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Context is Everything: The Impact of Social and Economic Variables on the Endogenous Relationship between Tax Progressivity, Income Inequality, and Economic Growth

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CONTEXT IS EVERYTHING: THE IMPACT OF SOCIAL AND ECONOMIC VARIABLES ON THE ENDOGENOUS RELATIONSHIP BETWEEN TAX PROGRESSIVITY, INCOME INEQUALITY, AND ECONOMIC GROWTH

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Abstract

Tax progressivity is a pivotal aspect of modern tax policy debates, namely due to its implications for both inequality and growth. In fact, it is known that combining the goals of equity and efficiency tends to be extremely challenging. Thus, this dissertation aims to study the endogenous relationship between tax progressivity, income inequality, and economic growth. Specifically, this goal is threefold. First, I investigate the dynamic impact of tax progressivity on the endogenous interplay between inequality and growth. Second, I incorporate and assess the influence of potential channels that mediate these relationships, testing if the impact of tax progressivity depends on these characteristics. Third, I analyze the relationship between the three main factors for each country in my sample, to understand if there are country-specific effects.

To achieve this, I employ an IPVAR methodology to a sample of 35 OECD countries for the 2000-2019 period. This method allows for a dynamic representation of the endogenous interactions between progressivity, inequality, and growth, and for the inclusion of a set of interaction terms between tax progressivity and each of the channels. Incorporating these interactions is crucial to assess whether the impact of tax progressivity on income inequality and economic growth depends on these mechanisms.

The results indicate that tax progressivity generates a trade-off between mitigating income disparities and promoting the growth of the economy, as they both register a negative effect resulting from a progressivity shock. Additionally, all channels included influence the impact of progressivity on the other two variables. Finally, there are relevant differences across countries regarding these interactions, with the inequality-growth trade-off not always occurring. Therefore, these findings emphasize that a one-size-fits-all approach to tax progressivity is not adequate. Countries have distinct characteristics and these will influence the success of the taxation policy.

Keywords: Tax Progressivity, Income Inequality, Economic Growth, IPVAR, OECD

Resumo

A progressividade fiscal é um aspeto crucial dos debates modernos sobre política fiscal, especialmente devido às suas implicações tanto na desigualdade como no crescimento económico. De facto, sabe-se que combinar os objetivos de equidade e eficiência tende a ser extremamente desafiante. Assim, esta dissertação tem como objetivo estudar a relação endógena entre progressividade fiscal, desigualdade de rendimentos e crescimento económico. Este objetivo é triplo. Primeiro, investigo o impacto dinâmico da progressividade fiscal na interação endógena entre desigualdade e crescimento. Segundo, incorporo e avalio a influência de potenciais canais que mediam estas relações, testando se o impacto da progressividade fiscal depende destas características. Terceiro, analiso a relação entre os três principais fatores para cada país na minha amostra, para compreender se existem efeitos específicos de cada país.

Para alcançar estes objetivos, utilizo uma metodologia IPVAR numa amostra de 35 países da OCDE para o período de 2000-2019. Esta metodologia permite uma representação dinâmica das interações endógenas entre progressividade, desigualdade e crescimento e a inclusão de um conjunto de termos de interação entre a progressividade fiscal e cada um dos canais. Incorporar estas interações é crucial para avaliar se o impacto da progressividade na desigualdade de rendimentos e no crescimento económico depende destes mecanismos.

Os resultados indicam que a progressividade fiscal gera um *trade-off* entre mitigar disparidades de rendimento e promover o crescimento económico, dado que ambos registam um efeito negativo resultante de um choque de progressividade. Adicionalmente, todos os canais incluídos influenciam o impacto da progressividade nas duas outras variáveis. Finalmente, existem diferenças relevantes entre países em relação a estas interações, sendo que o *trade-off* entre desigualdade e crescimento nem sempre ocorre. Portanto, estes resultados enfatizam que uma abordagem única para a progressividade fiscal não é adequada. Os países têm características distintas e estas influenciarão o sucesso da política fiscal.

Palavras-Chave: Progressividade Fiscal, Desigualdade de Rendimento, Crescimento Económico, IPVAR, OCDE

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Abbreviations

EU: European Union

GDP: Gross Domestic Product

GMM: Generalized Method of Moments

IPVAR: Interacted Panel Vector Autoregression

IRF: Impulse Response Function

OECD: Organization for Economic Cooperation and Development

PPP: Purchasing Power Parity

PVAR: Panel Vector Autoregression

SEM: Simultaneous Equations Model

SVAR: Structural Vector Autoregression

SVEC: Structural Vector Error Correction

SWIID: Standardized World Income Inequality Database

US: United States

VAR: Vector Autoregression

1. Introduction

The progressivity of a tax structure is notably influenced by the political and economic context. In light of recent debates on the necessity and impact of progressive taxation, current discussions highlight the need to understand how fiscal policies may combine the goals of equity and efficiency. Indeed, in a world that grapples with challenges such as the shifting in current political landscapes, the role of tax progressivity in promoting economic stability and social justice is essential. In fact, while some advocate for a more progressive tax system to ensure a fair distribution of tax burdens and resources, considering it the central and most effective tool in the homogenization of income levels (e.g., Gerber et al., 2020), others argue that the benefits of elevated progressivity must be weighed against its potential economic drawbacks (e.g., Rhee, 2013).

In other words, fiscal progressivity is expected to influence both income inequality and economic growth. Therefore, it is essential to understand the interactions among these elements. Although it is commonly accepted that progressive taxation is useful in mitigating income disparities, the impact on growth is particularly controversial, with some authors considering it harmful for investment and, in consequence, economic growth (e.g., Tanzi & Zee, 1997), while others advocate for a beneficial effect (e.g., Bourguignon & Verdier, 2000). Moreover, the relationship between income inequality and economic growth is, itself, very intricate and complex, as it is typically argued that simultaneously achieving the two goals may be very challenging (e.g., Gunasinghe et al., 2020). Hence, when studying the implications of tax progressivity, it is important to incorporate these nuances. Thus, this dissertation aims to answer the following research question: What is the impact of tax progressivity on the endogenous relationship between income inequality and economic growth?

So far, this question has only been partially answered, because the empirical literature is spread over three separate avenues. Firstly, several studies have analyzed the impact of tax progressivity in fighting income inequality, although not considering effects related to economic growth (Causa & Hermansen, 2020; Guillaud et al., 2020; Rubolino & Waldenström, 2020). The majority of these studies conclude that progressive taxation tends to be an effective instrument in reducing income disparities. Secondly, other studies have explored the impact of tax progressivity on economic growth, without considering effects arising from inequality (Milasi & Waldmann, 2018; Rhee, 2013; Rubolino & Waldenström,

2020). Regarding this front, there is a lack of consensus, as several studies consider that tax progressivity tends to harm economic growth, while others defend that it has insignificant economic effects or, even, a positive influence (Gerber et al., 2020; Milasi & Waldmann, 2018; Rieth et al., 2016). Indeed, the separation of these two topics within the research on tax progressivity is particularly evident. For example, despite Rubolino and Waldenström (2020) analyzing the influence of tax progressivity reforms on both inequality and economic growth, they analyze these effects separately. The disagreement among researchers is also evident in the third literature realm, which encompasses the empirical studies that delve into the impact of inequality on growth, without considering the origin of such inequality (Brueckner & Lederman, 2018; Ostry et al., 2014; Rubin & Segal, 2015). In fact, although earlier theoretical literature highlights some mechanisms that may mediate the relationship between inequality and economic growth, working as channels (e.g., Becker et al., 1990; De la Croix & Doepke, 2003; Kaldor, 1955), empirical studies have been neglecting such insights. It is, however, crucial to incorporate them, as they may solve the existing divergence.

To the best of my knowledge, no study has yet assessed the impact of tax progressivity, taking into consideration the endogenous relationships between progressivity, income inequality, and economic growth. Additionally, some theoretical frameworks disclose channels that may mediate the interaction between inequality and growth. However, no empirical study has considered the existence of channels between tax progressivity and the other two variables. Besides, there is no empirical evidence to sustain the possibility of the potential channels influencing these interplays. Because there is a lack of consensus regarding some elements of these relationships, including the channels may help to resolve the conflict.

Using a panel dataset of 35 OECD countries from 2000 to 2019, my goal is to study the influence of fiscal progressivity on the endogenous relationship between income inequality and economic growth, identifying potential mechanisms that may intervene in the interaction between progressive taxes and these two other endogenous variables. To do so, I seek to fill the gap in the literature, departing from it in three key ways.

First, I consider all three variables – tax progressivity, income inequality, and economic growth – to be endogenous. This approach allows me to test whether a progressivity shock creates a dynamic process, establishing intertemporal causality relationships and allowing the effects of the progressivity shock to intensify in the following years.

Second, I introduce the possibility of the relationships between tax progressivity and inequality and growth being dependent on certain variables. To do so, I employ the Interacted Panel Vector Autoregression (IPVAR) methodology, which involves adding interaction terms between tax progressivity and each of the potential channels. With the IPVAR approach, I can construct and compare two sets of IRFs derived from different percentiles of the variable distribution involved in the interactions. For instance, in evaluating whether the effect of a fiscal progressivity shock on economic growth depends on the country's level of human capital, I compute separate IRFs for larger and smaller levels of human capital. A systematic difference between these IRFs would be indicative of human capital playing a role in moderating the effects of fiscal progressivity on economic growth. Therefore, the inclusion of these interaction terms is pivotal, as it equips me with the means to dissect how countries' characteristics may condition both the magnitude and direction of the effects of fiscal progressivity on inequality and growth.

Third, the great diversity of countries in the selected sample, including 35 OECD members, allows me to incorporate a great variability of socioeconomic situations, which is extremely useful to assert the heterogeneity of the impacts among different nations. Additionally, besides the capacity of testing the existence of heterogeneous effects between countries, this approach enables me to study the importance of the different channels, as they tend to produce distinct effects depending on the situation of the country.

The main findings are as follows. First, I find that the global trade-off between income inequality and economic growth exists after a shock to tax progressivity. This result highlights the difficulty of combining the objectives of equality and efficiency, when applying progressivity policies. Therefore, ignoring the interactions between inequality and growth may compromise the understanding of the real effects of progressivity. Second, several channels do influence the relationship between tax progressivity and both inequality and growth. Third, the effects from tax progressivity appear to be heterogeneous across countries, resulting from the country's socioeconomic context. Indeed, in some countries, increasing progressivity mitigates inequality and stimulates growth, while in other countries, progressive taxation is an inadequate measure, as it harms both inequality levels and the growth of the economy.

The findings have implications for tax policy, especially when considering changes to the progressivity of a tax system. Overall, the results indicate that the level of progressivity is not

a one-size-fits-all policy. In fact, countries should take into consideration the influence of social and economic factors, such as the state of globalization and the level of human capital, when adjusting their progressivity. Relatedly, the findings may help countries to conduct better tailored progressivity measures, as they indicate that progressivity changes cause very distinct effects in terms of inequality and growth across countries: while they may be very beneficial in some nations, the same policy may be deeply defective in others.

This dissertation is organized as follows. The next chapter reviews the literature on tax progressivity, income inequality, and economic growth. Chapter 3 presents and justifies the testable hypotheses. In chapter 4, I present the methodological approach, as well as the selected variables. As for chapter 5, it includes the data sources and respective statistics. In chapter 6, I present and discuss the empirical findings on the impact of tax progressivity on inequality and growth and related channels. Lastly, chapter 7 concludes.

2. Literature Review

This chapter reviews the literature, divided into four subchapters. The first two subchapters focus on theoretical literature: subchapter 2.1. presents the relationship between income inequality and economic growth, and subchapter 2.2. explores progressive taxation and its interaction with both inequality and growth. Subchapters 2.3. and 2.4. follow the same structure, but for empirical research.

2.1. Theoretical Literature on the Relationship between Income Inequality and Economic Growth

While various dimensions of inequality may be considered when exploring the dynamics of inequality and growth (Benabou, 2000; Islam & McGillivray, 2020; Marrero & Rodríguez, 2013), the vast majority of the literature concentrates on income inequality. Shin (2012) defines income inequality as the disparities that exist in the distribution of income between the rich and the poor. This is the concept on which this review will be based, as it is the most common and general definition of inequality.

From earlier works to more recent investigations, the relationship between income inequality and economic growth has been very debatable, with some authors expecting a positive relationship (e.g., Alesina & Rodrik, 1994) and others expecting a negative influence or even an ambiguous effect (e.g., Li & Zou, 1998). Back in 1955, Kuznets (1955) proposed that the relationship between income inequality and economic development was not linear, but depended on the stage of country development. Initially positive, it turned negative as economies matured, forming an inverted U-shaped pattern. Labor migration from less to more developed sectors during early development explains this phenomenon. In the earlier stages, the transfer of the workforce to more sophisticated sectors has a favorable effect on *per capita* income because of the higher skills demand. In contrast, in later stages, low labor supply leads to an income increase for the less developed sectors' workforce. This idea is supported by Ahluwalia (1976) and Robinson (1976).

To better understand these interplays, several studies have been trying to find mechanisms that may affect the direction and magnitude of the relationship between income inequality and economic growth (e.g., Barro, 2000; De la Croix & Doepke, 2003; Saint-Paul & Verdier, 1996). I choose to emphasize four of them, referred to as channels, because they can be framed within the concept of tax progressivity, providing important insights.

First, the level of savings is suggested as a factor that may influence economic growth. Kaldor (1956) claims that, in the presence of higher inequality levels, savings tend to increase, stimulating growth. The reasoning is that individuals with higher income levels tend to save more. In consequence, capital accumulation increases, and consequently, so does economic growth (Aghion et al., 1999; Barro, 2000; Bourguignon & Morrisson, 1990).

Second, redistribution is also mentioned as a potential channel between income inequality and economic growth. Okun (2015) postulates that, in the presence of increased inequality, public support for redistribution also increases. Following this logic, transferring resources from the wealthy to the poor may harm growth, due to a potential detrimental effect on innovation, productivity, and investment (Alesina & Rodrik, 1994; Barro, 2000; Perotti, 1993). On a similar note, Persson and Tabellini (1994) reason that redistribution efforts often result in the taxation of growth-inducing activities, such as investment, hindering economic growth. Conversely, Saint-Paul and Verdier (1996) defy the positive relationship between inequality and redistribution, arguing that, if higher inequality is concentrated in determined income levels, it may not impoverish the median voter and, thus, generate redistributive policies. In addition, the authors note that wealthier agents have a bigger propensity to engage in tax evasion, potentially reducing the effectiveness of redistribution.

Third, institutions are considered a crucial element that can hinder growth in the presence of inequality (Chong & Gradstein, 2007; Sonin, 2003). Institutions are essential in promoting economic development in the long run and conducting income distribution (Acemoglu & Johnson, 2005; Smith, 1776). Increased inequality often leads to unfavorable institutions, as political decisions tend to favor the wealthy, resulting in inefficiency, resource misallocation, and instability (Hoff & Stiglitz, 2004; Sonin, 2003). In consequence, inequality propagates, continuing to constrain growth. Weak institutions have, then, a strong association with higher inequality, inefficiency, and sluggish growth. Alternatively, strong institutions parallel with lower inequality and favorable growth.

Lastly, the rate of fertility is also a factor causing income inequality to influence economic growth (Becker et al., 1990; De la Croix & Doepke, 2003). Families with lower resources typically choose to have more children, rather than invest in education, while wealthier families tend to educate the fewer children they opt to have. Dahan and Tsiddon (1998) inspect the relationship between income distribution, economic growth, and demographic transition and conclude that the impact of fertility on growth follows a Kuznets U-shaped

inverted function. In earlier development stages, poor families prioritize fertility, and this causes a surge in unskilled labor supply, declining respective wages. On the contrary, rich families favor human capital investment, leading to a slower growth in skilled labor supply and driving up those salaries. This motivates poor individuals to invest more in education, reversing the trend. While education levels increase and fertility declines, income distributions become more equitable, and economic growth rises.

2.2. Theoretical Literature on the Economic Impact of Tax Progressivity

The present chapter analyzes theoretical literature regarding tax progressivity. The concept of tax progressivity entails applying different tax rates, depending on the ability to pay of each individual, and following the principle of vertical justice (Wildowicz-Szumarska, 2022).

A significant portion of the literature regarding tax progressivity concentrates on the production of theoretical models to understand how progressive taxation affects the distribution of income (e.g., Atkinson & Stiglitz, 1976). More so, theoretical research tends to stress the concept of optimal tax progressivity, which balances both efficiency and inequality (e.g., Mirrlees, 1971; Slemrod & Bakija, 2000). Focusing on income inequality and economic growth, I will be reviewing theoretical studies that explain how progressive taxation may influence each of these variables. Moreover, to the best of my knowledge, the relationship between progressivity and both inequality and growth registers quite limited theoretical predictions and, so, I will also be covering these studies.

Starting with the literature on tax progressivity and inequality, theoretical research usually advocates that tax progressivity helps to reduce income disparities. Studies such as Fellman (1976), Jakobsson (1976), and Lambert (1993) postulate that progressive taxation attenuates post-tax inequality. They note, however, that regarding pre-tax income, the expected effects of tax progressivity on inequality are not inherently evident and may elicit diverse behavioral responses. Lambert (2001) also supports a favorable relationship, suggesting that under progressive taxation, any increase in direct tax revenue would amplify the distributive effect, thereby lowering inequality. In addition, Sung and Park (2011) suggest that income taxes, a relevant component of direct taxes and generally progressive, tend to have a significant and positive redistribution effect. Alternatively, Piketty et al. (2014) focus on the interaction between tax progressivity and pre-tax inequality. They argue that tax progressivity may decrease pre-tax inequality if it curtails work effort more at the upper end of the income distribution than at the lower end or if there is bargaining for compensation, with managers

striving harder to secure a greater share of the pie as their tax rates decrease. Heathcote et al. (2020) study how increased inequality affects progressive taxes. Their research highlights the importance of progressivity in mitigating inequality shocks. At the same time, by considering the influence of inequality on the level of progressivity, these authors also draw attention to the importance of contemplating endogenous effects between these variables. Although this is the most recurring perspective, some researchers have been questioning whether fiscal progressivity always achieves the desired outcome.

In a related vein, Duncan and Sabirianova Peter (2016) delve into the consequences of a negative relationship between progressive taxes and inequality. They agree that redistribution through progressivity is efficient in reducing income disparities. Conversely, as institutions increase progressivity levels, elevating tax rates for wealthy individuals relative to the poor, such individuals may try to reduce their taxable income, by decreasing their work effort or engaging in tax evasion/avoidance practices. Additionally, Atkinson (2004) introduces reasons why higher taxation may lead to higher inequality levels. He suggests that increased progressivity induces a substitution effect, reducing the effort of the more prosperous and increasing the income of the poor. Overall, the impact on income inequality may, then, be ambiguous.

Turning to the relationship between tax progressivity and economic growth, the majority of economic theory has suggested a strong link between fiscal policy and economic growth, usually suggesting an adverse effect of progressive taxation (Barro, 2000; Chen & Guo, 2013; Tanzi & Zee, 1997). Barro (2000) argues that, by reducing incentives to work, save, and invest among the richest, progressive taxes might harm growth. Chen and Guo (2013) study the destabilizing impact of non-linear tax structures, arguing that progressive taxation intensifies growth fluctuations, causing destabilization. More recently, Rubolino and Waldenström (2020) consider that reducing tax progressivity could enhance growth, as it may create job opportunities and stimulate investments in human capital because net-of-tax incomes for top earners increase.

Alternatively, authors like Hubbard et al. (1986) argue that higher marginal tax rates, in some circumstances, can promote efficiency, suggesting, then, that some level of progressivity might be valuable. Bourguignon and Verdier (2000) advocate for progressively taxing incomes, particularly those of the wealthy, to allow the poorest members of society to accumulate more productive assets and, in consequence, reduce poverty and boost economic

growth. Rhee (2013) also supports this perspective, although considering that economic theory cannot definitively predict the implications of tax progressivity on economic growth.

Finally, in relation to the theoretical literature that incorporates tax progressivity, inequality, and growth, while the greater part of the research focuses either on income inequality or economic growth, there are a few studies that touch on these three main points. Saint-Paul and Verdier (1996) defy the conventional economic theory that postulates that income inequality increases the level of redistribution, namely through progressivity, and, instead, argue that it reduces redistribution. In their perspective, this lower redistribution is the cause for the detrimental impact on growth. Alternatively, Rhee (2013) asserts that progressive taxation is effective in reducing income inequality, while there is uncertainty regarding the respective effect on economic growth. This skepticism is due to factors such as income distribution itself, labor supply elasticity, and other considerations. On the same note, Gunasinghe et al. (2020) note a dilemma in fiscal policy: progressive taxes aim to reduce income inequality and promote growth, but they often face trade-offs between these goals. Chen (2020) contends that progressive taxes alter the link between income inequality and growth, suggesting a positive relationship when tax progressivity changes. Likewise, Carneiro et al. (2022) conclude that progressivity changes have a very significant impact on the inequality-growth nexus, suggesting, in addition, a positive interaction between these two components.

This literature has, then, provided relevant lessons that should not be overlooked. In fact, theory has been highlighting the existence of endogenous relationships between my main variables, as well as potential mechanisms that may work as channels in these interconnections, perspectives that should be integrated into an empirical approach.

2.3. Empirical Literature on the Relationship between Income Inequality and Economic Growth

After examining the theoretical research, the present chapter's goal is to explore the existing literature that finds evidence of the much-studied and hypothesized relationship between income inequality and economic growth, considering the debate on the effects of inequality on the growth of the economy.

Starting with studies that find a negative interplay between inequality and growth, Ostry et al. (2014) suggest that elevated levels of income inequality tend to hurt medium-term

economic growth, encouraging efforts to reduce inequality to stimulate growth. Similarly, Kennedy et al. (2017) find a negative relationship between inequality and economic growth in Australia from 1942 to 2013. Halter et al. (2014) note that, while initial economic boosts from inequality may occur, in the long term, it diminishes GDP *per capita* growth globally. Besides these studies, other authors find in their research results that are in favor of the negative interaction between inequality and growth, such as Rubin and Segal (2015), who develop an analysis for the US and the period 1953-2008. In a similar vein, Atems and Jones (2015) explore the interaction between income inequality and economic growth, resorting to a panel VAR model and employing US state-level data from 1930 to 2005. The study results indicate that changes to the Gini coefficient do not immediately affect real *per capita* income. However, an unexpected increase in the Gini index leads, over time, to a decrease in real *per capita* income, although the long-term impact is insignificant.

The ambiguous findings in this literature highlight the importance of analyzing the endogeneity between income inequality and economic growth. In fact, several studies have been addressing this dynamic by incorporating additional variables that may affect the inequality-growth nexus, although not yet considering the influence of tax progressivity. For instance, Breunig and Majeed (2020) study data from 152 countries for the 1956-2011 period, including a poverty measure in the interactions between inequality and growth to understand if the inequality-growth relationship is related to the level of poverty. They find negative association between inequality and growth that is, however, concentrated only in countries with high poverty levels. In alternative, Brueckner and Lederman (2018) estimate a panel model, concluding that the inequality-growth interaction depends on initial income levels, with inequality propelling growth in low-income countries and restraining it in high-income nations.

While the main focus of my research is to analyze the effects of tax progressivity on the inequality-growth dynamic, a significant body of literature explores how other fiscal dimensions, such as the taxation structure or fiscal policies, can affect the interaction between income inequality and economic growth.

Multiple investigations suggest fiscal factors that may affect the inequality-growth nexus, including taxation differences, various timeframes, and several datasets (Adam et al., 2015; Biswas et al., 2017; Gründler & Scheuermeyer, 2018). Gunasinghe et al. (2020) investigate the impact of fiscal shocks on GDP and income inequality for Australia and between 1965

and 2014, employing a Structural Vector Autoregressive (SVAR) and Structural Vector Error Correction (SVEC) model. The results indicate that: changes to direct taxation receipts increase real *per capita* GDP without causing an inequality boost, reducing government expenditure harms income inequality, and the negative effect caused by indirect taxation receipts on income inequality overcomes the redistributive impact of government expenditure.

Defying previous notions of the influence of taxation systems, Kolev and Niehues (2016) develop their investigation of the relationship between income inequality and economic growth across 33 OECD countries from 1980 to 2005 and for a panel of 113 countries, spanning 1950 to 2010. They argue that the empirical studies that find a negative relationship between income inequality and economic growth frequently apply the System GMM estimator and that this estimator might be biased and not adequate to control for country heterogeneity. Instead, they apply different GMM estimations for different subsamples and find that the effect of net income inequality on growth seems to be negative only for less-developed countries and for countries with high levels of inequality, and non-significant or rather positive otherwise. An IPVAR approach, like the one used in the current research, enables the control of country heterogeneity, because of the presence of interaction terms with variables that measure the development level of the countries (for instance, GDP *per capita*, among others), thus eliminating the need to create subsamples. Additionally, the study investigates how tax system characteristics, such as total taxes as a percentage of GDP, top income tax rates, and progressivity measures, may simultaneously affect the respective outcomes. Results indicate that such elements have, in general, relevant negative effects on growth, as opposed to earlier beliefs.

On a different note, Gunasinghe et al. (2021), in a study of 19 high-income OECD countries during the 1995 and 2015 period, employ a simultaneous equations model (SEM) in order to address the interdependencies between the variables. They argue that redistributive expenses are capable of mitigating income inequality without harming growth. This suggests the possibility of increasing progressivity in personal income tax without harming economic growth, emphasizing the need to strike a balance between inequality and efficiency. In addition, this study also incorporates the existence of variables that may affect fiscal policy, inequality, and growth. However, the main focus of this research is fiscal policy, so it does not directly address the effects of a progressivity shock. Indeed, literature that empirically

investigates the interplay between inequality and growth has been emphasizing the necessity of considering the endogenous effects between these variables. Therefore, factoring in these effects when also including tax progressivity is essential to conduct an adequate analysis.

In sum, although empirical researchers have been considering the importance of endogenous relationships between income inequality and economic growth, they have not addressed the relevance of tax progressivity. In fact, studies have been incorporating other potential mechanisms that affect these interplays, including other fiscal variables, but the intricate interplays between the three factors have not yet been appropriately explored.

2.4. Empirical Literature on the Economic Impact of Tax Progressivity

Even though a stream of empirical studies have been incorporating additional variables to analyze the endogenous relationship between income inequality and economic growth, including some dimensions related to taxation, they do not examine the influence of tax progressivity (e.g., Breunig & Majeed, 2020; Brueckner & Lederman, 2018; Madsen et al., 2018). At the same time, there are empirical articles that underscore either the relationship between tax progressivity and income inequality or between progressivity and economic growth. However, studies that encompass all three dimensions together are very rare.

The first body of research empirically analyzes the interaction between tax progressivity and income inequality. Regarding this topic, the majority of studies find that tax progressivity is a helpful tool in reducing income disparities. Studies such as Duncan and Sabirianova Peter (2016) or Gerber et al. (2020) conclude that, despite reducing observed inequality in a specific group and inequality after taxes and transfers, tax progressivity might also affect overall and pre-tax inequality. In the former study, their results indicate that the effect on overall inequality is smaller, while the latter suggests that making a tax system more progressive can have a real effect on the market economy.

Political debates surrounding tax progressivity are fueled by various studies. Guillaud et al. (2020) scrutinize the impact of taxation and transfer policies across 22 OECD nations from 1999 to 2016, stressing that tax progressivity, average transfer rates, and transfer mechanisms significantly shape inequality reduction efforts. However, they also note a political trade-off, as high average tax rates often coexist with less progressive tax systems. Causa and Hermansen (2020) explore the influence of tax progressivity and transfer targeting on overall redistribution across OECD countries since the mid-1990s. They underscore the pivotal role

of tax and transfer systems in income redistribution and inequality reduction. However, they highlight a decline in the effectiveness of these systems in mitigating market income inequality, sparking debates on universal basic income and tax progressivity.

I now turn to the second body of research, which evidences the relationship between tax progressivity and economic growth. This literature tends to be divided, including the studies that indicate that progressivity is detrimental to growth, and those that suggest that progressive taxation can have mixed results or even be irrelevant.

In the first research avenue, Rieth et al. (2016) analyze the effect of personal income tax progressivity on output volatility for a sample of OECD countries from 1982 to 2009. The respective outcomes indicate that higher progressivity has a negative impact on volatility, therefore suggesting that growth may be harmed, as it is often associated with higher volatility. Balasoïu et al. (2023) study the effect of direct taxation on economic growth for 27 EU countries for the 2008-2020 period. Their results highlight that direct taxes, often progressive, tend to be detrimental to the growth of the economy. Therefore, lowering these taxes might lead to a more efficient tax system. Finally, Milasi and Waldmann (2018) explore the relationship between top marginal tax rates on personal income and economic growth, using a panel of 18 OECD countries over the period 1965-2009. They conclude that tax progressivity is not relevant, and that it is, rather, the top marginal income taxation *per se*, that impacts economic growth.

Gerber et al. (2020) go a step further by analyzing the influence of tax progressivity on *both* economic growth and income inequality. In their sample of 35 OECD countries between 1981 and 2017, the authors find that the impact of progressivity on economic growth is generally insignificant or even positive in certain contexts. They also observe that tax progressivity can reduce both post-tax and pre-tax income inequality. Similarly, Akgun et al. (2017) explore the impact of tax structure changes for a group of 34 OECD countries between 1980 and 2014. They investigate the influence of a tax shift on both income distribution and economic growth. Results indicate that the tax mix has relevant effects on the distribution of income and that tax progressivity has different impacts on output levels, depending on whether it is affecting high or low income levels. In the case of lower output, progressivity tends to benefit growth, harming it in the presence of higher outputs. Rubolino and Waldenström (2020) examine the impact of tax progressivity on top-income shares, particularly in Western tax reforms during the 1980s and 1990s. The results suggest that

progressivity decreases, namely through lower top marginal tax rates, affect the distribution of top incomes, promoting inequality. In addition, the authors estimate the efficiency effects of said tax reforms and find that they do not significantly affect the growth rates of GDP *per capita*. However, in all these studies, these impacts are investigated separately, without considering the endogenous relationships between the three variables.

Integrating these interplays, Muinelo-Gallo and Roca-Sagalés (2013) observe the interaction between growth, income inequality, and fiscal policy in 21 high-income OECD nations during the 1972-2006 period. Their empirical analysis contains two systems of structural equations, where gross income inequality determines different fiscal outcomes, which then affect economic growth and net income inequality. Results indicate that inequality has a strong influence on fiscal decisions, with typically progressive direct taxes negatively influencing both inequality and growth and underscoring the expected trade-off. This research is able to consider both the fiscal impact on inequality and growth and the interaction between these two factors.

In a study most closely related to the present project, Kim (2016) explores the effect of financial inclusion and tax progressivity on income inequality and, then, the effect of those practices on economic growth via the effect they have on inequality. The author uses a sample of 40 OECD and EU countries for the period 2004-2011. The findings show that income inequality has a very negative effect on economic growth. Additionally, tax progressivity does not have a very relevant impact in reducing income inequality in low-income or high-fragility countries, and it does not affect the relationship between income inequality and economic growth. Nonetheless, these authors do not consider the endogenous effects between the three main variables and do not address the influence of the channels that may explain the existing debate regarding these effects.

In essence, this project contributes to this literature stream in two main ways. First, while most studies focus only on pairs of relationships between tax progressivity, income inequality, and economic growth, I investigate the nuanced interactions, causal mechanisms, or feedback loops between these three variables. Second, because there is a lack of consensus on the direction and magnitude of these relationships, I incorporate a group of potential channels that may affect the main interactions and, thus, justify different outcomes in different nations and help to resolve the debate.

3. Testable Hypotheses

The previous literature review shows that the research that connects tax progressivity, income inequality, and economic growth still has important gaps to fill. In generic terms, it is possible to state that the literature is divided into two major groups.

The first group delves into the link between income inequality and economic growth. Here, the theoretical literature provides arguments for both a positive and negative relationship, although more often defending the incompatibility of the two goals, while empirical studies analyze this interaction, finding results in line with theoretical predictions (e.g., Alesina & Rodrik, 1994; Ostry et al., 2014; Rubin & Segal, 2015). The second category focuses on tax progressivity and its consequences on inequality or growth. Once again, literature is divided, with most authors finding that progressivity is a useful tool to reduce income disparities (e.g., Heathcote et al., 2020; Lambert, 1993; Rubolino & Waldenström, 2020), while its impact on growth remains uncertain (e.g., Barro, 2000; Milasi & Waldmann, 2018; Rieth et al., 2016). In addition, there is a literature stream that studies the effects of taxation on both inequality and growth, but does not focus specifically on progressivity (e.g., Biswas et al., 2017; Gunasinghe et al., 2020; Kolev & Niehues, 2016).

Therefore, the two first hypotheses I test are:

H1: Progressive taxation has a negative impact on the level of income inequality.

H2: Progressive taxation has a negative impact on economic growth.

Moreover, while the literature explores channels explaining the relationship between income inequality and economic growth, the same is not true for tax progressivity. To illustrate, authors like Aghion et al.(1999) and Barro (2000) consider the level of savings as a mechanism that impacts the relationship between income inequality and growth. Because savings are a function of income, when inequality is higher, rich individuals earn higher incomes, contributing to their savings, and this increases capital accumulation and growth. Considering these mechanisms is essential due to their influence on the main variables over time and across countries.

Therefore, I choose to include and test some mechanisms that may act as channels in the relationship between the main elements of interest, based on interpretations of some variables from existing literature. Here, I gather insights from the theoretical literature that

explores the relationship between income inequality and economic growth, including channels that are expected to affect these interplays and that I decide to analyze in the context of tax progressivity (e.g., Acemoglu & Johnson, 2005; Becker et al., 1990; Kaldor, 1955). In addition, I retrieve insights from theoretical research that includes third factors that could influence either income inequality or economic growth without being referred to as channels (e.g., Alderson & Nielsen, 2002; Gustafsson & Johansson, 1999; Slemrod & Bakija, 2000).¹ Overall, the investigation conducted in this realm indicates that the literature that studies tax progressivity fails to incorporate the influence of potential channels, not considering the possibility of mechanisms affecting the way progressive taxation impacts inequality and growth. Thus, my key contribution is to include two groups of channels, i.e., variables that are expected to affect the relationship between tax progressivity and income inequality and those influencing the impact of tax progressivity on economic growth. For the first group, I highlight three channels – unionization, the size of government, and globalization. The second group of channels include four variables – human capital, savings, quality of governance, and income level.

Starting with the progressivity-inequality interaction, the first of these channels is the level of unionization. The union membership rate reflects the bargaining power of employees, hence the possibility of increasing wages and lowering income disparities (Alderson & Nielsen, 2002; Bradley et al., 2003; Gustafsson & Johansson, 1999). In the presence of higher union membership rates, then, employees tend to have stronger negotiating leverage, which may help to reduce income inequality (Gunasinghe et al., 2020). Additionally, the tax progressivity-trade unionism interaction can impact income dispersion, as both mechanisms develop efforts to reduce it. As a result, changes in this tax policy may have very significant implications. A reduction in the level of progressivity of the labor tax may reduce both income inequality and economic growth, while capital income progressivity may generate a trade-off, stimulating growth but exacerbating income inequality (Huang et al., 2020). Ultimately, in countries with higher unionization levels, a positive shock to tax progressivity tends to mitigate income inequality. A stronger bargaining power among employees makes progressivity more efficient in redistributing income and fighting inequality. On the contrary,

¹ Some of these variables are also mentioned in empirical studies, which recognize their importance, but they are only used as control variables or in studies that do not focus on progressivity (e.g., Akgun et al., 2017; Gunasinghe et al., 2020; Islam & McGillivray, 2020).

in nations with weaker trade union presence, tax progressivity is expected to be less efficient in reducing inequality, due to weaker union influence.

Another potential channel is the size of the government. In economies with lower tax progressivity, the tax burden tends to be lighter on higher-income individuals compared to those with lower incomes. As a result, the resources available for the government to redistribute through welfare programs or public services to minimize income inequality, are considerably reduced and the gap between the rich and the poor continues to expand, as income inequality is heightened (Akgun et al., 2017; Johansson, 2016). Therefore, in countries with larger government sectors, there is typically more extensive economic intervention, with higher taxation levels and redistribution. In addition, these forms of government often provide comprehensive welfare programs that may also contribute to mitigating inequality. When this is combined with progressive tax systems, redistribution and inequality reduction tend to be a focus on the agenda. Conversely, when governments are smaller, economic intervention is not as extensive. In consequence, the efforts developed to promote social welfare and redistribution are smaller, and, thus, the impact of progressive taxes in reducing inequality tends to be less pronounced.

The final channel is globalization. Globalization has led to significant changes in the global economy. Despite having brought considerable development and growth all around the world, globalization has also led to a rise in income inequality within and between countries, due to the outsourcing of jobs to lower-wage countries, the valuing of higher skills because of technological development, or intensified competition between economies (Slemrod & Bakija, 2000). Correspondingly, in the globalization era, tax progressivity application tends to comprehend higher costs, becoming more challenging. Globalization allows economic agents, including individuals, firms, and capital, to freely move and seek jurisdictions with advantageous tax regimes. As a result, the ability of tax authorities to effectively tax high-income agents is diffculted. These agents, due to greater opportunities and resources, are often capable of entering tax planning strategies to minimize their fiscal responsibilities. In consequence, lower and middle-income earners tend to bear a greater tax burden relative to the affluent, exacerbating income disparities (Gunasinghe et al., 2020). To sum up, in countries with higher levels of globalization, tax progressivity tends to have a weaker impact on income inequality. The possibility of agents moving across nations and jurisdictions in a globalized economy erodes the redistributive power of progressive taxes. In contrast, in

countries with weaker globalization levels, an increase in tax progressivity may generate a stronger inequality reduction. With agents having fewer tax planning and evasion opportunities, progressive taxes may be more effective in mitigating income dispersion.

Moving on to the progressivity-growth relationship, the first hypothetical channel is education, or human capital. Theory argues that families decide on having more children or investing in their education, depending on the available financial resources (Becker et al., 1990; De la Croix & Doepke, 2003). In the presence of elevated inequality levels, poor households may prioritize fertility, rather than investing in human capital. More so, tax progressivity can exacerbate this effect. Progressive taxes on income, by diminishing tax rates supported by lower income individuals, may increase their availability to invest in education and human capital (Gunasinghe et al., 2020). At the same time, they tend to diminish the incentives to accumulate skills, as they promote earnings growth and, in consequence, move individuals to higher tax brackets (Heckman et al., 1998). Thus, when the level of education is high, a positive shock to tax progressivity may result in a negative effect on economic growth. This is because progressive taxation may disincentivize highly educated individuals from accumulating even more skills. Conversely, in lower human capital countries, a more progressive tax system may improve the capacity of the poorer individuals to access education, therefore fomenting human capital investment and minimizing the negative consequences on economic growth.

Another pertinent channel regards the level of savings. As earlier mentioned, the influence of savings is sustained by the argument that, when inequality is high, the rich tend to have a bigger marginal propensity to save, which leads to an increase in capital accumulation (Kaldor, 1956). Hence, when taxes are progressive, they are meant to channel resources from the rich to the poor, meaning that the rich will have fewer resources to save. As a result, investment will be harmed and the economy will grow less (Carneiro et al., 2022). Therefore, in countries with higher savings rates, a positive shock to tax progressivity tends to cause economic growth to decrease. With higher progressivity levels and related redistribution, more affluent individuals, who typically save the most, face a reduction on their available resources, possibly scaling back investment and hampering growth. Conversely, in countries with lower saving rates, tax progressivity may have a less pronounced effect on economic growth. Since a smaller segment of the population engages in savings, the redistribution of resources is less impactful.

Furthermore, the quality of governance is an important third factor that may influence the relationship in question. Previous research proposes that high-quality governance is crucial to implementing strong economic policies and promoting a positive environment for solid and equitable development (Acemoglu & Johnson, 2005; Islam & McGillivray, 2020; Kaufmann et al., 1999; Rodrik, 2000). Thus, in countries with superior quality governance, a favorable shock to tax progressivity is expected to stimulate economic growth. Effective governance allows progressive tax policies to be more proficient, contributing to improved economic growth. Low-quality governance countries, on the other hand, may register a more negative economic growth due to a progressivity increase. Because of the governance challenges, the implementation and enforcement of progressivity measures may be more difficult, potentially hindering growth.

Likewise, the level of income is a factor that may affect the impact of tax progressivity on economic growth. The literature stream that focuses on this argument reasons that when progressive taxation is used to reduce inequality between low and median-income households, it benefits economic growth. However, when it is applied to decreasing inequality between median and high-income households, it hinders growth (Biswas et al., 2017). Based on this information, it is possible to conclude that greater progressivity, at lower-middle income levels, is associated with higher long-run growth. On the contrary, at upper-income levels, progressivity is linked with lower output growth (Akgun et al., 2017).

Globally, these factors may, in theory, influence the way a tax progressivity change affects the distribution of income or the rate of growth of the economy. Understanding if they have real implications is, therefore, essential to better examine the relationship and potentially resolve some research conflicts. Hence, I test the following hypothesis:

H3: The included channels have relevant impacts on the relationship between tax progressivity, income inequality, and economic growth, and may explain the diversities between countries.

In order to understand if said channels are capable of explaining the existing debate on the interplay between progressivity, inequality, and growth, possibly causing different impacts, depending on countries' characteristics, I include this last hypothesis:

H4: There are differences between countries in relation to the impact tax progressivity has on both income inequality and economic growth.

4. Methodology

The present chapter presents the methodology, containing three subchapters. In the first subchapter, 4.1., I explain the different tax progressivity measures used in the literature and justify the choice of the measure selected for the ongoing investigation. In subchapter 4.2., I present and define the variables used in the project. In subchapter 4.3., I explain the methodological choice and define the empirical design of the Interacted Panel Vector Autoregression (IPVAR) model (4.3.1.), as well as the adopted methodological approaches (4.3.2.).

4.1. Measures of Tax Progressivity

This subchapter presents the diverse approaches in the literature regarding measures of tax progressivity, as well as the justification and clarification for the metric I use in the ongoing study.

Tax progressivity is a characteristic of tax systems where tax rates increase with the level of income. When progressive taxes are present, the marginal tax rate is required to be higher than the average tax rate (Musgrave & Thin, 1948). This notion derives from the concept of vertical equity and is commonly related to the principles of “ability-to-pay” and “equal-sacrifice”. Regarding the first principle, it originates from Adam Smith's (1776) “Wealth of Nations”, proclaiming that individuals with higher abilities to pay should pay more. Moreover, the “equal-sacrifice” principle, arising from Mill (1848), states that taxpayers should face the same absolute and proportional reduction in their utility from being imposed a tax.

Even though the theoretical definition of tax progressivity is well established, measuring it tends to be somewhat problematic. Tax progressivity is often defined in relation to a point in the distribution of income, and this makes calculating and comparing the overall progressivity of taxes very difficult. Additionally, it is hard to define which progressivity is being measured, whether it is the progressivity of the tax structure or of the actual tax paid by households. Thus, there have been two main approaches to measuring tax progressivity in the literature: “structural progressivity”, associated with the tax rate structure, and “effective progressivity”, focusing on taxes paid (Musgrave & Thin, 1948; Thomas, 2023).

The first approach, “structural progressivity”, tends to produce measures of progressivity at different points along the income distribution, generating local metrics. While these measures

tend to be easier to calculate, beyond being only local, they completely ignore the underlying income distribution, which constitutes a great downside. A typical example is the “average rate progression”, which consists of measuring the rate of change in the average tax rate (Musgrave & Thin, 1948). It can be calculated as the ratio of the difference between the average tax rates for two levels of income on the difference between those levels of income.

To address these concerns, “effective progressivity” takes into consideration both the tax structure and the underlying distribution of income. Therefore, it produces a global measure, able to reduce the entire progressivity of a tax to a single metric. Even though this is a much more complete picture of progressivity, the main drawback it presents is the necessity for information on the tax system and the income distribution, being very data intensive, which can make its utilization difficult. An early and less complex measure is the Musgrave and Thin (1948) indicator, consisting of:

$$Musgrave \& Thin = \frac{1 - G^*}{1 - G} \quad (4.1)$$

where G and G^* denote the before and after-tax income Gini coefficients. In addition, the Reynolds and Smolensky (1977) index is defined as:

$$Reynolds - Smolensky = G - C \quad (4.2)$$

where G represents the Gini coefficient for (equivalized) pre-tax income and C denotes the (equivalized) post-tax income concentration coefficient, ranked by pre-tax income. Another commonly used measure for “effective progressivity” is the Kakwani (1977) index, which can be calculated as:

$$G^* = G - \frac{tP}{(1 - t)} \quad (4.3)$$

where G and G^* denote the before and after-tax income Gini coefficients, respectively, P is the progressivity measure and t represents the average tax rate.

To overcome the problems in the two types of metrics, “progressive capacity” arises as a hybrid alternative. In this case, the metrics are still of global progressivity, but there is an attempt to focus on the tax structure and give less importance to the pre-tax income distribution. This category of metric is especially important because of the relevance of making cross-country comparisons in terms of progressivity. An example of this approach is the Gerber et al. (2020) progressive capacity measure. These authors focus mostly on

income levels between 1% and 500% of GDP *per capita* and calculate the average tax rates for each of these 500 points. Then, for these 500 points and their respective average tax rates, they calculate the Kakwani index for each of the 35 OECD countries they analyze (Thomas, 2023).

This is the approach I will be using in the current research. The main difference is that, instead of directly applying the data used by Gerber et al. (2020), I will be employing the progressive capacity data from Asai et al. (2023), as these authors updated the earlier version of the data and, therefore, it can be used for the entire period of analysis, instead of only existing until 2017. Although the Musgrave and Thin (1948) measure and the Kakwani (1977) index are frequently used in related literature (Duncan & Sabirianova Peter, 2016; Eydam & Qualo, 2023; Guillaud et al., 2020), these measures tend to be more old-fashioned and suffer from several of the mentioned problems, and so, I opt for the most recent and advantageous metric.

4.2. Variables

The current subchapter presents and defines all the variables used in the empirical model. This study employs three types of variables: endogenous, exogenous, and controls. In terms of the first category, I choose tax progressivity, income inequality, and economic growth because I consider the endogenous effects that exist between these three factors, as earlier research tends to overlook this dimension. In other words, these variables are considered endogenous, since I intend to study the impact of progressive taxation on the endogenous relationship between income inequality and growth. The vector is the following:

$$Y_{i,t} = [Prog_{i,t}; Ineq_{i,t}; Growth_{i,t}] \quad (4.4)$$

Regarding these variables, *Prog_{i,t}* is the progressive capacity measure, *Ineq_{i,t}* corresponds to the measure of income inequality, the post-tax Gini coefficient and *Growth_{i,t}* denotes economic growth, measured as the growth of *per capita* GDP. The post-tax Gini coefficient is used because I want to investigate how tax progressivity impacts inequality and, therefore, this is visible on the after-tax income.

In terms of exogenous variables, the present study incorporates seven, which can be divided into two categories: channels that influence the impact of tax progressivity on income inequality and variables that affect the impact of tax progressivity on economic growth.

Regarding the first category, three variables represent potential channels between tax progressivity and income inequality, as indicated in the previous chapter 3. Building on previous literature, I select trade unionism as a mechanism that may influence the impact of tax progressivity on income inequality. Thus, I include a unionization ($Unionization_{i,t}$) variable to assess such impact, measuring it as the percentage of employees that are members of trade unions. As for the second channel, following insights from existing literature, I argue that the government dimension might have an important influence on the progressivity-inequality relationship. In order to measure this impact, I add the size of government ($Size_Gov_{i,t}$) as an exogenous variable, measuring it as general government spending relative to GDP. Lastly, I include globalization as a channel in the interplay between tax progressivity and income inequality. To ascertain this effect, I add a globalization variable ($Globalization_{i,t}$), the KOF Globalization Index, in order to accommodate the economic, social, and political dimensions of globalization (Dreher, 2006; Rubolino & Waldenström, 2020). I choose this index instead of trade openness, which is a common choice in the literature for measuring the level of globalization (Asteriou et al., 2014; Cevik & Correa-Caro, 2015; Roine et al., 2009), because it integrates other dimensions of globalization besides those related to movements of goods and services.

For the second category, I consider four channels, taken from chapter 3. First, I include human capital because, as mentioned in the referred chapter, it has the potential to intervene in the relationship between tax progressivity and economic growth. Hence, I add a human capital ($Human_Capital_{i,t}$) variable in order to examine the influence of such factor. To measure its impact, I use a human capital index, based on years of schooling and returns to education. As for the second channel, I include savings as another mechanism in the progressivity-growth interaction, due to a potential effect retrieved from the literature that relates income inequality and economic growth. To check whether this effect is present in the current research, I include savings ($Savings_{i,t}$) as another of the exogenous variables, using the ratio of domestic savings to GDP as my measure. In relation to the third channel, governance quality is a mechanism that may influence the way tax progressivity affects economic growth, as explained in the previous chapter 3. Therefore, quality of governance ($Governance_{i,t}$) is added as a variable with the purpose of testing the relevance of this effect, measuring it recurring to the Worldwide Governance Indicators, with their respective weightings. Finally, I include income level ($GDPpc_{i,t}$) because the level of income is also

expected to act as a channel in the relationship between progressivity and growth. Thus, I use the *per capita* expenditure-side real GDP at chained purchasing power parities (PPPs) to represent this concept.

To sum up, the vector of exogenous variables can be presented as:

$$X_{i,t} = \begin{bmatrix} Unionization_{i,t}; Size_Gov_{i,t}; Globalization_{i,t}; \\ Human\ Capital_{i,t}; Savings_{i,t}; Governance_{i,t}; GDPpc_{i,t} \end{bmatrix} \quad (4.5)$$

Besides the endogenous and exogenous variables, I also include a group of four controls, according to those used in the empirical literature (e.g., Balasoïu et al., 2023; Duncan & Sabirianova Peter, 2016; Gerber et al., 2020). This group includes inflation, population growth, the unemployment rate, and the ratio of population over 65 years of age. They are incorporated to ensure that the relationships between the endogenous variables and between these and the exogenous variables are not influenced by third factors. They can be represented by the following vector:

$$J_{i,t} = [Inflation_{i,t}; Pop_Growth_{i,t}; Unemployment_{i,t}; Pop_over_65_{i,t}] \quad (4.6)$$

In Table 1, I define the key variables used to quantify tax progressivity, income inequality, and economic growth, as well as the respective channels and controls.

Table 1: Definition of Key Variables

Variable Name	Definition	Source	References
<i>Endogenous Variables</i>			
Tax Progressivity	Kakwani index calculated over a fixed range of income levels (1% and 500% of GDP).	Asai et al. (2023)	Asai et al. (2023); Gerber et al. (2020)
Income Inequality	Gini coefficients for disposable (net) income.	Standardized World Income Inequality Database, version 9.6.	Breunig & Majeed, (2020); Madsen et al. (2018); Ostry et al. (2014)

(Continued)

Table 1: Definition of Key Variables (Continued)

Variable Name	Definition	Source	References
Economic Growth	Growth rate of the <i>per capita</i> expenditure-side real GDP at chained PPPs (in mil. 2017US\$) (%).	Author's calculations and Penn World Tables, version 10.01.	Brueckner & Lederman (2018); Milasi & Waldmann (2018); Ostry et al. (2014).
<i>Exogenous Variables: Progressivity-Inequality Channels</i>			
Unionization	Trade union density as a percent of employees (%).	Author's calculations and OECD.	Rubolino & Waldenström (2020).
Size of Government	General government spending as a percentage of GDP (%).	Author's Calculations, OECD and Datastream.	Akgun et al. (2017); Johansson (2016).
Globalization	KOF Index of Globalization.	KOF Swiss Economic Institute.	Dreher (2006); Rubolino & Waldenström (2020).
<i>Exogenous Variables: Progressivity-Growth Channels</i>			
Human Capital	Human capital index, based on years of schooling and returns to education.	Penn World Tables, version 10.01.	Jalles & Karras (2023).
Savings	Ratio of domestic savings to GDP (%).	World Bank's World Development Indicators.	Koo & Song (2016); Pascual-Saez et al. (2020).

(Continued)

Table 1: Definition of Key Variables (Continued)

Variable Name	Definition	Source	References
Quality of Governance	Ponderations of the six Worldwide Governance Indicators.	Author's calculations and World Bank.	Akgun et al. (2017; Gunasinghe et al. (2020); Islam & McGillivray (2020).
GDP <i>per capita</i>	<i>Per capita</i> expenditure-side real GDP at chained PPPs (in mil. 2017US\$).	Author's calculations and Penn World Tables, version 10.01.	Brueckner & Lederman (2018); Milasi & Waldmann (2018); Ostry et al. (2014).
<i>Control Variables</i>			
Inflation	Inflation, consumer prices (annual %)	World Bank's World Development Indicators.	Barro (2000); Duncan & Sabirianova Peter (2016); Muinelo-Gallo & Roca-Sagalés (2013).
Population Growth	Population growth (annual %).	World Bank's World Development Indicators.	Baiardi et al. (2019); Gerber et al. (2020); Ostry et al. (2014).
Unemployment Rate	Unemployment, total (% of total labor force) (modeled ILO estimate).	World Bank's World Development Indicators.	Afonso & Jalles (2014); Balasoiu et al (2023); Kim (2016).

(Continued)

Table 1: Definition of Key Variables (Continued)

Variabel Name	Definition	Source	References
Population Over 65 Years	Population ages 65 and above (% of total population).	World Bank's World Development Indicators.	Adam et al. (2015); Forbes (2000); Muinelogallo & Roca-Sagalés (2013).

Note: this table provides information regarding the selected variables in this study.

4.3. Empirical Design

4.3.1. Model Specification

While the relationship between income inequality and economic growth has been widely covered in the literature, the impact of tax progressivity on this interaction is still not addressed enough. In fact, because studies so far have found ambiguous results regarding the influence of tax progressivity on economic growth or the effect of income inequality on growth, it becomes crucial to explore different mechanisms that can explain these relationships. Therefore, the choice of methodology is conditioned by the need to respect these multiple interactions in order to answer two main problems. First, the empirical model should be able to determine the impact of tax progressivity on both income inequality and economic growth. Second, the model should be non-recursive to incorporate the loop effects between tax progressivity, inequality, and growth. This means that the three main variables are considered endogenous within the empirical model. Moreover, this dissertation aims to investigate which potential mechanisms can affect and explain the impact of tax progressivity on both income inequality and economic growth. Accordingly, the empirical model should also allow the introduction of interaction terms between progressivity and these potential channels.

In consequence, I adopt an IPVAR model because it fulfills the imposed conditions and allows me to delve into the intertemporal dynamics caused by a shock on progressivity, by assuming that the impact of such shock is not exhausted in the first period itself. The use of VAR models dates back to 1980, with the contribution of Sims (1980), enabling a systematic way to capture important dynamics in multiple time series, with its statistical component being simple and easy to interpret (Stock & Watson, 2001). Furthermore, PVAR models serve as an extension of the VAR model, allowing the combination of the temporal and

cross-section dimensions (Canova & Ciccarelli, 2013). This expansion enables the analysis of issues such as heterogeneity in the transmission of progressivity changes between countries by allowing the introduction of the values of each country. On top of that, the IPVAR model, developed by Amendola et al. (2020), Sá et al. (2014), and Towbin and Weber (2013), equips the PVAR model to explore non-linear relationships among endogenous variables, by introducing interactions between the variables. This implies that the interaction component aims to investigate whether progressivity is affected by the considered exogenous variables and if they produce different effects, depending on the country under observation.

The model may be specified as it follows:

$$Y_{i,t} = \sum_{i=1}^N C_i D_{i,j} + \sum_{i=1}^N \sum_{k=1}^L A_{i,k} D_{i,j} Y_{i,t-k} + F^1 X_{i,t-1} + F^2 X_{i,t-1} \times Prog_{t-1} + K^1 J_{i,t-1} + u_{i,t} \quad (4.7)$$

where $t = 1, \dots, T$ represents the time dimension, $i = 1, \dots, N$ is the selected country in the sample, and $k = 1, \dots, L$ denotes the lag structure. $Y_{i,t}$ represents the vector of endogenous variables, including tax progressivity ($Prog_{i,t}$), income inequality ($Ineq_{i,t}$) and economic growth ($Growth_{i,t}$).

Attending to the model above, the first component of the equation denotes the average heterogeneity for each country, which the model is not capable of explaining, where C_i is the country-specific intercept of country i and $D_{i,t}$ is an indicator or dummy variable for each country (equal to 1 if $i = j$, and 0 otherwise). In the second component, each country has its own relationship with the endogenous variables, with $A_{i,k}$ representing the matrix of autoregressive coefficients attached to the endogenous variables. The next component denotes the addition of the exogenous variables, the referred channels that are expected to impact the relationships between the endogenous variables. The fourth component represents the interaction term of the model. Here, F^1 and F^2 consist on the pooled estimated coefficients, $X_{i,t-1}$ is the vector of exogenous variables and $X_{i,t-1} \times Prog_{t-1}$ is the interaction of the exogenous variables with tax progressivity. Next, $K^1 J_{i,t-1}$ denotes the inclusion of a set of control variables that are specific to each country. Finally, $u_{i,t}$ is a vector of normally distributed residuals with mean zero and covariance matrix Σ_i .

Introducing the interaction terms is the key procedure that allows for testing if the impact of tax progressivity on the dynamic relationship between inequality and growth is affected by the group of channels. In particular, they provide an understanding of what happens to income inequality and economic growth when there is a shock to progressivity and whether this shock depends on the level of the various exogenous variables. In order to address these questions, I build and compare Impulse Response Functions (IRFs) at different percentiles of the distribution of the variable in the interaction. For instance, to test whether the response of economic growth to the progressivity shock depends on the level of human capital, I compute an average IRF of the observations with high levels of human capital and another one for the observations with low levels of human capital. If the difference between these two IRFs is systematic, then the level of human capital affects the impact of tax progressivity on economic growth.

4.3.2. Inference and Estimation

In order to construct the IRFs, I decide on a set of options. Firstly, I set the lag to one period; the confidence intervals were constructed based on a Monte Carlo simulation with 10000 draws and applying Bayesian inference, according to Sá et al. (2014). Besides, I choose generalized impulse response functions, as established by Pesaran and Shin (1998).

Because I want to isolate the effects of each interaction, I use the Entropy Balancing technique, traditionally applied in settings with a treatment group and a control group (Hainmueller, 2012). In fact, using an IPVAR model with multiple interaction terms and correlated variables within those interactions may difficult the isolation of a single factor. To confront this concern, I select two groups of observations, associated with different IRFs. The goal, here, is to create two groups that are similar in all covariates' characteristics, except for the treatment variable. To better understand this technique within the IPVAR framework, assume that $X = [X_1 X_2 \dots X_n]$ is a vector of variables used to construct the interaction terms. More so, suppose that the shock is to variable X_j and the aim is to determine if the impact of the shock depends on X_i . To implement Entropy Balancing, I follow four steps. Firstly, I define the treatment variable that identifies the control and treatment groups. This variable is 1 for values above the 67th percentile of X_i and 0 for values under the 33rd percentile, while the rest of the observations do not belong to any group. Secondly, the treatment and control groups are based on this treatment variable. Thirdly, I implement the Entropy Balancing algorithm, ensuring that the variables in X other than

X_i maintain identical means across both groups. Lastly, I derive the weights assigned to each observation.²

After calculating the weights, I proceed to utilize them in the IRFs, through three additional steps:

- 1) Employing Bayesian inference, I derive fresh estimates for the IPVAR betas and compute the IRF for each individual observation.
- 2) Next, I determine the group-wise average IRF of the observations by employing a weighted mean, utilizing the weights obtained from entropy balancing.
- 3) Finally, I conduct a Monte Carlo simulation by repeating steps 1) and 2) a total of 10000 times.

² When applying this technique, it was not possible to approximate the means associated with all variables. In cases where this was present, I opted to exclude variables with weaker correlation to the treatment variable.

5. Data

This chapter aims to describe the data used in the current research. Here, subchapter 5.1. presents the description of the sample and the data sources used to develop the analysis. Subchapter 5.2. displays and explores the descriptive statistics associated with the data.

5.1. Data Selection

The sample includes 35 of the current 38 OECD members, for the period between 2000 and 2019. The choice of countries can be explained by the availability and reliability of data and, especially because this is the sample of countries used in Gerber et al. (2020) and, later, in the updated Asai et al. (2023) version.³ Concerning the time frame, the data frequency of this study is annual because most variables are only available once a year. The 2000-2019 period is chosen since the data are annual and, therefore, the analysis period needs to be relatively long, in order to draw robust conclusions, at the same time as some of the data is only available, at least in a comprehensive way, from 2000 onwards and until 2019. In addition, by ending the analysis in 2019, I can exclude the effects and distortions caused by the recent pandemic, allowing a more precise approach.

As earlier mentioned, the variables used in this research are presented in Table 1 in chapter 4. The selected variables may be grouped into three classifications. The first group contains the endogenous variables, which include tax progressivity, income inequality, and economic growth. In the first case, I use the progressive capacity measure, developed by Gerber et al. (2020) and updated by Asai et al. (2023), with data provided by the authors. More so, I add two other progressivity measures. The first is the Kakwani (1977) index, calculated using pre and post-tax Gini coefficients from the Standardized World Income Inequality Database (SWIID), version 9.6., originated from the Solt (2009) dataset, as well as the average personal income tax and social security contribution rates on gross labor income from the OECD database. I apply the formula presented in the previous chapter 4.1. to these data. Additionally, I incorporate the Musgrave and Thin (1948) measure, also explained in chapter 4.1., using the same Gini coefficients from the SWIID 9.6. database.

The other endogenous variables are income inequality and economic growth. To measure inequality, I once again apply the post-tax income Gini coefficient from the SWIID, version 9.6. database. Economic growth is measured as the growth rate of the *per capita* expenditure-

³ From the 38 original members, Colombia, Costa Rica, and Lithuania were excluded because these countries lack data regarding the tax progressivity metric.

side real GDP at chained PPPs (in mil. 2017US\$), from the Penn World Tables, version 10.01. The choice of these measures is in line with related literature (Brueckner & Lederman, 2018; Milasi & Waldmann, 2018; Ostry et al., 2014).

In terms of the exogenous variables, these are categorized into two types: the variables that act like channels in the relationship between tax progressivity and income inequality and those that affect the interaction between tax progressivity and economic growth. In relation to the first category, I retrieve my unionization data from the OECD Trade Union database. As for the size of government, represented by general government spending, I combine data from the OECD database and Datastream. Lastly, the KOF Index, employed to assess the level of globalization, is measured using data from the KOF Swiss Economic Institute. Regarding the second group, I retrieve data for the human capital index from the Penn World Tables, version 10.01. As for savings, I use the ratio of domestic savings to GDP from the World Bank's World Development Indicators. Concerning the quality of governance variable, I use data from the Worldwide Governance Indicators, provided by the World Bank. At last, data to construct the GDP *per capita* variable is also collected from the Penn World Tables, version 10.01.

Finally, the last group of variables includes the control variables, which incorporate factors that are capable of confounding the relationships between the variables of interest. In this case, the data for all four control variables – inflation, population growth, unemployment rate, and population over 65 years of age – is gathered from the World Bank's World Development Indicators database.

5.2. Descriptive Statistics

Table 2 reports summary statistics for the three categories of variables. A few trends characterizing the sample can be identified. Concerning the different tax progressivity measures, it is evident that they have significance on distinct scales. There are relevant differences across all three variables, as well as some variation, as noted by the existing standard deviations. In particular, the progressive capacity measure, the main metric used in this research, has a minimum value of -0.0027, registered in Hungary, which suggests that this country denotes the existence of regressive taxation during the period in which the indicator computes a negative value.

Table 2: Descriptive Statistics of the Sample

Variables	Mean	Minimum	Maximum	Stand. Dev.
<i>Endogenous Variables</i>				
Progressive Capacity	0.0757	-0.0027	0.2462	0.0390
Kakwani Index	0.3016	0.0354	0.8251	0.1417
Musgrave & Thin Measure	1.3172	1.0233	1.5839	0.1177
Inequality (pre-tax)	47.44	33.64	56.22	4.19
Inequality (post-tax)	31.03	22.40	50.51	5.53
Economic Growth (%)	2.43	-16.22	39.05	3.95
<i>Exogenous Variables</i>				
<i>Progressivity-Inequality Channels</i>				
Unionization (%)	28.18	4.50	93.30	20.00
Size of Government (%)	41.93	16.50	64.90	8.94
Globalization	80.30	57.47	90.93	6.84
<i>Progressivity-Growth Channels</i>				
Human Capital	3.24	2.00	3.89	0.37
Savings (%)	26.04	7.52	58.53	7.48
Quality of Governance	2.76	-1.24	4.74	1.34
Income Level	39183.45	11103.81	112941.45	16013.29
<i>Control Variables</i>				
Inflation (%)	2.67	-4.48	54.92	4.00
Population Growth (%)	0.61	-2.08	2.89	0.73
Unemployment (%)	7.46	1.81	27.69	4.07
Population over 65 (%)	15.41	5.00	29.28	3.99

Stand. Dev. – Standard Deviation

Note: This table provides the summary statistics for all variables, from 2000 to 2019.

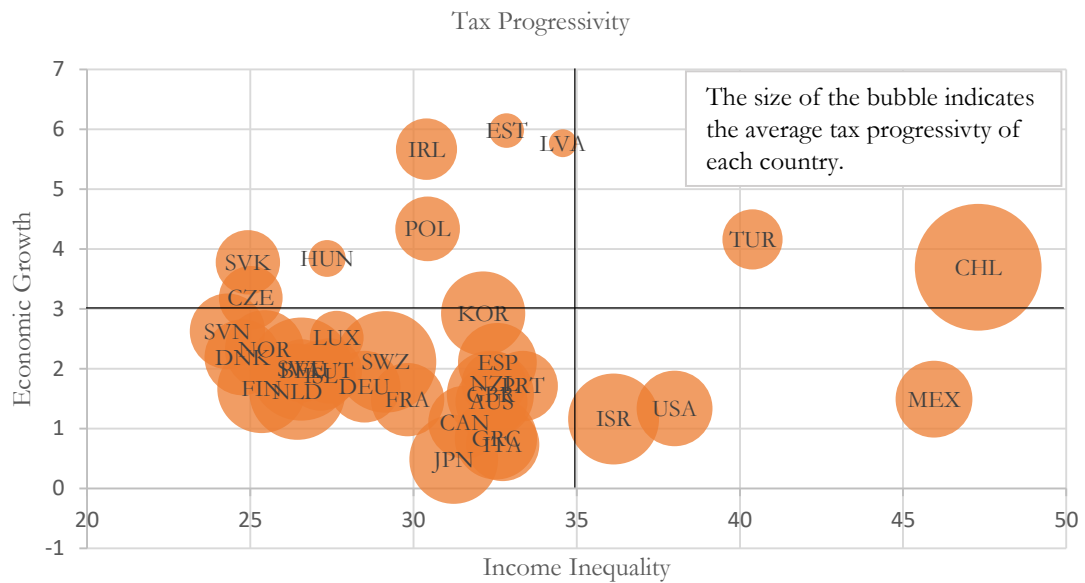
In relation to income inequality, when the Gini coefficient is calculated for pre-tax income, the mean value is 47.44, which is considerably higher than the mean Gini coefficient for post-tax income, with a value of 31.03. This difference is due to the fact that the post-tax coefficient includes the effects of taxation and transfer policies applied to redistribute income, namely tax progressivity, which justifies the fact that the level of inequality is lower in this case. With respect to economic growth, the mean value is 2.43%, a relatively low value, which may indicate that the sample is dominated by richer countries, registering typically

slower rates of growth. It is also relevant to highlight that the minimum economic growth value of -16.22% is documented in 2009, underscoring the influence of the global financial crisis in my sample.

Regarding the exogenous variables, there are a few relevant conclusions. The level of unionization encompasses a relatively low average of 28.18% of employees, suggesting that high values, like the maximum, are not very common in the sample. As for the size of government, it tends to range between less significant values (16.50%) and values that exceed half of the *per capita* GDP (64.90%). Regarding globalization, the values tend to be fairly high, with an average index of 80.30, translating the notion that the world is becoming increasingly globalized. In terms of human capital, the values of the global index vary around 1 and 5. For the sample in question, the average is considerably high, suggesting that these countries tend to have reasonable levels of human capital. At the same time, the variation is quite significant, considering that the index has a reduced scale of possible values. As for savings rates, these tend to vary significantly, ranging from just over 7.5% to almost 60% of GDP. The quality of governance also has relevant diversities, including some negative observations, indicating a very poor governance quality. Finally, for the level of income, the registered values are, as expected, quite different, as the values of the *per capita* GDP tend to vary considerably across countries and even between years, visible through the elevated standard deviation of 16013.29.

Concerning the endogenous variables, I also opt to statistically analyze their average values across countries. Figure 1 represents the interaction among the three values, with the average level of post-tax inequality being measured on the horizontal axis, economic growth on the vertical axis, and tax progressivity by the size of the bubble. The figure emphasizes a generally slightly negative relationship between income inequality and economic growth. In fact, there is a group of five countries that stands out in terms of elevated average inequality, including Chile, Mexico, Türkiye, the USA, and Israel. As for economic growth, a panel of nine nations notes particularly high growth rates, namely Estonia, Latvia, and Ireland. Focusing on the average progressivity measure, this figure conveys the idea that lower progressivity is associated with greater economic growth, as the smallest bubbles typically identify countries with higher average growth rates (e.g., Estonia, Latvia, Hungary). Chile is an interesting case, as the country documents a very high average progressivity and, simultaneously, the utmost inequality level.

Figure 1: Average Tax Progressivity, Income Inequality and Economic Growth, by country



Note: This figure provides the mean values for each of the endogenous variables, across all 35 countries and between 2000 and 2019.

Additionally, I conduct an analysis of the average values of each exogenous variable in order to determine if there are significant differences between countries. These variables are considered channels in the relationship between tax progressivity and both income inequality and economic growth, and, therefore, it is important to check which countries register higher and lower values of each of these channels. To do so, I incorporate Table 3, which registers the position of each country regarding the exogenous variables. Here, countries are ordered from 1 to 35, where 1 represents the lowest average value of the respective variable and 35 represents the highest value.

Concerning the degree of unionization, there are significant and meaningful discrepancies among nations, with countries like Iceland documenting an elevated participation of employees in labor unions, while Estonia, Türkiye, and Korea report inferior rates of participation. The size of government is considerably larger in countries like France and Denmark, whereas Chile and Mexico operate the most compact governments. In terms of globalization, the highest degrees are registered in Belgium and Switzerland, while Mexico and Türkiye document the minor indexes.

Table 3: Ranking Table of Descriptive Statistics of the Exogenous Variables

Variable Country	<i>Progressivity- Inequality Channels</i>			<i>Progressivity-Growth Channels</i>			
	Unioni- zation	Size of Govern- ment	Globa- lization	Human Capital	Savings	Quality of Gover- nance	Income Level
Australia	15	9	15	26	16	25	26
Austria	26	30	29	16	24	24	27
Belgium	31	33	35	12	19	20	22
Canada	23	13	20	31	12	26	24
Chile	6	1	7	6	26	16	2
Czechia	11	19	19	32	30	11	11
Denmark	33	34	30	22	25	34	25
Estonia	1	8	12	24	28	14	7
Finland	32	32	26	19	21	35	21
France	4	35	27	11	9	17	19
Germany	18	23	28	33	20	23	23
Greece	21	29	14	5	1	3	10
Hungary	7	28	22	14	22	9	6
Iceland	35	25	4	9	10	27	29
Ireland	25	6	25	10	34	21	34
Israel	24	17	8	28	13	7	16
Italy	28	27	17	7	8	4	17
Japan	13	7	5	25	18	18	18
Korea	3	4	6	23	32	10	13
Latvia	9	10	3	8	7	5	4
Luxembourg	29	14	23	13	35	29	35
Mexico	8	2	1	3	5	1	1
Netherlands	17	21	33	17	29	28	30
New Zealand	19	12	9	18	14	33	14
Norway	30	22	24	27	33	30	32
Poland	12	20	11	15	6	8	5
Portugal	14	24	18	2	3	15	9
Slovak Republic	16	16	13	29	17	6	8
Slovenia	27	26	10	21	23	12	12
Spain	10	18	21	4	11	13	15
Sweden	34	31	32	20	27	31	28
Switzerland	20	5	34	30	31	32	33
Türkiye	2	3	2	1	15	2	3
United Kingdom	22	15	31	34	2	22	20
United States	5	11	16	35	4	19	31

Note: This table provides the rankings of the average values for all exogenous variables, from 2000 to 2019, by country. The colors represent observations in different position thirds: green indicates observations in the first third (low values), yellow indicates the second third (moderate values), and red indicates the third third (high values).

In relation to the level of human capital, countries like Türkiye or Portugal have the lowest degrees of education, while the United States and the United Kingdom register the highest human capital positions. Regarding the savings rates, Luxembourg and Ireland significantly outperform in recording the highest values, whilst Greece, the United Kingdom, and Portugal report the lowest savings rates. As for the quality of governance, it is, on average, superior in countries like Finland and Denmark, while Mexico and Türkiye report a notably inferior governance quality. Lastly, regarding the level of income, there is a great dispersion of values across countries. Nonetheless, it is noticeable that Luxembourg registers, by far, the highest mean GDP *per capita*, at the same time as less developed countries, such as Mexico, Chile, and Türkiye record, once again, lower income levels.

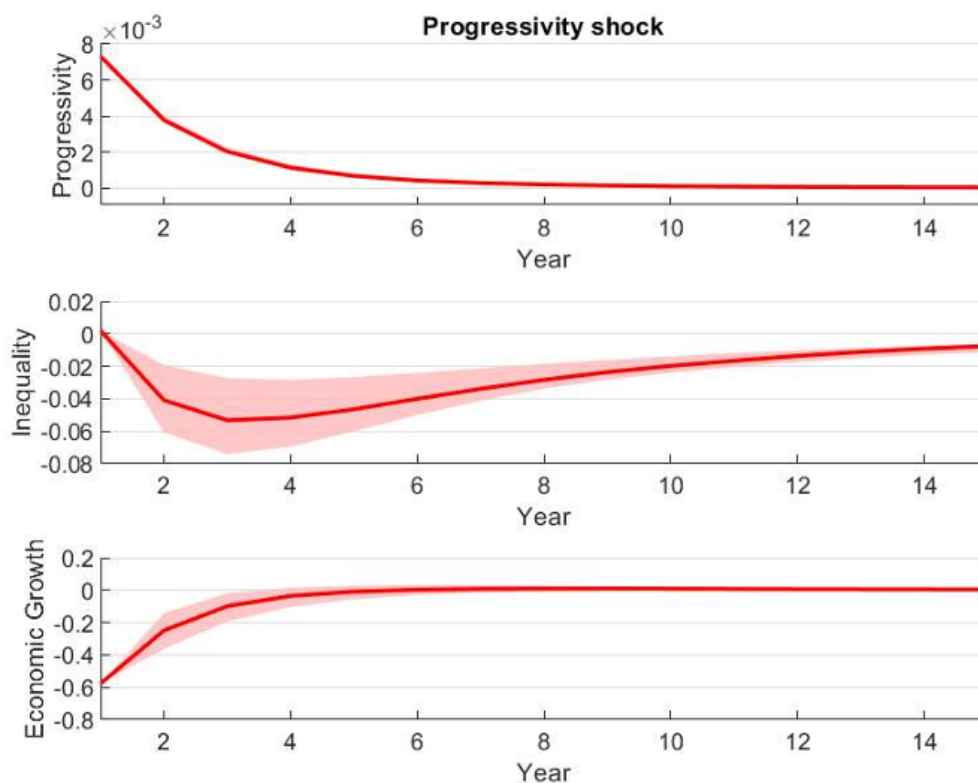
6. Results

This chapter is organized into three subchapters. The first subchapter explores the median effects of a tax progressivity shock. The second subchapter focuses on the factors that may explain the different reactions to the progressivity change. Lastly, the third subchapter examines the reactions in terms of income inequality and economic growth of said shocks in each of the 35 OECD countries under analysis.

6.1. Median Effects of a Tax Progressivity Shock on Income Inequality and Economic Growth

Figure 2 presents the impulse response functions following a positive one standard deviation for tax progressivity, portraying a positive shock. These functions capture the impact of such shock on the different endogenous variables: tax progressivity itself, income inequality, and economic growth. In each plot, the red line represents the median response, while the red shaded area plots the 90% confidence interval.

Figure 2: Impulse Response Functions to Tax Progressivity Shocks



Note: This figure illustrates the impulse response functions of the endogenous variables to a tax progressivity shock. The red line plots the median response, while the red shaded area represents the 90% confidence interval.

Starting with the first panel, the reaction of tax progressivity denotes a positive memory, with significant effects for around six years. This memory process suggests that an increase in progressivity is not exhausted within a period and rather, it is applied gradually over several years. Gradual fiscal adjustments, namely of tax progressivity, may occur to resolve implementation gaps, ensuring a better conduction of these policies to achieve the inequality and growth objectives, as indicated by Baum et al. (2012). Furthermore, my results highlight the necessity of adopting a dynamic approach because the shock does not immediately extinguish. Instead, a static approach, like the ones typically employed in related research (Gerber et al., 2020; Kim, 2016), may overlook the evolving nature of the response to this shock and fail to accommodate the changing dynamics induced by it. Hence, a dynamic approach, like the one adopted in this project, is essential to understand how this shock unfolds and what effects it generates in related variables.

Turning to the next panel, the IRF for income inequality shows a median negative relationship between the progressivity shock and inequality. Immediately after the shock, the impact is null, but afterwards, income inequality starts to decrease, intensifying its effect around the third year. After this, the effect on inequality reduction begins to weaken, until it dissipates around 12 years later, reflecting the most extensive effect out of the endogenous variables. This result suggests that progressive taxes are efficient tools in reducing income disparities, which is in line with the majority of the literature (e.g., Gerber et al., 2020; Heathcote et al., 2020; Muinelo-Gallo & Roca-Sagalés, 2013). However, previous literature tends to analyze this perspective using a static approach, and I find evidence that indicates that this approach may not be adequate. In fact, the immediate effect of a tax progressivity shock on inequality is nonexistent, meaning that a static technique would not be able to encompass the true impact of the shock. Additionally, using a dynamic approach allows me to understand the evolution of the inequality reaction, until it dissipates after the 12th year, which indicates that this is a prolonged reaction, showcasing, once again, the necessity of a dynamic method. Ultimately, based on these results, it is not possible to reject hypothesis H1, which suggests that tax progressivity has a negative impact on the level of inequality.

Finally, the last panel representing the IRF for economic growth presents a median negative relationship with the tax progressivity shock. While income inequality registers a subsequent reduction after the progressivity shock, economic growth suffers an immediate negative effect. This effect then starts to gradually diminish until it depletes about six years later, yet

again demonstrating the significance of dynamic effects. This evidence aligns with early literature, where studies suggest that tax progressivity tends to be harmful to growth (e.g., Barro, 2000; Tanzi & Zee, 1997). However, some research has also been addressing potential benefits of progressive taxation on growth (e.g., Bourguignon & Verdier, 2000; Rubolino & Waldenström, 2020), at the same time as authors such as Rhee (2013) reconcile both perspectives, arguing that economic theory cannot predict the definite impact of progressivity on the growth of the economy. Understanding if this median negative reaction is consistent across countries or if specific results showcase different impacts is, therefore, essential to assess the real effects of progressive taxation on economic growth. Still, such results do not reject hypothesis H2, which proposes that tax progressivity has a negative impact on growth.

Furthermore, by combining the implications of progressivity for both inequality and growth, these results highlight the typical trade-off between these two variables. In fact, after the progressivity shock, the graphs illustrate a decline in both inequality and growth, although the inequality reduction translates to a more moderate initial effect that then intensifies and takes longer to disappear, and the impact on growth is more immediate and short-lived. Such evidence is in line with predictions from Carneiro et al. (2022), Chen (2020), and Gunasinghe et al. (2020), which note that, while progressivity is helpful in reducing inequality, its effects on economic growth are not as linear, due to this trade-off, arguing that the inequality-growth nexus is very sensitive to progressivity changes. Considering that these results showcase the median effects of a tax progressivity change on both income inequality and economic growth, it is essential to understand if they are consistent across countries. As it happens, an important strength of the present approach is that it allows me to investigate potential differences across nations that may occur because these relationships are dependent on each country's characteristics. Thus, it is essential to investigate the influence of the included exogenous variables.

6.2. Explaining Heterogeneous Reactions to the Progressivity Shock

In the previous chapter, I find a median negative impact of a tax progressivity shock on income inequality and economic growth. In order to understand if specific country's characteristics work as channels in these interplays, causing differential impacts, I now analyze the results regarding the identified channels. With this purpose in mind, Tables 4 and 5 indicate the cumulative reactions of income inequality and economic growth, respectively,

to a tax progressivity shock, depending on the level of the channel under analysis. Specifically, for each row, the tables assess and compare the mean reactions for the observations where each one of these channels has a lower value than the 33rd percentile to the reactions for the observations where the channel has a value higher than the 67th percentile. Moreover, note that, following chapter 4.3.2., I also employ the Entropy Balancing technique to ensure that the observations with low and high values of each channel have similar means in all variables except the channel under analysis in order to isolate the effect of the single channel. Therefore, these tables have three columns: the first column indicates the mean reactions for lower-value observations, the second column indicates the mean reactions for higher-value observations, and the last column shows the difference between the first two. From these columns, it is possible to understand if such variables have a significant impact on the transmission of the progressivity shock to income inequality and economic growth.

To begin, I examine the potential channels that can influence the effect of tax progressivity on income inequality, represented in Table 4. Regarding the first line, the results indicate that tax progressivity increases income inequality in countries with lower levels of unionization, but decreases income inequality when union participation is more intense, resulting in a positive and significant difference. According to previous theoretical predictions, trade unionism reinforces the bargaining power of employees (Alderson & Nielsen, 2002; Bradley et al., 2003; Gustafsson & Johansson, 1999). This means that a higher union membership rate usually translates into stronger bargaining power among employees, which, when combined with more progressive taxes, can reinforce inequality mitigation. In fact, trade unions have a crucial role in promoting economic justice, helping tax progressivity in creating a more equitable distribution of income. Therefore, in the presence of more intense union membership, the efforts of tax progressivity may be supported, and inequality may register a stronger decline (Gunasinghe et al., 2020).

Turning to the second row in Table 4, my results show that the size of government amplifies the reduction of income inequality following an increase in tax progressivity. Pre-existing research suggests that bigger government sectors usually have more available resources to redistribute through welfare programs, helping to mitigate inequalities (Akgun et al., 2017; Johansson, 2016). Hence, when countries have governments with bigger dimensions, progressive taxation tends to be combined and facilitated by these resources, and, in consequence, combating income disparities becomes more effective. Conversely, when

governments are smaller, this redistributive intervention tends to be less intensive, and the inequality reduction is less pronounced.

Table 4: Reaction of Income Inequality to Tax Progressivity

Tax Progressivity Shock – Income Inequality			
<i>Exogenous Variables</i>	Low	High	Difference
Unionization	0,1865***	-1,1682***	1,3546***
Size_Gov	-0,3701***	-1,0538***	0,6837***
Globalization	-0,9414***	-0,7591***	-0,1823**

Note: This table shows the cumulative median reactions on income inequality for the low and high observations and the respective difference for each channel, resulting from a tax progressivity shock. The third column corresponds to the difference between the results for low and high observations of each channel. **, *** Denote statistical significance at the 5% and 1% confidence levels, respectively.

Lastly on the progressivity-inequality nexus, the third line of the table illustrates the relevance of globalization as a channel in the interaction between these endogenous variables. The values in the table indicate a negative impact of tax progressivity on income inequality through globalization in both groups of countries, although more powerful in nations with lower globalization levels, culminating in a significant negative difference. As for the theoretical literature, it argues that the globalization era has led and continues to lead to an increase in income disparities, because of the ability of economic agents to freely move between jurisdictions (Slemrod & Bakija, 2000). Due to this freedom, the implementation of tax progressivity becomes more challenging, as agents have more opportunities to relocate their tax responsibilities, therefore hindering the effectiveness of progressive taxation (Gunasinghe et al., 2020). Thus, when the levels of globalization are higher, tax progressivity tends to have a smaller impact in mitigating income inequality, with a more pronounced effect happening in less globalized locations.

As for the channels affecting the relationship between tax progressivity and economic growth, I present the results in Table 5. The first line illustrates the influence of the human capital channel. Here, the outcomes indicate a negative impact of tax progressivity on economic growth, regardless of the human capital level. However, this impact is a lot more intense in countries with higher human capital, resulting in a more pronounced economic growth decline. According to existing theory, families choose between having more children or investing in their education, depending on their available resources (Becker et al., 1990; De la Croix & Doepke, 2003). Progressive tax increases might generate a double effect: by

reducing taxes paid by lower-income individuals, they endow these individuals to invest more in education; on the other hand, after a certain point, the incentive to accumulate skills is reduced, as the elevated earnings might move individuals to higher tax brackets (Gunasinghe et al., 2020; Heckman et al., 1998). Hence, when the level of human capital is lower, this potential adverse effect of accumulating capital tends to be less intense, and, therefore, the negative consequences on growth are less harmful. Conversely, in highly educated nations, the progressivity shock may discourage individuals from accumulating even more skills, further reducing the rate of growth of the economy.

Table 5: Reaction of Economic Growth to Tax Progressivity

Tax Progressivity Shock – Economic Growth			
<i>Exogenous Variables</i>	Low	High	Difference
Human Capital	-0,4012***	-1,6594***	1,2582***
Savings	-0,3778***	-1,0163***	0,6386***
Governance	-1,0698***	-0,3165**	-0,7533***
GDPpc	-1,6443***	-0,5799***	-1,0644***

Note: This table shows the cumulative median reactions on economic growth for the low and high observations and the respective difference for each channel, resulting from a tax progressivity shock. The third column corresponds to the difference between the results for low and high observations of each channel. **, *** Denote statistical significance at the 5% and 1% confidence levels, respectively.

Turning to the savings channel, the second row of Table 5 shows that savings amplify the negative impact of a progressivity shock on growth. According to several theoretical studies, in the presence of high inequality, rich individuals have a greater marginal propensity to save, increasing capital accumulation (Kaldor, 1956). Because tax progressivity is implemented to channel resources from the more to the less affluent, this means that, after the progressivity shock, the wealthy will have fewer available resources to save, harming investment and, in consequence, growth (Carneiro et al., 2022). Thus, when the level of savings is elevated, the negative impact of the progressivity shock on growth tends to be more severe because the wealthy, who saved the most, have fewer resources and less incentive to continue to invest and promote economic growth. The overall impact presented in Table 5 is, therefore, in line with predictions from economic theory.

Moving on to the third line in Table 5, it illustrates the reaction of economic growth, depending on the quality of governance. The results indicate that the impact of progressivity on growth is always negative but more severe when the quality of governance is weaker,

which is in accordance with previous theoretical research. As reported in the literature, the quality of governance is fundamental to implementing strong economic policies and creating equitable development (Acemoglu & Johnson, 2005; Islam & McGillivray, 2020; Kaufmann et al., 1999; Rodrik, 2000). Hence, when countries are equipped with superior governance quality, the favorable shock to tax progressivity tends to be less harmful to economic growth. This higher governance quality helps the progressive taxation policies to be more efficient, resulting in less damage to the growth of the economy. On the contrary, when countries deal with weak governance structures, the enforcement of the progressivity measure is more challenging, and growth is normally more severely harmed.

Finally, the last line in Table 5 shows the impact of the income level channel on the relationship between tax progressivity and economic growth. The results indicate that the effect of the tax progressivity shock is negative in both groups, but much more intense in the case of low income levels. As for previous theoretical predictions, they argue that tax progressivity causes distinct effects on growth, depending on the level of income. When it is applied to decreasing inequality between low and median-income households, it benefits growth. On the contrary, when it is used to combat inequality between median and high-income households, it hinders economic growth (Akgun et al., 2017; Biswas et al., 2017). Earlier predictions, such as Kuznets (1955), of inequality reducing in the later stages of development were not being corroborated by evidence. So, these more recent authors suggest a new necessity to develop policies to reduce inequality, namely tax progressivity measures, yet noting that these might have different effects on distinct income groups. However, the present project's results indicate that the effect of tax progressivity on growth is always negative but actually more severe in situations of low income. This may be due to a strong impact of inequality on growth, which is not mitigated enough by tax progressivity, as suggested by Kim (2016), who claims that the lower the income level, the more intense the growth reduction.

In sum, all these channels reveal a significant influence on the impact of the tax progressivity shock on income inequality and economic growth. It is, then, impossible to reject hypothesis H3, which argues that the included channels have relevant impacts on the relationship between tax progressivity and the two other endogenous variables and may explain the diversities between countries. Actually, they may provide an understanding of possible heterogeneity observed between nations, explaining why, in some cases, the progressivity

change may generate a trade-off between inequality and growth, in other circumstances may cause a detrimental effect on both variables and, sometimes, even an advantageous outcome on the two factors.

6.3. Cross-Country Heterogeneous Effects of Tax Progressivity Shocks

In this subchapter, I analyze the effects of a tax progressivity shock across countries in order to understand if there are heterogeneous reactions. To accomplish this, I determine the cumulative sum of the reaction to a tax progressivity shock for each of the 35 OECD countries in the sample and for each of the other endogenous variables. I begin by analyzing the effects of the progressivity shock on income inequality and then proceed to examine the reactions of economic growth.

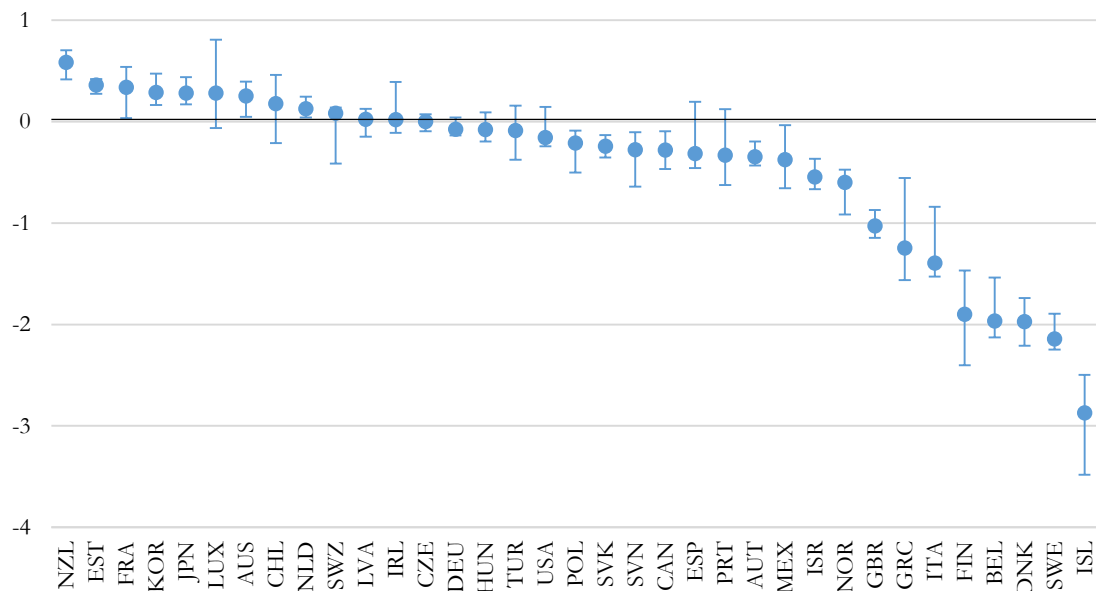
Figure 3 presents the cumulative impact of the progressivity shock on income inequality in blue, where the dots represent the median reaction of a country and the error bars denote the variability between the 95th percentile and the median and between the median and the 5th percentile. I arrange the outcomes in descending order, starting with countries where the progressivity shock has a cumulative positive impact on inequality and ending with the most intense reductions.

The overall results indicate a negative reaction of income inequality for the majority of countries, in line with the results found in the previous subchapter 6.1. and, once again, not rejecting hypothesis H1. 12 countries (out of 35) have insignificant results, suggesting that increasing progressivity does not improve income inequality in these countries.⁴ Focusing on the significant reactions, 16 countries register a negative influence on inequality, resulting from the progressivity change. Among this group, Iceland, Sweden, Denmark, Belgium, and Finland document the largest reductions in income inequality, suggesting a great effectiveness of progressive taxation in tackling income disparities in this group of Nordic nations. Illustratively, a one standard deviation shock on tax progressivity results in a 2.87 percentage points cumulative decline on the Gini coefficient in Iceland, across a span of 15 years. On the contrary, seven countries record undesirable effects on inequality, suggesting that tax progressivity actually increases it, with New Zealand, Estonia, France, Korea, and Japan displaying the topmost values. Here, a one standard deviation increase on tax

⁴ These countries are Luxembourg, Chile, Switzerland, Latvia, Ireland, Czechia, Germany, Hungary, Türkiye, the United States, Spain, and Portugal.

progressivity generates a 0.58 percentage points cumulative increment on inequality in New Zealand.

Figure 3: Reaction of Income Inequality to a Tax Progressivity Shock



Note: This figure represents the median response in terms of income inequality for each country, in reaction to a tax progressivity shock. This graph plots 90% confidence intervals.

It is relevant to integrate here findings from the channels' subchapter in order to understand if observed differences between countries are effectively explained by discrepancies among channels. When analyzing the impact of tax progressivity on income inequality, the group of countries that register a positive influence of tax progressivity on income inequality includes countries like New Zealand, Estonia, France, Korea, and Japan. Referring to the previously presented data, these nations register relevant influence from the channels. For instance, both Estonia and Korea combine very low levels of union participation and a smaller government size, both contributing to a weaker inequality reduction after progressivity changes. Similarly, Japan documents a government of smaller dimensions, contributing to the less intense inequality mitigation. France, on its turn, also denotes lower rates of unionization at the same time as a high state of globalization, both contributing to a less favorable effect on income inequality.

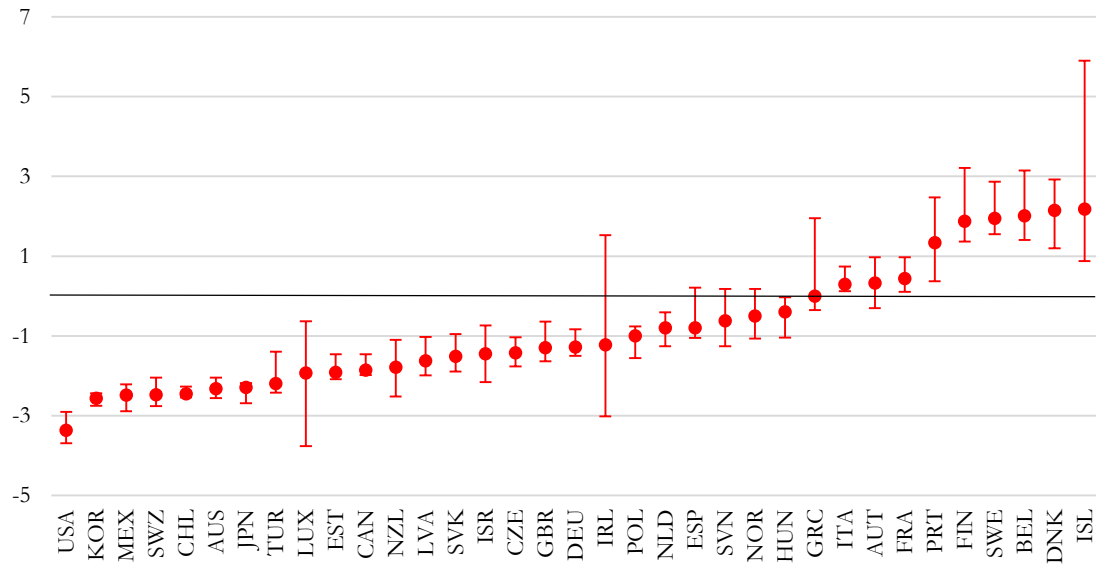
In contrast, nations such as Iceland, Sweden, Denmark, Belgium, and Finland record the most significant inequality reduction after a tax progressivity shock. In fact, when analyzing the data regarding the different channels, it is possible to observe that Iceland documents

both high union participation and large government size, while the level of globalization is very low. All three channels contribute to the leading position of the country, as they all intensify the effect of tax progressivity in inequality reduction. As for the other four countries, they all document elevated unionization levels and an increased size of government. Although the level of globalization is intense in this subsample, it seems that the less beneficial effect this channel has on inequality mitigation is contradicted by the more vigorous effect promoted by the other two factors. It is, then, important to point out that evidence shows a heterogeneous response across countries in relation to the reaction of income inequality to the tax progressivity change.

Figure 4 plots the impact of the tax progressivity shock on economic growth in red, and the dots and error bars convey the same information as in the previous graph. Now, I present the outcome in ascending order, starting with the most intense negative effects and ending with the biggest beneficial impacts on growth.

This figure presents a predominant median negative reaction for the countries, once again in line with the former results subchapter and not rejecting hypothesis H2. In closer detail, a group of six nations, including Ireland, Spain, Slovenia, Norway, Greece, and Australia, do not exhibit a significant reaction to the progressivity shock. A negative and relevant influence on economic growth is observed in 21 out of the 35 OECD countries in the sample. As for the largest median economic growth decline, it happens in the United States, followed by Korea, Mexico, Switzerland, Chile, and Austria. As an example, a one standard deviation positive shock on tax progressivity brings about a 3.37 percentage points cumulative decline in the rates of economic growth over the 15 years of analysis in the US. This typical negative reaction is in line with a significant part of related literature, with Rieth et al. (2016) suggesting a similar reaction for a sample of OECD countries. Regarding the most positive effects on growth, countries like Iceland, Denmark, Belgium, Sweden, and Finland report the most relevant results. As a case in point, after a one standard deviation positive shock on tax progressivity, Iceland documents a 2.17 percentage points favorable effect on the growth rates of the economy across the 15-year period.

Figure 4: Reaction of Economic Growth to a Tax Progressivity Shock



Note: This figure represents the median response in terms of economic growth for each country, in reaction to a tax progressivity shock. This graph plots 90% confidence intervals.

It is, then, essential to understand if the existing diversities between countries may be explained by differences in terms of the progressivity-growth channels. Focusing on the left side of Figure 4, the USA, Korea, Mexico, Switzerland, and Chile represent the group of countries that register the most detrimental impact of a tax progressivity shock on economic growth. In particular, the United States document the highest human capital level in the sample, contributing to a very negative impact on economic growth. Alternatively, Korea registers a high savings rate at the same time as a poor governance quality, both intensifying the negative consequences on growth. Mexico and Switzerland denote completely opposite characteristics. On the one hand, Mexico documents a low value in all channels, suggesting that the detrimental effects of low governance quality and income level overcome the mitigation of the negative effects caused by low human capital and savings rates. On the other hand, Switzerland expresses high values in all channels, indicating that the more elevated human capital and savings have a more intense impact on harming growth than the elevated governance quality and income level in mitigating this effect. Lastly, Chile combines a high degree of savings with a low level of *per capita* income, once again hindering the growth of the economy.

Conversely, Iceland, Denmark, Belgium, Sweden, and Finland integrate the group of nations with the most beneficial impact of tax progressivity on economic growth. In fact, Iceland

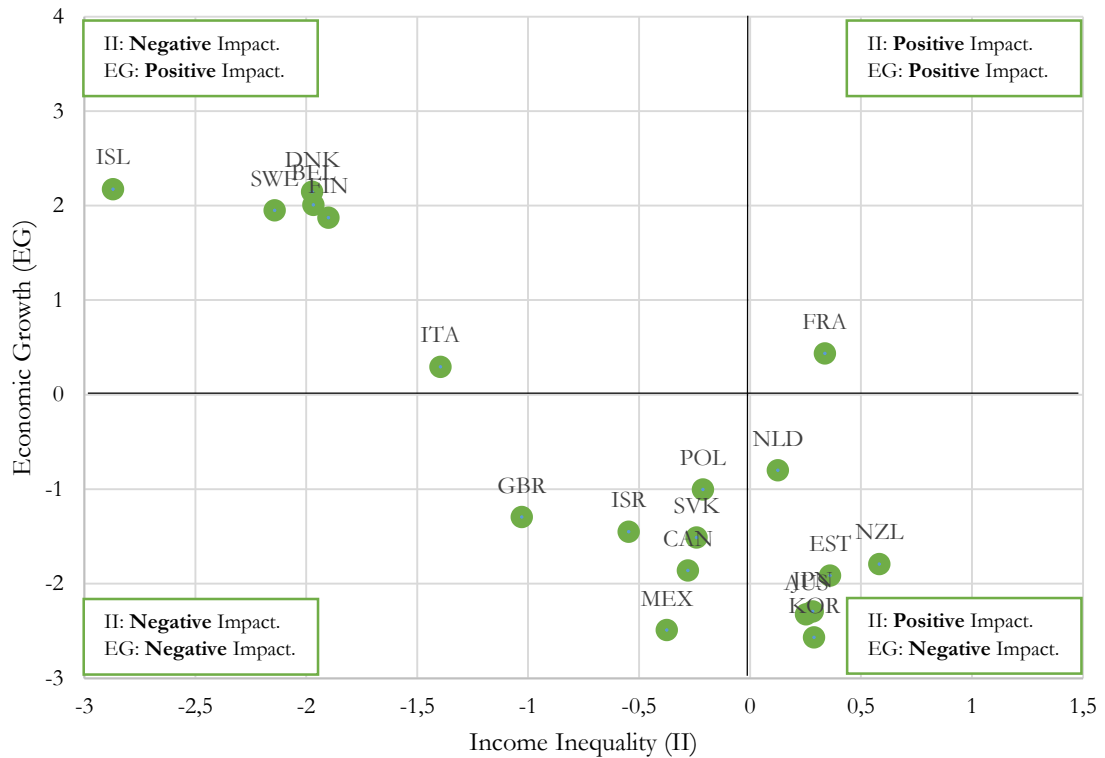
documents low values on both human capital and savings and high values in relation to the quality of governance and the level of income. Globally, all these factors contribute to a less detrimental impact on economic growth, explaining why Iceland has the most favorable results. As for Denmark and Sweden, for example, they register elevated values in terms of governance quality and income level. These outcomes contribute to a more positive effect on growth that is not harmed by the presence of higher savings in these two nations. Lastly, Finland is characterized by a strong quality of governance, helping to promote the growth of the economy.

It is important to highlight, as well, that the general evidence demonstrates the traditional trade-off between inequality and growth. In fact, in both graphs, it is possible to see that tax progressivity has a general negative effect on inequality and growth, evidencing the difficulty of developing progressivity policies capable of mitigating inequality while, at the same time, promoting the growth of the economy. This is consistent with scholarly findings, like Brys et al. (2016) and Muinelo-Gallo and Roca-Sagalés (2013), that denote a negative reaction of both inequality and growth after a progressivity increase.

However, the current results also indicate that some countries register outcomes that are not in accordance with the typical inequality-growth trade-off. To prove this point, Figure 5 portrays the interaction between the inequality and economic growth results after the tax progressivity change. The green dots indicate the median response in terms of both variables and for each country where there is a significant impact of tax progressivity on both income inequality and economic growth.

It is possible to observe that some countries are able to simultaneously reduce inequality levels and benefit economic growth (left-upper quadrant). This is evident in the group of Nordic countries, such as Iceland, Denmark, Belgium, Sweden, and Finland, that document the most intense inequality reductions and the highest positive contributions to growth, which is according to academic studies, such as Gunasinghe et al. (2021). Accordingly, these countries register levels of the channels that are in line with a favorable impact on both inequality and growth. In the case of Iceland, which denotes the biggest inequality reduction and the most intense growth increase, all seven channels document values that contribute to such results.

Figure 5: Interaction between Income Inequality and Economic Growth after a Tax Progressivity Shock



Note: This figure represents the median response in terms of income inequality and economic growth for countries with significant outcomes, in reaction to a tax progressivity shock. This graph plots 90% confidence intervals.

On the contrary, countries like Australia, Estonia, Korea, the Netherlands, and New Zealand are not capable of achieving either of the objectives, with the progressivity shock increasing inequality and harming economic growth (lower-right quadrant). Such results may be due to the very negative influence of inequality on growth (e.g., Kennedy et al., 2017; Ostry et al., 2014; Rubin & Segal, 2015) that, in some circumstances, may not be sufficiently affected by tax progressivity, as found by Kim (2016). As a case in point, Estonia documents low levels of union participation and a smaller size of government, both contributing to weaker inequality mitigation. At the same time, the degree of human capital and savings are elevated, while the level of income is considered low, harming the growth of the economy. Alternatively, Korea denotes low values on all inequality channels, indicating that the favorable effect induced by weaker globalization is overcome by the less favorable influence of unionization and government size. As for the progressivity-growth channels, the rate of

savings is high, whereas the governance quality is poor, both promoting a very negative influence on growth.

Globally, the evidence I collect in this study draws attention to the extremely complex relationship between the three main variables, namely across countries, suggesting that certain contexts may change how these mechanisms interact with each other. Using a sample with a great diversity of countries allows me to understand that changing tax progressivity might have very different impacts on both inequality and growth. For instance, Gerber et al. (2020), although finding strong evidence on the favorable impact of progressivity on the degree of inequality, note that the effect on growth is sometimes insignificant, while Akgun et al. (2017) observe that the relationship between these variables depends on how third factors behave in different contexts. These results, then, do not reject hypothesis H4, which suggests that there are differences between countries in relation to the impact tax progressivity has on both income inequality and economic growth. This accentuates the importance of the present research. By incorporating the different outcomes registered by countries at the same time as the influence of suggested channels in explaining these relationships, it provides the opportunity to better understand the intricate interplays between the three variables.

7. Conclusion

In this dissertation, I explore how tax progressivity dynamically affects the endogenous relationship between income inequality and economic growth, focusing on three objectives: analyzing the dynamic impact of a tax progressivity shock on both inequality and growth, assessing whether this impact depends on the potential channels, and examining differences in the reactions across countries to the progressive taxation change.

Overall, I underscore three main elements in my methodology. First, I develop an IPVAR model that allows me to consider the existence of intertemporal causal relationships between tax progressivity, income inequality, and economic growth. Second, the IPVAR model introduces a set of interaction terms between tax progressivity and each channel. This inclusion enables me to explore non-linear relationships between these variables by constructing and comparing two IRFs at different percentiles of the distributions of the channel. If the difference between these IRFs is significant, there are non-linear relationships, meaning that the channels influence the impact of progressive taxes on inequality and growth. Third, my model includes the relationship between endogenous variables in all countries in my sample, providing the country-specific effects of a tax progressivity shock.

The findings can be divided into three distinct groups. First, they suggest the existence of dynamic relationships among the three variables – tax progressivity, income inequality, and economic growth. Regarding tax progressivity, the results suggest that a positive shock results in positive memory, as the effects continue to be felt several years after the shock occurs. As for income inequality, there is a decrease in the level of income disparities following a tax progressivity shock. In fact, this effect intensifies for a few years, after which it begins to weaken. Finally, in terms of economic growth, the effect of tax progressivity is also negative. Globally, these results indicate the importance of a dynamic methodology, as no impacts are extinguished in one period. Moreover, the outcomes highlight a trade-off between income inequality and economic growth: after the progressivity shock, the median effects on these variables are both negative.

Second, I find that the effect of the progressivity shock on the other two endogenous variables is mediated by the channels I proposed based on related literature. I divide this analysis into two categories: channels that affect the impact of tax progressivity on income inequality and those that influence the impact on economic growth. In the first category, all channels considered – unionization, the size of government, and globalization – affect the

magnitude of the progressivity shock on inequality. Namely, countries with higher union participation register a more noticeable inequality reduction after tax progressivity, in relation to countries where trade unions are weaker. As for the second category, all channels – human capital, savings, quality of governance, and income level – reveal significant influences on the impact of the progressivity shock on growth. For instance, countries with higher human capital levels denote a more intense negative impact on growth compared to those with lower human capital levels, after the progressivity shock.

Third, I register very diverse reactions to the tax progressivity shock, depending on the country. In fact, while the overall results indicate the inequality-growth trade-off arising from a change in the level of progressivity, this is not the truth for all countries. First, I denote several countries where the typical trade-off is present, with both inequality and growth registering a negative effect. Second, I pinpoint a group of countries where changing progressive taxation results in a favorable effect on both inequality and growth. Lastly, I detect a group of nations where increasing tax progressivity is extremely detrimental to both income disparities and economic growth.

The findings of this dissertation suggest several policy implications. Keeping in mind the dynamic relationships between tax progressivity, income inequality, and economic growth, policymakers must take into account the difficulty of reducing income disparities while simultaneously promoting growth. Thus, authorities should aim for a balanced approach, complementing inequality reduction with measures that support growth, continuously monitoring these effects to guarantee that policies remain effective over time.

Additionally, recognizing the non-linear effects of a tax progressivity shock, policymakers should develop tailored policies that take into consideration the social and economic contexts of the different countries, in order to optimize the respective outcomes. In particular, enhancing union participation to reinforce the inequality mitigation effect, or improving governance quality to better implement taxation policies, ensure stability, and control corruption, could work as complementary measures to mitigate the negative impacts of progressivity on growth and increase the success of progressive taxation.

Recognizing the varied impacts of tax progressivity across countries, policies should be tailored to specific national circumstances. This includes conducting assessments of the consequences of progressivity changes to address the unique challenges and difficulties faced

by each country. Indeed, implementing a tax progressivity change because of its beneficial effects on a nearby nation might generate dangerous consequences, and so, policymakers should take this into consideration. Additionally, because the countries' contexts tend to change over time, a progressivity measure, which might have been adequate at a certain point in time may, lead to adverse effects in a distinct period. Therefore, the approach to tax progressivity should be nuanced, highlighting that countries will register different performances depending on their characteristics. Ultimately, context is everything.

Finally, these results should be analyzed with caution due to possible limitations. One limitation might be the selection of potential channels, because it consists of a new approach and thus, may not capture the full range of mechanisms through which tax progressivity affects inequality and growth. Estimating the influence of alternative mediating factors, assessing the effects of alternative progressivity measures and applying this analysis to other types of fiscal shocks could be interesting extensions of the study.

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Annex 1: OECD Countries

Table 6: OECD Countries and Respective Country Codes

Country	Country Code
Australia	AUS
Austria	AUT
Belgium	BEL
Canada	CAN
Chile	CHL
Czechia	CZE
Denmark	DNK
Estonia	EST
Finland	FIN
France	FRA
Germany	DEU
Greece	GRC
Hungary	HUN
Iceland	ISL
Ireland	IRL
Israel	ISR
Italy	ITA
Japan	JPN
Korea	KOR
Latvia	LVA
Luxembourg	LUX
Mexico	MEX
Netherlands	NLD
New Zealand	NZL
Norway	NOR
Poland	POL
Portugal	PRT
Slovak Republic	SVK
Slovenia	SVN
Spain	ESP
Sweden	SWE
Switzerland	SWZ
Türkiye	TUR
United Kingdom	GBR
United States	USA

Source: OECD

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