	27.47
	Developing	2070	8.411	6.354	0.25	38.8
Age Dep. Ratio	All	3317	62.166	18.758	27.311	116.934
	Developed	1178	49.302	6.092	27.311	70.937
	Developing	2139	69.250	19.594	37.104	116.934