



ECONOMIC DEPARTMENT
MASTER OF ECONOMICS PROGRAM

The Impact of Public Debt on Income Inequality

An Empirical Analysis for Developed and Developing Countries

أثر الدين العام على مستوى اللامساواة في الدخل

تحليل تجريبي للبلدان المتقدمة والنامية

Student: AbedAlmonim Saleh

(1165517)

Supervisors:

Dr. Mohannad Ismael

Dr. Shaker Sarsour

March, 2023

This Thesis was submitted in partial fulfillment of the requirements for the Master's Degree
in Economics from the Faculty of Graduate Studies at Birzeit University, Palestine

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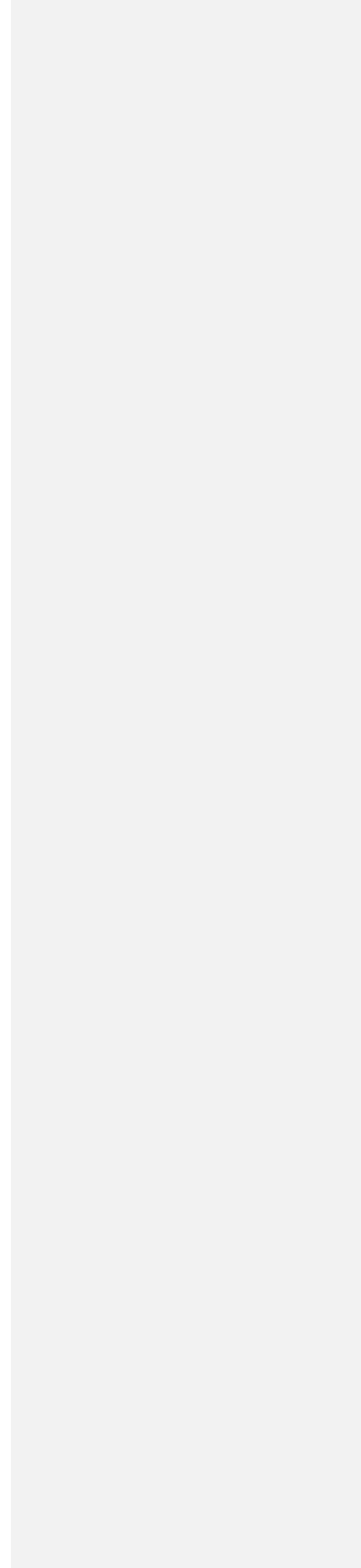


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“We live in a data-abundant world and yet we lack basic information about
inequality.”

(Chancel et al., 2021)

Abstract

Since the advent of modern economic thought, thinkers have addressed the issue of economic inequality, focusing on the economic factors they have experienced and the economic changes that have shaped their times. Given the current increase of public debt among the world's governments and the shift in the composition of that debt toward private sector borrowing, it has become necessary to examine the potential impact of public debt on inequality as a contribution to diagnosing the causes of economic inequality and identifying its mechanisms, especially given the high level of inequality worldwide over the past three decades.

This study empirically examines the impact of public debt on income inequality and compare the potential impact between developed and developing countries, by employing Fixed-Effects panel regression for a sample of 30 developing and developed countries over the period (1990-2019). The results show that public debt has significant positive impact on income inequality for the pooled group of selected countries (the full sample). However, the study failed to get robust comparison between the debt-inequality sensitivity in the sub-samples of developed and developing countries.

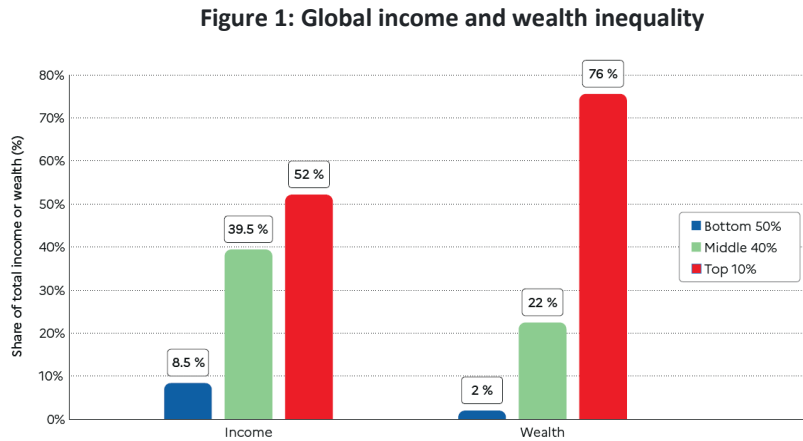
1. Introduction

Global economic inequality has been increasing over the course of the past four decades. This reality fuel the already existed discussions that attribute main social, political, humanitarian, and economic proplems to the large divergence in income and wealth distribution. Modern literutere is rich of studies that introduce evidences about impact of Income and wealth inequality on health, social cohesion, crime, poverty, housing, Aggregate demand, consumption, household debt, economic crises, Conversely, we lack basic information about economic inequality itself and about factors that contribute at its evolution.

1. Background and Research Rationale

The distribution of income and wealth in recent societies is a function of many different factors ranging from institutions and economic policies to social norms and macroeconomic conditions (Dabla-Norris et al., 2015). When the economic inequality dynamics in the last four decades are examined, it is found that many developed and developing countries have experienced a persistent worsening in income and wealth equalities during this period (Milanovic, 2016). During the 1995-2021 period, the bottom 50% of the global population gained only 2% of the real wealth growth, whereas the top 1% gained 38% of the wealth growth (Chancel et al., 2021). When the real income growth numbers are examined, it is found that during the 1980-2020 period, the bottom 50% of the global population gained only 9% of the real income growth, whereas the top 1% gained 23% of the income growth (Chancel et al., 2021). Hence, these numbers imply that economic equality has worsened in recent decades. There are many studies that examine the dynamics

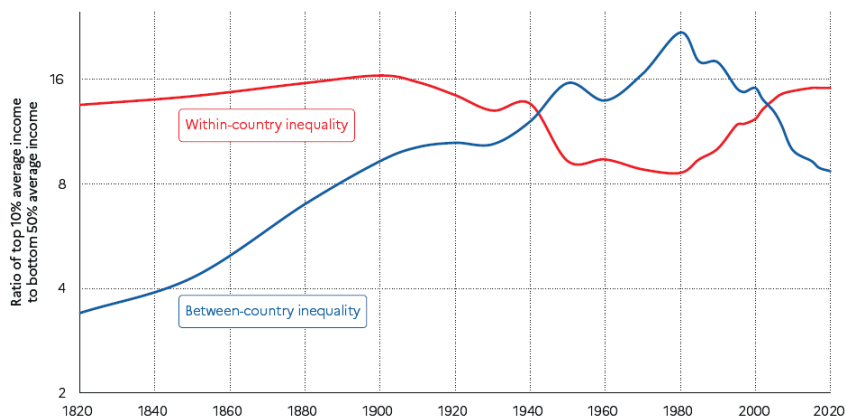
of economic inequalities in terms of trends and determinants (Piketty, 2014; Bahmani-Oskooee et al., 2008; Tridico, 2018; Furceri & Ostry, 2019). Figure (1) shows the extreme concentration of global income and wealth in 2021.



The distribution of global income (measured after unemployment payments and before taxes and transfers), and wealth, in 2021 at Purchasing Power Parity (PPP). (Chancel et al., 2021)

Figure (2) provides us valuable insights for deeper understanding of global income inequality and its evolution throughout the last 200 years. It reveals that the ratio of top 10% to bottom 50% of global income (within-country ratio) had been steadily rising throughout the period (1820 – 1910), then declined until 1980¹, then rose again. However, inbetween-country inequality increased between 1820 and 1980, then sharply declined since 1980. This rise in inequality within countries has meant that the world remains particularly unequal today, despite strong economic growth in emerging economies.

¹ In his seminal work, “Capital in the Twenty First Century”, Thomas Piketty attributes this decline in income inequality in that interval to “the major economic and political shocks” triggered by the Great Depression and the two World Wars, emphasizing that it is not a natural outcome of inequality mechanisms within the capitalism system. (Piketty 2014)

Figure 2: Global income inequality: 1820-2020

Between-country and within-country inequality, as measured by the ratio T10/B50 between the average incomes of the top 10% and the bottom 50%. Income is measured per capita after unemployment payments and before taxes. Sources and series: wir2022.wid.world/methodology and Chancel and Piketty (2021). (Chancel et al., 2021)

Given that many different factors would affect income and growth dynamics, it is natural that various variables would be among the determinants of inequality. For instance, globalisation in terms of the movement of goods and people across countries can change the distribution of income to a large extent (Harrison et al., 2011; Helpman et al., 2017). The leading trade theories such as the Ricardian theory or the Heckscher-Ohlin theory imply that countries specialise in the goods and services that they have comparative advantages in terms of technology or input abundance (Krugman et al., 2017). Then, when countries specialise within the global economic system, they start to import goods and services that they do not have comparative advantages. For example, rich countries such as the US and the UK would import labour-intensive goods from other countries with abundant labour input such as China and India. In return, the returns for unskilled labour in the US and the UK would decline in relative terms compared to other inputs of production such as skilled

labour and capital. As a result, globalisation and international trade can be important factors affecting income distribution in these countries. Similarly, the flows of labour or migration are shown to be among the factors with crucial implications for income inequality (Bastia, 2013). Moreover, policy variables (such as taxation, trade union density, and minimum wages) also affect the distribution of income in a country (Piketty, 2015).

While the literature is abundant on the determinants of inequality in terms of globalisation, technology, and policy variables, the relevant literature is relatively scarce in terms of financial variables and public debt. Some recent studies try to connect credit and debt with income distribution. For example, Kus (2012) examines the relationship between various financial indicators such as bank credits and income inequality for OECD countries and finds that higher credit levels are associated with higher income inequality levels. The author argues that financialisation can benefit wealthy people as they would gain high interest and capital incomes on their financial investments. Lin and Tomaskovic-Devey (2013) conduct a detailed study in the case of the US and find that credits are associated with higher inequality levels. In contrast to these studies that look at the impact of private credit/debt, the relevant literature is relatively scarce regarding the impact of public debt on income inequality. As a possible causal mechanism, higher public debt levels can imply a transfer of income to the holders of the relevant assets (generally wealthy people in the country), thereby leading to major changes in income distribution (Salti, 2015). While these mechanisms are discussed in the literature, no recent studies provide detailed empirical analyses of the possible impacts of public debt on income inequality.

The present study aims to fill this research gap for a sample of developed and developing countries. The importance of such an analysis is underscored by the fact that

public debt has increased in recent years and its composition has rapidly changed. Governments have become increasingly indebted to private creditors. e.g. In IDA-eligible countries, from 2010 to 2021, external debt as a share of GNI rose from 20% to 36.2%, the share owed to private creditors rose from 5% to 21%. (World Bank 2022b)

2. Research Aim, Question, and Objectives

The aim of the present research is to document the impacts of public debt on income inequality. In this context, the relevant research question is given as follows: “What are the income inequality impacts of public debt for developed and developing countries?”. For this purpose, a sample of developed and developing countries is collected covering recent decades. In this context, these research objectives are also followed in the study: to document the inequality dynamics in developed and developing countries over recent decades, to examine public debt trends in developed and developing countries, to investigate the relationship between public debt and income inequality in these countries, to check whether the inequality-debt nexus varies by country groups, and to produce policy recommendations on public debt and inequality.

The study is structured into six chapters. After this introductory chapter, the second chapter provides a critical review of the prior studies and identifies the research gaps, while the third chapter presents the theoretical and analytical framework. Then, the fourth chapter presents the details of the data and methodology utilised in the empirical analysis. The fifth chapter provides the empirical results and their analyses. Finally, the last chapter concludes the study and makes some policy recommendations.

2. Literature Review

This chapter provides a critical review of the relevant studies in the literature regarding income inequality trends, their determinants, and the role of public debt in explaining inequality dynamics. The first part provides a glimpse about the contributions of the main classical thinkers who addressed the question of economic equality. The second part provides a review of the modern relevant literature on the trends and general determinants of income inequality. Then, the third part presents a critical review of the relationship between public debt and income inequality.

1. Classical literature of inequality

Since the economic and social transformations of the late eighteenth and early nineteenth centuries, the question of distribution of wealth and income is a widely discussed and controversial. In contrast to Adam Smith (1723–1790), who was optimistic about the equitable distribution of the growing income from the market-industrial society, other influential thinkers like Thomas Malthus (1766–1834), David Ricardo (1772–1823), Karl Marx (1818–1883), and others, introduced dismal views about the future of inequality within Capitalism. Each of those thinkers drew on intimate knowledge of the capitalism of his time and extensive analysis of the related underlying dynamics of inequality.

For Thomas Malthus, the main catalyst for his analysis was the unprecedentedly rapid population growth in west Europe, he argued that overpopulation generates an inevitable poverty and suffering for the majority of people, as continuous wealth concentration for the capitalists. Regarding Ricardo, the chief concern was the long-term evolution of land prices and land rents, which leads to an increasing share of national income for the landlords class, at the expense of the other classes in the society.

Marx lived later than Smith, Malthus, and Ricardo, so he observed more of the development of the Industrial Capitalism and the resulted economic and social changes. The most striking facts for Marx were the poverty and suffering of the labour class, and the unprecedented concentration of wealth in fewer and fewer hands of capitalists. He introduced the “The Principle of Infinite Accumulation”, that is, the inordinate tendency for capital to accumulate and become concentrated “with no natural limit to the process”.(Piketty, 2015)

None of those thinkers had a way of anticipating the steadily increasing productivity - thanks to technology- which created radical changes with new dynamics of inequality.

2. Income Inequality: Trends and Determinants

Economic inequality can be examined from different perspectives such as income inequality, wealth inequality, racial/ethnic inequality, and gender inequality. Hence, it is possible that these inequality types are connected to each other, while they can also display different dynamics and trends, especially over countries and periods. Since covering these broad dimensions of economic inequality is not in the scope of the present study, the study focuses on the income inequality dimension. Given that income inequality is a broad concept, the literature has developed various indicators to measure the level of inequality in an economy (Jenkins, 2017). Among these measures, the Gini coefficient is the most commonly used indicator (Milanovic, 1997). This indicator is constructed as a statistic taking values between 0 and 1. The lowest value of 0 shows that the society has a perfectly equal distribution of income, with every household having the same income level. Then, the highest value of 1 corresponds to the situation of perfect inequality, with a single household taking all national income and the rest taking no income. While these two extreme cases are

not realistic, the higher values of the Gini coefficient imply higher levels of income inequality in a country. In addition to the Gini coefficient, the literature also directly uses the income shares of different percentiles such as the bottom 50%, the top 10%, or the top 1% (Alvaredo, 2011). The literature also utilises different measures such as the Atkinson index (which puts different weights on the different parts of the income distribution), the coefficient of variation (i.e., the ratio of the standard deviation of the income distribution and the mean value), the decile ratios (such as the income ratio of the top 10% and the bottom 10%), the Kakwani progressivity index (especially used in the case of healthcare expenditures), and the Sen poverty index (De Maio, 2007). In order to display the inequality trends, the commonly used indicators are the Gini coefficient and the income shares.

Figure 3: Gini coefficients for five leading economies

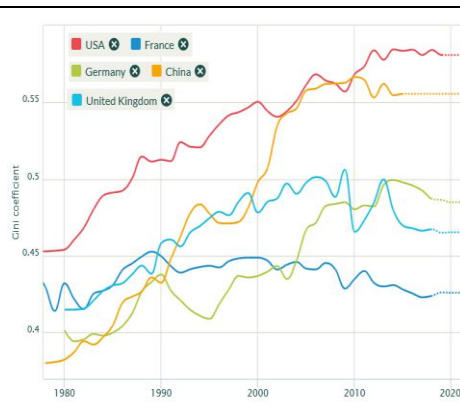
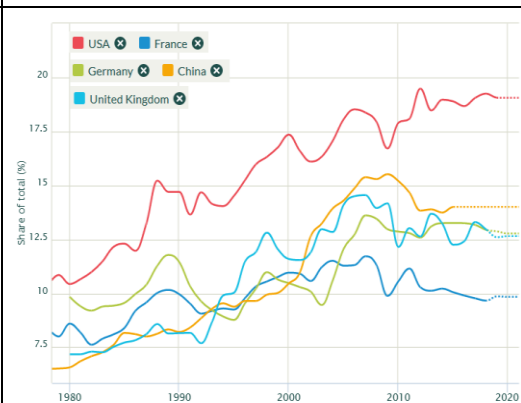


Figure 4: The Top 1% Income Shares five leading economies



Source: World Inequality Database (2022, n.p.).

The above discussions show that the main indicators for measuring income inequality are the Gini coefficient and the income shares of different population groups. In this context,

Figure 1 presents the evolution of the Gini coefficients for the leading five countries in the world (i.e., the US, China, Germany, France, and the UK), while Figure 2 shows the evolution of the top 1% income share in these countries. It is seen from the graph that the Gini coefficients varied between 0.38 in China and 0.45 in the US as of 1980. However, all countries in the graph, except for France, experienced upward trends in their Gini coefficients. As of 2020, the Gini coefficients reached 0.56 in China and 0.58 in the US, which are the worst two performers in the graph in terms of worsening income equality trends in the last four decades. Regarding the other inequality indicator of income shares, Figure 2 shows that the income shares of the top 1% as of 1980 varied from 6.6% in China and 7.2% in the UK to 9.8% in Germany and 10.4% in the US. A similar worsening is experienced in this indicator, and the income shares of the top 1% reached 14% in China and 19.1% in the US. Overall, these two indicators show that there was a trend of worsening income inequality in the leading economies during the last four decades, while the size of worsening varied across countries. Given the major social, economic, and political consequences of worsening income distributions (Neckerman & Torche, 2007; Dabla-Norris et al., 2015), a large and growing body of literature examines the determinants of income inequality.

When the broad literature on the determinants of income inequality is examined, it is found that the leading factors are identified as related to the following dimensions: globalisation, international trade, migration, technology, automation, labour market institutions, and government policies (such as taxation and minimum wages). In the case of globalisation and international trade flows, as discussed in the previous chapter, the specialisation of countries in different segments of goods and services can have major implications for the incomes of different factors of input such as unskilled labour, skilled labour, and capital (Harrison et al., 2011; Grossman & Helpman, 2018). For example, when

the US buys labour-intensive goods from China, real returns for unskilled labour in the US can decline in relative terms, whereas real returns for labour in China can increase. In return, the corresponding international trade flows can lead to a worsening of income distribution in the US and an improvement in China. Regarding the technology dimension, Krusel et al. (2000) show that the rise of skilled-labour supply and the associated skill premia can account for a major portion of worsening income distribution in the US. These dynamics can be related to skill-biased technological change. In addition, relevant studies such as Goos et al. (2009, 2014) find that automation and technological changes can lead to the loss of medium-wage jobs and create job polarization in economies (i.e., the rise of low and high-paying jobs at the expense of medium-paying jobs). Hence, these technological factors can also be important to explain the rising inequality trends in the last four decades.

In addition to globalisation (including trade and migration flows) and technology as important determinants of inequality dynamics, the relevant literature also identifies policy variables to understand inequality trends. For example, as countries switched from welfare-state policies to neoliberal policies starting from the early 1980s (Harvey, 2007), labour market policies and institutions have also experienced major changes. For example, trade union density levels dropped significantly in the last four decades (Bell & Pitt, 1998) and as a relevant development, the coverage of collective bargaining agreements also declined to a large extent in the same period (Schnabel, 2020). In return, these developments decreased the bargaining power of workers relative to the business sector, which is increasingly dominated by large multinational corporations with monopsony power, to some extent, in labour markets. Hence, these institutional changes in the labour markets would also have important implications on income inequality (Keune, 2021). In addition to the labour market institutions, direct policy measures such as taxation and minimum wages also significantly

affect the income distribution dynamics (David et al., 2016; Piketty & Cantante, 2018). Overall, the relevant literature identifies factors ranging from globalisation and technology to labour market institutions and policies as the leading determinants of income inequality dynamics and trends. However, the focus of the literature on financial factors, especially government debt, is relatively limited. For example, important review studies such as Acemoglu (2002) and Glaeser (2005) do not mention the role of public debt or other financial variables in accounting for inequality dynamics. One reason for this limited focus is that the financial factors and public debt are examined as possible determinants of inequality only during recent periods and the following part provides a critical review of the relevant literature.

3. Public Debt and Inequality

The previous section has shown that the literature identifies the leading determinants of inequality as globalisation, technology, institutions, and policies. However, the literature does not provide conclusive evidence on the relative weights of these factors, as the results can differ significantly across samples and periods. In addition, the relevant literature does not provide sufficient attention to other important macroeconomic developments such as financialisation and public debt dynamics. Regarding the public debt dimensions, major debates have taken on the impacts of public debt on economic growth, especially around the global financial crisis (Reinhart & Rogoff, 2010; Eberhardt & Presbitero, 2015; Woo & Kumar, 2015). These studies generally find that public debt can lead to lower growth, especially after a threshold such as 90% of GDP. While the literature on the public debt-growth nexus is very vibrant and growing, the relevant literature on the possible inequality effects of public debt is relatively scarce.

There are a few studies that examine the relationship between public debt and inequality. For example, Azzimonti et al. (2014) note that the world economy experienced rising financialisation and public debt levels, as well as some worsening in income distribution, since the 1980s and argue that these developments can be fundamentally connected. Normally, the public debt dynamics are closely related to war financing and business cycle management. However, the upward trend since the 1980s was not connected to these developments. In this context, the authors claim that governments increased their public debt levels, partly thanks to the deepening financial markets, as a policy tool or insurance against the rising income inequality levels. Similar arguments are put forward in the case of household debt, as well, in the sense that rising inequality levels are associated with higher household debt levels (Iacoviello, 2008). While these studies provide theoretical mechanisms connecting debt and inequality, they do not conduct any cross-country empirical analyses to support their arguments as they mainly rely on model simulations.

Marchionne and Parekh (2015) conduct a cross-country empirical study to examine the relationship between growth, public debt, and inequality. The authors argue that the non-linear relationship between public debt and growth can be conditional on the level of income inequalities in different countries. The paper uses a sample of 27 developed and developing countries for the 1994-2010 period. The results indicate that for countries with higher inequality levels, the turning point of public debt is lower. Namely, for these countries, public debt starts to create negative growth effects at lower levels. While this paper shows that the growth-debt nexus can depend on the level of inequality, it does not examine the possible direct effects of public debt on income inequality. A similar study is conducted by Maebayashi and Konishi (2021). In this paper, the authors show that the sustainability of public debt is not only a function of the level of public debt but also the level

of income inequality in countries. This paper also does not look at the direct implications of public debt for inequality.

In an early study, Prechel (1985) examines the effects of public debt, along with exports and economic development, on income inequality. The author examines the case of 28 less developed countries but does not find statistically significant results. One issue with the paper is that the sample period corresponds to limited financial development and crisis times (i.e., the developing country debt crisis during the late 1970s and early 1980s). Hence, it does not include the recent trends in public debt and inequality dynamics. In a more recent study, Karlin (2018) looks at the possible effects of public and external debt on income inequality for 22 OECD countries covering the 1980-2015 period. The empirical results based on panel data regression methods show that public debt has a positive effect on income inequality as measured by market income. Namely, higher public debt levels are associated with higher market income-based inequality levels. However, these results are reversed when the dependent variable becomes disposable income-based inequality. This is a relevant and interesting finding in the sense that government policies might be effective in changing the debt-inequality nexus. In another relevant study, Salti (2015) examines the relationship between public debt and income inequality, with a focus on the composition of public debt in terms of domestic and external components. The author argues that while public debt can lead to higher inequality levels, this impact can be stronger in the case of domestic debt because domestic debt can imply a transfer of income from the tax base to the rich people within a country. In order to test these claims, the author collects a cross-country panel dataset covering the 1990-2007 period and finds that both the public debt level and the share of domestic debt in public debt are associated with higher levels of income inequality. While this paper produces valuable findings on the research question of

the present study, its time span is relatively limited and it does not conduct an analysis of the possible differences between developed and developing countries in terms of the debt-inequality nexus.

Overall, there are only a few studies that directly examine the relationship between public debt and income inequality. In addition, these studies do not provide comprehensive evidence in terms of the sample of countries and periods. Given that public debt levels increased to very high levels in the last two decades for both developed and developing countries, it is important to examine the consequences of public debt, including its effects on income inequality. The present study aims to fill these research gaps by examining the debt-inequality relationship using a detailed dataset.

3. Theoretical and Analytical Framework

This chapter presents the theoretical and analytical framework based on the existing literature review findings. The literature review chapter has shown that many countries experienced a worsening in their income distribution in the last four decades when the neoliberal structural and policy changes were implemented. There is a large and growing body of literature that examines the trends and determinants of income inequality. The literature identifies globalisation, international trade, migration, technology, automation, and policy factors (such as taxation and minimum wages) as the leading factors of income inequality. Within this broad literature, a new strand of studies also looks at the role of credit and debt in inequality dynamics. However, this literature is very scarce and recent, especially regarding the effects of public debt on income inequality. So, the public debt-inequality nexus stands out as an important research gap in the literature. In addition, a few

studies look at this relationship, but they do not discuss the possible differences across developed and developing country groups.

In terms of theoretical mechanisms connecting public debt to income inequality, discussions in relevant studies such as Salti (2015) and Karlin (2018) become relevant. From a theoretical point of view, public debt can be relevant for income distribution in terms of financing expenditures and debt burden. In the first channel of government expenditures, higher public debt levels can be used to support transfer and subsidies, to some extent, thereby decrease income inequality. However, Barro (2003) notes that government expenditures might have lower efficiency and can result in lower growth rates. In this case, government expenditures financed by public debt can have negative effects on income distribution. Hence, the inequality impact of the expenditure channel is not very clear. In the case of the second channel of debt service burden, the government needs to make some transfers from the fiscal resources to the holder of government debt. Since these debt holders would be generally wealthy agents and institutions in a country (Salti, 2015), the debt burden channel can lead to a worsening in income distribution. Hence, based on these theoretical and analytical discussions, it can be argued that the public debt would lead to a worsening in inequality as the final effect. In addition to this argument, our study investigates the potential difference for this effect between developed and developing countries. In this context, the relevant two research hypotheses are postulated as follows:

Research Hypothesis 1: Higher public debt levels are associated with higher income inequality levels.

Research Hypothesis 2: Developing countries have higher sensitivity of inequality to public debt compared to developed countries.

As discussed above, the first research hypothesis argues that the negative distribution effects of public debt are dominant, similar to the arguments of Salti (2015) and Karlin (2018). Namely, public debt can be financed by taxation on the whole public, whereas the financiers of the public debt can be the top income percentiles in a country. As a result, public debt can amount to a transfer of income from low-income segments to high-income segments in an economy. As another possible mechanism, high public debt levels would require larger portions of public finance as debt payment burdens. In return, the government can have limited fiscal room to address inequality issues. Hence, these channels would imply that higher public debt levels would lead to higher inequality levels.

Regarding the second research hypothesis, it is postulated that the above mechanisms can be stronger in the case of developing countries compared to developed countries. In order to test this research hypothesis, the sample is divided into two sub-groups of developed and developing countries as different results are expected between the country groups due to various factors and mechanisms. For example, it is likely that the financial development levels in developing countries are lower and the general public has limited access to government financing instruments. Hence, the wealthy parts of society can get interest and capital incomes from public debt. Moreover, the borrowing rates for public debt of developing countries are generally higher due to inherent risks compared to developed countries. As other possible factors, the lower quality of institutions and higher levels of corruption can restrict the ability of the state to direct debts for the benefit of the general public. Therefore, these differences can translate into higher debt service burdens and debt volatility levels for developing countries. In return, income distribution in these countries can be more sensitive to the public debt dynamics.

In order to document the impact of public debt on income inequality, this study controls for the effects of six relevant factors, in the following we explain these factors and discuss the channels through which each of them affects inequality:

- **Economic growth:**

According to the Kuznets' Inverted U-hypothesis, income inequality rises in the initial stages of growth, and after reaching the maximum level, it falls as growth increases further. This hypothesis is supported by Lewis's labour-surplus model, which suggests that as economic growth takes place with withdrawal of surplus labour from the low-wages agriculture sector to the higher-wages modern industrial sector, income inequality will first increase and then after a point tends to decrease.

However, The impact of economic growth on income inequality is a complex and debated topic. It has the potential to alleviate income inequality by creating more employment opportunities, increasing wages, and improving living standards for all segments of society. When an economy experiences sustained growth, it can lift people out of poverty and narrow the income gap. However, the relationship between economic growth and income inequality is not always straightforward. In some cases, economic growth can exacerbate income inequality, particularly when the benefits of growth are disproportionately captured by a small segment of the population, such as high-income earners or wealthy individuals. This can occur due to factors like unequal access to education, limited social mobility, and unequal distribution of assets and resources. Ultimately, the impact of economic growth on income inequality depends on the specific context and the effectiveness of policies in promoting inclusive growth.

- **Unemployment:**

Unemployment has a substantial impact on income inequality within an economy. When individuals lose their jobs or face difficulty finding employment, their income levels typically decline or become unstable. This can disproportionately affect low-income individuals and exacerbate income inequality. The loss of a job can lead to reduced access to resources, limited opportunities for skill development, and increased financial insecurity. Moreover, prolonged unemployment can create long-term negative effects on individuals' earning potential and career progression, widening the income gap between those who are employed and those who are not. Additionally, unemployed individuals may face social stigmatization and reduced access to social networks, further hindering their ability to find new job opportunities. Addressing unemployment and its impact on income inequality requires comprehensive labor market policies, including job creation initiatives, training and re-skilling programs, and social safety nets to provide support for those experiencing job loss or difficulty in finding work.

- **Female labor force participation:**

The impact of female labor force participation on income inequality is multifaceted and can have significant implications for economic equality. Increased female participation in the labor force can contribute to reducing income inequality in several ways. Firstly, it expands the pool of skilled and productive workers, which can lead to overall economic growth. When women have access to employment opportunities and are empowered to contribute to the workforce, it can lead to higher household incomes and a more equitable distribution of resources within families. Secondly, female labor force participation can help address gender wage gaps by promoting equal pay for equal work and challenging discriminatory practices. By narrowing the income disparities between

men and women, it can contribute to reducing overall income inequality. Moreover, female labor force participation has been linked to positive social outcomes such as improved educational attainment for children, enhanced healthcare access, and decreased poverty rates.

However, Since income inequality measured on the level of households, assortative marriage play an essential role in determining of the impact of women's labor force participation on inequality. If the desired within-couple similarities draws on earning capacity, female participation tends to increase income inequality (Esping-Andersen 2007).

- **International trade:**

The literature review chapter has shown that international trade specialisation and flows can affect the returns to the factors of production and change the distribution of income in major ways (Harrison et al., 2011; Helpman et al., 2017). According to Stolper-Samuelson Theorem (1941), in the developing countries, trade openness increases wages for the abundant low skilled labor and decreases wages for the scarce high skilled labor, leading to a reduction in income inequality. The reverse effect hold for the developed countries. The study presents the mechanisms through which trade affects income distribution by synthesizing existing research and analyzing various dimensions.

Industry and Job Shifts

Trade liberalization influences industry dynamics and job shifts, such changes can lead to wage stagnation or job displacement in higher-income countries, potentially widening income inequality (Autor et al., 2013). Conversely, trade can create employment

opportunities and raise wages in lower-income countries, thereby reducing income disparities (Goldberg & Pavcnik, 2007).

Skill-Biased Effects

International trade can contribute to wage polarization (Trefler, 2004). certain sectors, such as technology and finance, benefit from trade, leading to increased wages and a higher demand for skilled labor (Trefler, 2004; Harrison & McMillan, 2007). Simultaneously, there are adverse effects on low-skilled workers, who may face wage pressure or job displacement in industries exposed to import competition (Autor et al., 2013).

Income Redistribution

Trade can generate economic growth and, if accompanied by effective redistribution mechanisms, contribute to a reduction in income inequality (World Bank, 2019).

Terms of Trade

The dynamics of terms of trade can have a significant impact on income inequality within an economy. Terms of trade refer to the ratio at which a country's exports can be exchanged for imports, and they are influenced by various factors such as global market conditions, exchange rates, and commodity prices. When a country experiences a positive shift in its terms of trade, such as an increase in the price of its exports relative to its imports, it can lead to an improvement in the income of exporting sectors and potentially boost overall economic growth. However, this positive impact is not evenly distributed across the population. Income inequality may widen as those already benefiting from export-oriented activities, such as large corporations or wealthy individuals, capture a larger share of the increased profits. Meanwhile, workers in non-

export sectors may not experience the same level of income growth, leading to a divergence in income levels. Consequently, the dynamics of terms of trade can exacerbate income inequality unless accompanied by policies that ensure more inclusive distribution of the gains, such as investments in education, social safety nets, and targeted support for marginalized groups. (Rodrik, 2018).

- **Political factors:**

Since the question of inequality is "deeply political and cannot be reduced to purely economic mechanisms" (Piketty, 2014), the present study controls of Trade Unions & Collective Bargaining as important factors.

By representing and advocating for the interests of workers, trade unions play a role in negotiating better wages. This can lead to a more equitable distribution of income and reduce income inequality. Trade unions often focus on improving the wages and benefits of low- and middle-income workers. Additionally, trade unions can contribute to reducing wage differentials between different occupations or industries, thereby promoting income equality. On the other hand, trade unions may contribute to income inequality by protecting the interests of specific sectors or occupations, which could result in higher wages for their members but leave others behind. This selective focus may lead to a divergence in income levels between different groups of workers.

Ultimately, the impact of trade unions on income inequality depends on various factors, including the balance of power between unions and employers, the level of unionization, and the broader social and economic context. Efforts to mitigate potential negative effects and ensure a fair and inclusive labor market can be achieved through policies that

promote collective bargaining rights, support non-unionized workers, and address broader systemic issues of income inequality.

Data and Methodology

This chapter presents the details of the data and methodology utilised in the empirical analysis of the present study. The chapter is organised into two parts, with the first part introducing and describing the dataset and the second part giving the details of the methodological approach.

Data

The main variables of interest in the empirical analysis are public debt and income inequality. Public debt is a relatively clear variable, which shows the financial liabilities of a government, including domestic liabilities and external liabilities. This variable is commonly available from public and reputable sources such as the World Development Indicators (WDI) database of the World Bank (2022), the credit database of the BIS (2022), and the debt database of the OECD (2022). In order to make the relevant debt numbers comparable across countries, the public debt variable is measured as a ratio to the GDP of the corresponding countries. The decomposition of the public into domestic versus external components (as in the case of Salti, 2015) or domestic currency versus foreign currency denomination can be useful to understand the public debt dynamics and effects in more detail. However, given the scope of the present study and the data availability issues, these decomposition factors are not included in the empirical analysis.

While the measurement of public debt is relatively easy and this variable is widely available from the main public sources, the measurement of income inequality is a more complex issue. As discussed in the previous chapter, the inequality level can be conceptualised and measured in different ways (De Maio, 2007). The leading inequality indicators are the Gini coefficient and the top income shares (such as the top 10% and top 1% income shares) (Alvaredo, 2011). In addition, one can use other indicators such as the Atkinson index, the coefficient of variation, the decile ratios, the Kakwani progressivity index, and the Sen poverty index. Given that the majority of the papers reviewed in the literature review chapter use the Gini coefficients as their main dependent variable, the present study also follows the same convention to produce comparable results. Even when the Gini coefficients are chosen as the main measure of income inequality, there can be additional issues with the measurement of specific income types (Armour et al., 2013). For example, the incomes of households can be measured based on market activities, before any involvement of government policies. Then, this Gini coefficient indicator would be based on market incomes. However, governments conduct many different policies such as income taxes, subsidies, and transfers. Then, the disposable incomes of households can be very different from their market incomes. As a result, another approach can use the Gini coefficients based on disposable incomes. Since both indicators provide different information on the content of household income, it would be feasible to use one or two of them in the analysis. In this context, the present study focus on Gini market income to analyse the potential impact of public debt on income inequality. Besides, the study utilise Gini disposable incomes to throw light on the effectiveness of government policies in reducing income inequality. The Gini coefficients are also widely available from main public sources such as the World Bank (2022) and the OECD (2022). However, since the underlying

surveys are not generally conducted every year for some countries, there can be gaps in the corresponding Gini coefficient estimates. In this context, one important source to overcome this challenge, as well as to make different indicators comparable across countries, is the Standardized World Income Inequality Database (SWIID) of Solt (2016). Hence, this dataset is utilised to obtain the two Gini coefficients for a large sample of developed and developing countries.

In order to document the impact of public debt on income inequality, it would be necessary to control for the effects of other relevant factors. For example, the literature review chapter has shown that international trade specialisation and flows can affect the returns to the factors of production and change the distribution of income in major ways (Harrison et al., 2011; Helpman et al., 2017). As a result, it would be necessary to control the impact of international trade on income inequality. In this context, the trade ratio (i.e., the sum of exports and imports as a ratio to GDP) can be a control variable in the empirical analysis. Kus (2012) provides a detailed account of the main control variables in understanding the determinants of income inequality. In addition to the trade variable, the author includes the GDP growth rate (with an expected negative sign, i.e., growth leading to lower inequality), the unemployment rate (with an expected positive sign, i.e., unemployment leading to higher inequality), the female labour force participation rate (with an expected positive sign, i.e., higher participation rates leading to higher inequality), trade union density (with an expected negative sign, i.e., higher union rates leading to lower inequality), and collective bargaining coverage (with an expected negative sign, i.e., higher bargaining coverage rates leading to lower inequality). The present study also uses these indicators as control variables in the empirical analysis.

Regarding the data sources for the above variables, the dependent variable (i.e., the inequality indicators as measured by the two Gini coefficients), the independent variable (i.e., the public debt to GDP ratio), and the control variables are obtained from the four public data sources of the SWIID by Solt (2016), the World Development Indicators (WDI) by the World Bank (2022), the credit database by the BIS (2022), and the labour market database by the OECD (2022). The sample of countries is determined based on the data availability from these sources. In this context, a sample of 30 developed and developing countries is selected as follows: Australia, Austria, Belgium, Canada, Chile, Colombia, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Israel, Italy, Japan, Korea, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom, and the United States. The sample period starts in 1990 and ends in 2019. However, the sample is unbalanced as some indicators (such as trade union density and collective bargaining coverage variables) are not available in a continuous fashion. The development status of countries (i.e., classification in terms of developing versus developed countries) is determined based on the Human Development Index (HDI) level covering the 1990-2019 period. This variable is obtained from the UNDP (2022) and a critical value of 0.80 is used to classify countries as developing or developed. Hence, the classification is dynamic in the sense that countries initially below the threshold of 0.80 can move from the developing category to the developed category when they exceed the 0.80 threshold.

Methodology

The relevant studies that look at the relationship between income inequality such as Salti (2015) and Karlin (2018) utilise panel data regression methods, including pooled OLS

regressions and fixed-effects regressions. Since the pooled OLS method does not take the country effects and panel data nature of the dataset into account, fixed-effects method form the empirical method of the present study. In this context, the following regression model is estimated:

$$\text{Gini Market Coefficient}_{i,t} = \alpha + \beta \text{Public Debt}_{i,t} + \gamma \text{Control Variables}_{i,t} + \varepsilon_{i,t}$$

In the above equation, countries are denoted by *i*, while years are denoted by *t*.

Where:

Variable	Description	Source
Gini Market Coefficient	<i>A statistical measure of market income inequality (pre-tax, pre-transfer)</i>	<i>The Standardized World Income Inequality Database</i>
Public Debt	<i>Total credit to the government sector at market value (core debt) As a percentage of GDP</i>	<i>Bank for International Settlements (BIS)</i>
Control Variables		
GDP growth	<i>Annual percentage growth rate of GDP at market prices based on constant local currency. Aggregates are based on constant 2015 prices, expressed in U.S. dollars.</i>	<i>The World Bank Data</i>
Unemployment Rate	<i>The unemployed are people of working age who are without work, are available for work, and have taken specific steps to find work. This indicator is measured in numbers of unemployed people as a percentage of the</i>	<i>OECD Data</i>

	<i>labour force. (OECD 2022)</i>	
<i>Female LFP</i>	<i>Labor force participation rate, female (% of female population ages 15+). Labor force participation rate is the proportion of the population ages 15 and older that is economically active: all people who supply labor for the production of goods and services during a specified period. (The World Bank n.d.)</i>	<i>The World Bank Data</i>
<i>Trade Openness</i>	<i>The sum of exports and imports of goods and services measured as a share of gross domestic product.</i>	<i>The World Bank Data</i>
<i>Trade Union Density</i>	<i>The number of net union members (i.e excluding those who are not in the labour force, unemployed and self-employed) as a proportion of the number of employees.</i>	<i>OECD Data</i>
<i>Collective bargaining coverage</i>	<i>the share of workers covered by valid collective agreements in force.</i>	<i>OECD Data</i>

The first research hypothesis implies that $\beta > 0$, while the second research hypothesis postulates that $\beta_{developing} > \beta_{advanced}$. These hypotheses are examined empirically in the next chapter.

Panel Estimation Method:

Panel estimation is the process of analysing a group of cross-sectional units observed over time. The panel data test introduces two models, random effects which used when

individual differences are random from the point of view of the researcher, and fixed effects model which controls for time-invariant differences between the individuals.

The following equation represents the fixed effects model:

$$Y_{it} = \alpha_i + \beta_1 * X_{it} + u_{it}$$

Where,

- Y_{it} is the dependent variable where t represent time and i stands for entity
- α_i ($i=1\dots n$) is the unknown intercept for each entity
- X_{it} represents one independent variable
- β_1 is the coefficient for IV,
- u_{it} is the error term, $u_{it} = \mu_{it} + v_{it}$,

Whereas in the fixed effects model, the error term (α_i) are allowed to be correlated with the independent variables X_{it} . Assuming that X_{it} is uncorrelated with the idiosyncratic error u_{it} .

Hausman Test:

Hausman test developed to choose between the random effects and the fixed effect models. The test compares the coefficient estimates from the random effects model to those from the fixed effects model and evaluates the consistency. If μ_{it} is correlated with the independent variables, then the random effects estimator is inconsistent, while the fixed model remains consistent.

Fisher test

Fisher's test examine the stationary condition in panel data analysis. It does not require a balanced panel.

Variance Inflation Factor

A variance inflation factor (VIF) detects multicollinearity in regression analysis. It estimates how much the variance of a regression coefficient is inflated due to multicollinearity in the model. Variance inflation factors range from 1 upwards. It indicates the percentage the variance is inflated for each coefficient.

4. Results and Analysis

This chapter presents the empirical results and analyses them. The empirical findings are presented in three parts. The first part discusses the data trends and summary statistics as background information. Then, the second part conducts a correlation analysis to see the bivariate relationship between the dependent and independent variables. Finally, the last part presents the regression results and the corresponding analysis.

1. Descriptive Analysis

As the previous chapter has explained, the relevant variables are collected from four public sources: the Standardized World Income Inequality Database (SWIID) by Solt (2016), the World Development Indicators (WDI) by the World Bank (2022), the credit database by the BIS (2022), and the labour market database by the OECD (2022). The dependent variables are the two Gini coefficients (as measured between 0 and 100), one based on market income and the other based on disposable income. Then, the independent variable is the public debt ratio, while the control variables include the GDP growth rate, unemployment rate, female labour force participation rate, trade ratio, trade union density, and collective bargaining coverage. The summary statistics of these variables are presented in Table 1. The table shows that the average Gini market coefficient was 47.1, with a

standard deviation of 4.8. In the case of the Gini disposable coefficient, the average was 31.8 and the standard deviation was 6.2. In addition, the Gini market coefficient ranged between 30.6 and 55.5, while the Gini disposable coefficient varied between 22.3 and 53.2. Hence, the lower ranges and values of the Gini disposable coefficient imply that government policies are effective in decreasing income inequality levels in the full sample of developed and developing countries.

Variable	Obs	Mean	Std.Dev.	Min	Max
Gini Market	469	47.114	4.761	30.6	55.5
Gini Disposable	469	31.808	6.173	22.3	53.2
Public Debt	469	62.979	37.609	4.6	208.5
GDP growth	469	2.444	2.661	-8.074	11.467
Unemployment	469	7.092	3.744	2.05	27.47
Female LFP	469	52.022	8.752	23.07	70.64
Trade	469	74.916	36.679	18.349	217.614
Trade Union Density	469	26.54	18.181	6.3	81
Collective Bargaining	469	50.159	33.02	.7	100

The public debt variable in Table 1 shows that the average debt was 63% of GDP in the sample, with a standard deviation of 37.6%. The range is from the minimum value of 4.6% to the maximum value of 208.5%, thereby showing the large extent of variation in the public debt variable. Regarding the control variables, the average GDP growth was 2.4%, with a standard deviation of 2.7%, while the average unemployment rate was 7.1%, with a

standard deviation of 8.8%. The table also shows that the female labour force participation rate had an average value of 52% and a standard deviation of 8.8%, while the average trade ratio was 74.9% of GDP, with a standard deviation of 36.7%. Hence, these control variables display high levels of dispersion in the sample. This finding is expected given that the sample covers many decades and very different countries. Finally, the table presents the summary statistics for the labour market institutions. Namely, the trade union density had an average value of 26.5%, with a standard deviation of 18.2%, while the average collective bargaining coverage was 50.2%, with a standard deviation of 33%. The sample is constructed in a way that all variables have the same number of observations.

Given that the research is also interested in the differences across developed and developing countries, it would be informative to look at the summary statistics for these country groups separately. In this context, Table 2 presents the summary statistics for the developed and developing countries in the upper and lower panels, respectively.

Developed Countries	Obs	Mean	Std.Dev.	Min	Max
Gini Market	408	47.283	4.481	31.8	55.5
Gini Disposable	408	30.544	4.568	22.3	47.4
Public Debt	408	66.866	37.982	5.7	208.5
GDP growth	408	2.2	2.413	-8.074	11.467
Unemployment	408	7.095	3.723	2.12	27.47
Female LFP	408	53.543	7.452	30.24	70.64
Trade	408	77.535	37.742	18.349	217.614

Trade Union	408	28.256	18.644	6.9	81
Collective Bargaining	408	54.946	31.929	6.7	100
<hr/>					
Developing Countries	Obs	Mean	Std.Dev.	Min	Max
<hr/>					
Gini Market	61	45.984	6.255	30.6	55.2
Gini Disposable	61	40.262	8.491	24.7	53.2
Public Debt	61	36.979	21.37	4.6	97.5
GDP growth	61	4.077	3.551	-5.75	11.2
Unemployment	61	7.072	3.919	2.05	22.67
Female LFP	61	41.848	9.992	23.07	58.17
Trade	61	57.398	21.743	30.71	137.407
Trade Union	61	15.061	8.153	6.3	51.5
Collective Bargaining	61	18.139	19.776	.7	100

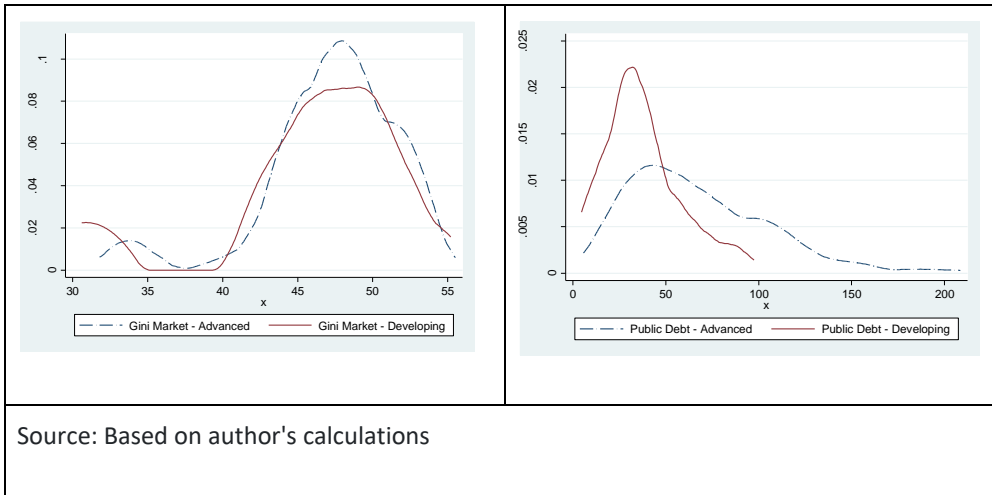
The upper panel of Table 2 shows that the average Gini market coefficient was 47.3, with a standard deviation of 4.5 for developed countries. In the case of the Gini disposable coefficient, the average was 30.5 and the standard deviation was 4.6. In addition, the Gini market coefficient ranged between 31.8 and 55.5, while the Gini disposable coefficient varied between 22.3 and 47.4. Hence, the lower ranges and values of the Gini disposable coefficient imply that government policies are more effective in decreasing income inequality levels in the sample of developed countries. In fact, this impact is larger compared to the results in Table 1. Namely, in the case of developed countries, government policies decrease the inequality level by around 17 points (from 47.3 to 30.5), while the same

decrease is around 15 points (from 47.1 to 31.8) in Table 1. So, the redistribution policies seem to be more effective in the case of developed countries. The public debt variable in Table 2 shows that the average debt was 66.9% of GDP in the developed country sample, with a standard deviation of 38%. Hence, the public debt levels are larger in the case of developed countries. Regarding the control variables, the average GDP growth was 2.2% for developed countries, with a standard deviation of 2.4%, while the average unemployment rate was 7.1%, with a standard deviation of 3.7%. Hence, both the growth rate and unemployment rate, along with their volatilities, are smaller in the case of developed countries. The table also shows that the female labour force participation rate had an average value of 53.5% and a standard deviation of 7.5%, while the average trade ratio was 77.5% of GDP, with a standard deviation of 37.7%. Hence, developed countries are found to have higher female LFP and trade ratios compared to the full sample. Lastly, the table shows that the trade union density had an average value of 28.3%, with a standard deviation of 18.6 %, while the average collective bargaining coverage was 54.9%, with a standard deviation of 31.9%. Hence, the developed country sample has higher trade union density levels and broader coverage of collective bargaining.

Then, for the case of developing countries, the lower panel of Table 2 shows that the average Gini market coefficient was 46, with a standard deviation of 6.3 for developing countries. In the case of the Gini disposable coefficient, the average was 40.3 and the standard deviation was 8.5. In addition, the Gini market coefficient ranged between 30.6 and 55.2, while the Gini disposable coefficient varied between 24.7 and 53.2. While these numbers imply that government policies are effective in decreasing the inequality levels in developing countries, this effect is weaker compared to the same effect in developed countries. Namely, in the case of developing countries, government policies decrease the

inequality level by around only 6 points (from 46 to 40.3), while the same decrease is around 17 points (from 47.3 to 30.5) in the upper panel of Table 2 for developed countries. So, the redistribution policies seem to be more effective in the case of developed countries. The public debt variable in the lower panel of Table 2 shows that the average debt was 37% of GDP in the developing country sample, with a standard deviation of 21.4%. Hence, the public debt levels are lower in the case of developing countries. Regarding the control variables, the average GDP growth was 4.1% for developing countries, with a standard deviation of 3.6%. In addition, the average unemployment rate was 7.1% for developing countries, with a standard deviation of 3.9%. So, the growth rate was larger in the case of developing countries. The lower panel of the table also shows that the female labour force participation rate had an average value of 41.8% and a standard deviation of 10%, while the average trade ratio was 57.4% of GDP, with a standard deviation of 21.7%. Hence, developing countries are found to have lower female LFP and trade ratios compared to the developed country sample. Finally, the table shows that the trade union density in developing countries had an average value of 15.1%, with a standard deviation of 8.2%, while the average collective bargaining coverage was 18.1%, with a standard deviation of 19.8%. So, the developing country sample has lower trade union density levels and narrower coverage of collective bargaining. Overall, the comparison of the summary statistics in Table 2 documents major similarities and differences in data properties such as similar inequality levels but lower public debt levels in developing countries. These differences are also presented in Figures 3 and 4. In return, it can be expected that these properties can be reflected in the empirical analysis in terms of different debt-inequality nexuses across country groups.

Figure 5: Kernel Density for Gini Market	Figure 6: Kernel Density for Public Debt
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2. Correlation Analysis

After presenting the summary statistics of the dependent, independent, and control variables, this part conducts a simple correlation analysis among these variables to see their bivariate associations with each other. In this context, Table 3 presents the Pearson correlation coefficients in the full sample of developed and developing countries. The results indicate that the Gini market coefficient has a positive, moderate, and statistically significant correlation with the Gini disposable coefficient. In addition, the Gini market coefficient has a positive, statistically significant, and relatively moderate (with a correlation coefficient of 0.345) correlation with the public debt variable. Hence, this finding provides supportive evidence for the first research hypothesis in the sense that higher debt levels are associated with higher inequality levels. Regarding the correlations with the control variables, Table 3 shows that the Gini market coefficient is positively associated with the unemployment rate, female LFP, trade union density, and collective bargaining coverage, whereas it is negatively associated with the growth rate. In the case of the Gini disposable coefficient, Table 3 shows that it has a negative, statistically significant, but relatively small (with a correlation

coefficient of -0.121) correlation with the public debt variable. Hence, this finding provides contradicting evidence for the first research hypothesis in the sense that higher debt levels are associated with lower inequality levels. This puzzling finding is similar to the case of Kalin (2018), who also finds changing signs when the inequality measures are changed.

Table 3: Pearson Correlation Coefficients for the Full Sample

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) Gini Market	1.000							
(2) Gini Disposable	0.225*	1.000						
(3) Public Debt	0.345*	-0.121*	1.000					
(4) GDP Growth	-0.272*	0.145*	-0.347*	1.000				
(5) Unemployment	0.315*	0.098*	0.276*	-0.152*	1.000			
(6) Female LFP	0.105*	-0.364*	-0.147*	-0.119*	-0.295*	1.000		
(7) Trade	-0.024	-0.532*	-0.043	-0.013	-0.108*	0.087	1.000	
(8) Trade Union	0.138*	-0.532*	0.081	-0.176*	-0.015	0.312*	0.250*	1.000
(9) Collective_Barg.	0.221*	-0.590*	0.289*	-0.290*	0.252*	0.107*	0.347*	0.614*

* shows significance at the 0.05 level

Regarding the correlations with the control variables, Table 3 shows that the Gini disposable coefficient is positively associated with the growth rate and the unemployment rate, whereas it is negatively associated with the female LFP, trade ratio, trade union density, and collective bargaining coverage. Some of these signs are expected (such as the inequality-decreasing effects of trade union density and collective bargaining coverage), while some other signs are not as expected (such as the inequality-increasing effects of economic growth).

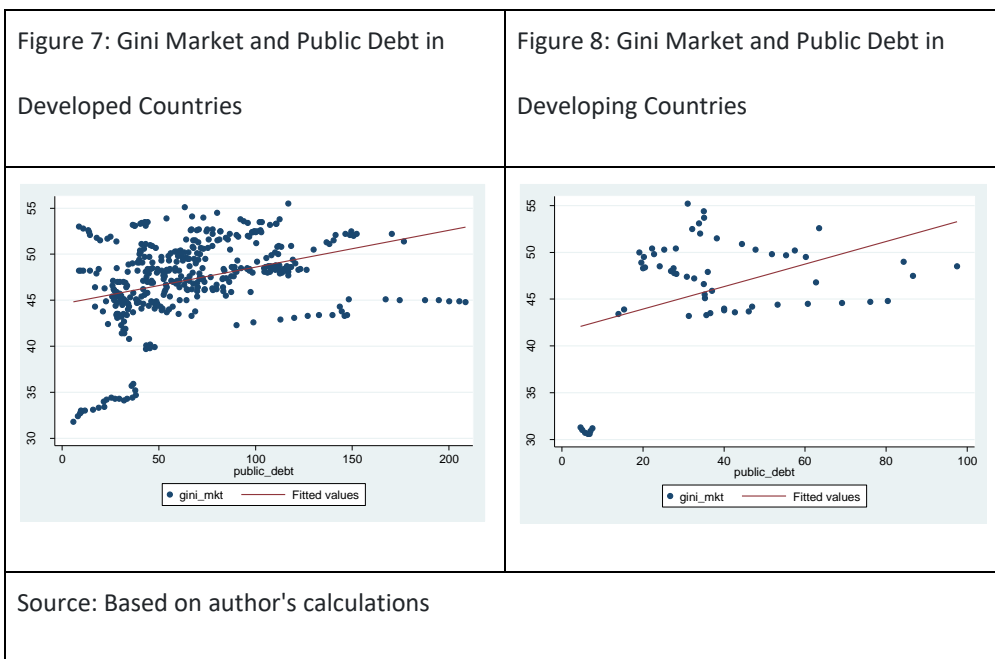
The same correlation analyses are repeated for the developed and developing countries separately in Table 4. It is seen from the upper panel of Table 4 that the Gini market coefficient has a positive, small, and statistically significant correlation with the Gini disposable coefficient, with a correlation size of 0.234, for developed countries. In addition, the Gini market coefficient has positive, statistically significant, and moderate (with a correlation coefficient of 0.339) with the public debt variable. Hence, this finding provides supportive evidence for the first research hypothesis in the sense that higher debt levels are associated with higher inequality levels. Regarding the correlations with the control variables in the case of developed countries, the upper panel of Table 4 shows that the Gini market coefficient is positively associated with the unemployment rate, trade union density, and collective bargaining coverage, whereas it is negatively associated with the growth rate. In the case of the Gini disposable coefficient for developed countries, the upper panel of Table 4 shows that it has a positive, but statistically insignificant, and relatively small (with a correlation coefficient of 0.050) correlation with the public debt variable. Hence, the above puzzle in the case of the full sample is resolved for the developed country sample in the sense that both Gini coefficients are positively associated with public debt.

Developed Countries	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) Gini Market	1.000							
(2) Gini Disposable	0.234*	1.000						
(3) Public Debt	0.339*	0.050	1.000					
(4) GDP Growth	-0.205*	0.087	-0.322*	1.000				
(5) Unemployment	0.314*	0.164*	0.262*	-0.165*	1.000			
(6) Female LFP	0.048	-0.240*	-0.323*	0.008	-0.364*	1.000		

(7) Trade	-0.055	-0.569*	-0.109*	0.054	-0.106*	0.005	1.000	
(8) Trade Union	0.126*	-0.557*	0.003	-0.126*	-0.022	0.252*	0.211*	1.000
(9) Collective_Barg.	0.232*	-0.529*	0.197*	-0.245*	0.271*	-0.100*	0.306*	0.584*
<hr/>								
Developing Countries	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) Gini Market	1.000							
(2) Gini Disposable	0.570*	1.000						
(3) Public Debt	0.413*	-0.117	1.000					
(4) GDP Growth	-0.435*	-0.137	-0.275*	1.000				
(5) Unemployment	0.338*	-0.033	0.609*	-0.120	1.000			
(6) Female LFP	0.159	0.028	-0.306*	-0.090	-0.180	1.000		
(7) Trade	0.050	-0.542*	0.145	-0.128	-0.179	0.000	1.000	
(8) Trade Union	0.120	-0.443*	0.404*	-0.211	0.056	0.154	0.316*	1.000
(9) Collective_Barg.	0.031	-0.582*	0.480*	-0.139	0.303*	0.108	0.293*	0.552*
<hr/>								
* shows significance at the 0.05 level								

In the case of developing countries, the lower panel of Table 4 shows that the Gini market coefficient has a positive, large, and statistically significant correlation with the Gini disposable coefficient, with a correlation size of 0.570. In addition, the Gini market coefficient is positive, statistically significant, and moderate (with a correlation coefficient of 0.413) with the public debt variable. Hence, this finding provides supportive evidence for the first research hypothesis in the sense that higher debt levels are associated with higher inequality levels. In the case of the Gini disposable coefficient for developing countries, the lower panel of Table 4 shows that it has again a negative but statistically insignificant correlation with the public debt variable. Overall, these numbers show that the debt-inequality nexus is generally positive but can vary across developed versus developing

countries. This positive association is also shown with scatter plots in Figures 5 and 6. Moreover, the debt-inequality correlation coefficient is larger in the case of developing countries, which supports the second research hypothesis. While correlation analysis provides some indicative evidence of the debt-inequality relationship, its bivariate nature (i.e., the lack of controlling for other relevant variables) becomes an important shortcoming. Hence, the following part conducts multivariate regression analyses to produce more robust findings.



3. Regression Analysis

This part conducts the multivariate regression analysis for the full sample of countries, as well as the sub-samples of developed and developing countries. Table 5 presents the regression model estimation using the panel data methods of fixed-effect regressions and the Gini market coefficient. The choice between the fixed-effects model and

the random-effects model is examined using the Hausman test (Wooldridge, 2010). The relevant p-value is less than 0.05, implying that the fixed-effects model is the preferred estimation. The corresponding results show that the R^2 parameter is estimated as 0.421, thereby implying that the regression model and the independent variables explain 42.1% of the variation in the Gini market coefficient for the full sample of countries. In addition, the F-stat is estimated as 44.922, with a corresponding p-value of 0.000. Hence, these statistics imply that the set of independent variables, including the public debt variable, is statistically significant at the 1% level in a joint way. Hence, the R^2 and F-stat imply that the regression model has explanatory power for the Gini market coefficient.

One possible issue in the regression is multicollinearity, which arises in the case of very high correlation coefficients among the independent variables (Wooldridge, 2010). In order to test for the presence of the multicollinearity problem, the Variance Inflation Factors (VIF) are estimated after the regression results. The results indicate that none of the VIF factors is above three; hence, the OLS results do not suffer from the multicollinearity problem. According to Fisher test, the variables used in the regression model satisfy stationarity assumption.

Table 5: Fixed-Effects Regression Results of Gini Market Coefficient for the Full Sample

Gini Market	Coef.	St.Err.	t-value	p-value	Sig
GDP Growth	-0.025	0.022	-1.15	0.249	
Unemployment	0.149	0.026	5.79	0.000	***
Female LFP	0.100	0.021	4.83	0.000	***
Trade	0.004	0.005	0.72	0.473	
Public Debt	0.019	0.003	5.57	0.000	***
Trade Union	-0.124	0.018	-6.74	0.000	***

Collective Barg.	-0.003	0.009	-0.28	0.782	
Constant	42.840	1.471	29.13	0.000	***
Mean dependent var	47.114		SD dependent var	4.761	
R-squared	0.421		Number of obs	469.000	
F-test	44.922		Prob > F	0.000	
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$					

When the statistically significant individual regression coefficients in Table 5 are examined, it is found that trade union density has a negative association with inequality, whereas the unemployment rate and female LFP have positive associations. These findings are in line with the results in the literature such as Kus (2012) in the sense that trade union density rates lead to lower inequality, whereas higher unemployment and female LFP rates lead to higher inequality. As the leading result, the upper panel of Table 5 shows that the regression coefficient of public debt is positive and statistically significant at the 1% level. The regression coefficient of 0.019 implies that when the public debt level increases by 1% points, the Gini market coefficient increases by 0.019 points. These findings provide strong supportive evidence for the first research hypothesis that higher public debt levels are associated with higher inequality levels. This finding also improves over the existing results in the literature such as Salti (2015) and Karlin (2018), as these studies focus on limited samples or obtain mixed results.

The second research hypothesis postulates that debt-inequality sensitivity can be higher in developing countries due to various structural differences between developed and developing countries. In order to test this hypothesis, Table 6 repeats the fixed-effects regression model for the sub-samples of developed and developing countries in the upper and lower panels, respectively. The main focus is on the difference in the regression

Comment [A1]: Normally, the table comes after the explanations ...

coefficients for the public debt variable. Table 6 shows that the relevant regression coefficient is estimated as 0.014 in the case of developed countries and 0.017 in the case of developing countries. The regression coefficient is statistically significant at the 1% level for the developed countries but not statistically significant at the 10% level for developing countries. Which indicates that public debt has no impact on income inequality in the developing countries. Hence, the study failed to provide evidence for the second research hypothesis.

Table 6: Fixed-Effects Regression Results of Gini Market Coefficient					
Gini Market –	Coef.	St.Err.	t-value	p-value	Sig
Developed Countries					
GDP Growth	-0.025	0.021	-1.19	0.235	
Unemployment	0.173	0.023	7.42	0.000	***
Female LFP	0.141	0.021	6.74	0.000	***
Trade Openess	0.013	0.005	2.61	0.009	***
Public Debt	0.014	0.003	4.42	0.000	***
Trade Union	-0.176	0.020	-8.72	0.000	***
Collective Barg.	0.014	0.008	1.67	0.097	*
Constant	40.811	1.570	26.00	0.000	***
Mean dependent var		47.283	SD dependent var		4.481
R-squared		0.569	Number of obs		408.000
F-test		70.439	Prob > F		0.000
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$					
Gini Market –	Coef.	St.Err.	t-value	p-value	Sig
Developing Countries					
GDP Growth	0.041	0.039	1.05	0.297	

Unemployment	-0.102	0.120	-0.86	0.397	
Female LFP	-0.310	0.054	-5.69	0.000	***
Trade Openess	-0.064	0.020	-3.11	0.003	***
Public Debt	0.017	0.018	0.94	0.354	
Trade Union	-0.085	0.058	-1.47	0.148	
Collective Barg.	-0.115	0.046	-2.49	0.016	**
Constant	65.892	2.720	24.23	0.000	***
Mean dependent var		45.984	SD dependent var		6.255
R-squared		0.620	Number of obs		61.000
F-test		10.247	Prob > F		0.000
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$					

We can attribute this variation in the impact of public debt on income inequality between developed and developing countries to the following factors:

- **Limited Access to Financial Markets:** Developing countries often face constraints in accessing international financial markets and may have limited borrowing options (World Bank, 2019). As a result, they might accumulate less debt compared to developed countries. The lower levels of public debt in developing countries might reduce the likelihood of negative effects on income inequality.
- **Informal Economy and Social Networks:** Developing countries often have a larger informal economy, characterized by self-employment and small-scale enterprises. While the informal sector can contribute to income inequality by offering lower wages and limited social protection, it can also provide income opportunities for marginalized groups who may not have access to formal employment. Additionally, strong social networks and community support systems prevalent in developing countries can help mitigate income disparities by providing informal social safety nets (ILO, 2018; World Bank, 2019). Public debt policies and investments that focus on

bridging formal-informal dualism, such as promoting formalization or supporting informal sector development, can help reduce income inequality.

- **Crowding Out Effect:** When a developed country accumulates public debt, it usually finances this by issuing bonds, which are bought by both domestic and international investors. By doing so, the government is competing with the private sector for funds, which could otherwise be used for business expansion, innovation, and job creation. This might affect income distribution negatively.

1. Conclusions

The present study postulates that higher public debt levels would be associated with higher inequality levels. One possible mechanism is that public debt is financed through taxation levied on the general public, whereas debt financing is in the interest of those who have the means to lend to the government. Hence, public debt can be regressive as it can imply transfers of income from poor to rich. In addition, higher public debt levels can squeeze fiscal space through higher payment burdens, thereby decreasing the ability of governments to address inequality issues. In order to test this possible inequality-increasing effect of public debt, the study conducts detailed pooled OLS and fixed-effects regression estimations. The results provide robust evidence of the positive association between public debt and inequality, i.e., higher public debt levels lead to higher inequality levels.

The additional results show that the corresponding sensitivity parameter is larger in the case of developing countries; however, the corresponding evidence is not strong, which

pave the way for context-oriented studies to investigate the factors that control this sensitivity.

The findings of the present study can have important policy implications. Related to the research topic, evidence of the inequality-increasing effects of public debt implies that governments can use debt as a policy tool to address inequality. Namely, the persistently rising or high levels of public debt in recent periods in many countries can be harmful to economic equality. As "the most just and efficient solution" (Piketty, 2014), some economists argue that governments should impose an exceptional tax on private capital to reduce public debt levels in order to improve income distribution.

The imposition of an exceptional tax on private capital as a means to decrease public debt is a policy approach that has been considered and implemented by some countries in specific circumstances. One notable example is the one-time wealth tax imposed by France in the early 1980s. The tax aimed to alleviate public debt and reduce income inequality. However, studies analyzing the long-term impact of the French wealth tax suggest mixed results in terms of its effectiveness in reducing debt and its effects on the economy and capital flight (Piketty, 1997; Atkinson, 2001). Another example is the case of Argentina, which implemented a one-time tax on worth-net-high individuals in 2001 as a response to its severe economic crisis. The tax aimed to raise revenue and address the country's fiscal challenges. The short-term impact of the tax was an increase in government revenue, but its long-term effects on public debt and income inequality are subject to ongoing analysis and debate (Cetrángolo & Chisari, 2009). It is important to note that the effectiveness and fairness of such a tax policy can be subjective and depend on various factors, including the specific design of the tax, its impact on economic growth and investment, and the political

and social context in which it is implemented. The feasibility and consequences of implementing such a tax would require careful analysis and consideration of potential implications.

The regression results show that labour market institutions such as trade unions and collective bargaining can be helpful to decrease inequality. Then, governments can implement measures that would increase the bargaining power of workers relative to large corporations in order to improve income equality. Overall, the study contributes to the relevant literature by producing comprehensive and robust evidence on the inequality effects of public debt in developed and developing countries.

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