The Impact of Fiscal Austerity Measures on Inequality: A Study of OECD countries

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Resumo:

Este estudo analisa os efeitos da consolidação fiscal na desigualdade de renda em países da OCDE de 1978 a 2014, utilizando dados de Alesina et al. (2019). Empregando a metodologia de Jordà (2005), estimamos o efeito da austeridade nas desigualdades: de renda disponível, de mercado, salarial e funcional. Estimamos um aumento da desigualdade salarial no curto e médio prazos, e queda na participação do trabalho na renda a curto prazo. O efeito redistributivo ressalta a importância da proteção social a curto prazo. Encontramos também um aumento significativo na desigualdade de ganhos com relação à base da distribuição.

Palavras-chave: austeridade fiscal, política fiscal, desigualdade de renda, projeções locais.

Abstract:

This study examines the effects of fiscal consolidation on income inequality in OECD countries from 1978 to 2014, using data from Alesina et al. (2019). Employing Jordà's methodology (2005), we estimate the impact of austerity on inequalities: disposable income, market income, wage, and functional. We find an increase in wage inequality in the short and medium runs, and a decrease in labor's share of income in the short run. The redistributive effect underscores the importance of social protection in the short term. Additionally, we observe a significant increase in earnings inequality, when including the lower end of the distribution.

Keywords: fiscal austerity, fiscal policy, income inequality, local projections.

JEL: D30, D60, E60, E62.

Área Temática: 1- Economia.

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1) Introduction

The global financial crisis that erupted in 2007-2008 has spurred research on the consequences of austerity measures on aggregate demand (Blanchard and Leigh, 2014; Guajardo et al., 2014; Heimberger, 2017; Jordà and Taylor, 2016, Gechert et al. 2019; Alesina et al., 2019). Following the crises, several advanced economies implemented fiscal austerity measures in an attempt to address rising government debt levels. Contrary to the hypothesis of an expansionary fiscal adjustment (Alesina and Ardagna, 2010), these countries experienced reduced economic growth rates that contributed to a slow and hesitant economic recovery (Fatàs and Summers, 2018).

The econometric literature assessing the impact of fiscal austerity measures on income inequality has received comparatively less attention, as pointed out by Heimberger (2020). Still, as illustrated by Table 1, numerous studies on the topic exist for OECD countries (Agnello and Sousa, 2012; Ball et al., 2013; Woo et al., 2013; Schaltegger and Weder, 2014; Agnello and Sousa, 2014; Furceri et al., 2016; Agnello et al., 2016; Schneider et al., 2017; Castro, 2018; Klein and Winkler, 2019; Ciminelli et al., 2019; Heimberger, 2020) and for emerging economies (Cardoso and Carvalho, 2023; Jalles, 2017; Furceri et al., 2018).

While Castro (2018) focuses only on the market income inequality (pre-fiscal income), Agnello and Sousa (2012), Agnello and Sousa (2014), and Woo et al. (2013) argue that the primary impact of austerity measures occurs via the tax and transfer system. As commented by Woo et al. (2013): "*Following Agnello and Sousa (2011), we impose cross-equations restrictions on the coefficients of fiscal consolidation measures in the market income inequality equation (i.e., these coefficients are assumed to be zero) under the common assumption that the fiscal austerity measures (discretionary changes in taxes and spending) only affect disposable income (i.e., income after taxes and transfers)* [...]" (Woo et al., 2013, p.9).

Subsequently, the literature largely focused on the impacts of austerity measures on disposable income (post-fiscal, net of taxes and transfers) inequality (Agnello and Sousa, 2012; Ball et al., 2013; Woo et al., 2013; Schaltegger and Weder, 2014; Agnello and Sousa, 2014; Furceri et al., 2016; Furceri et al., 2018; Klein and Winkler, 2019; Ciminelli et al., 2019; Heimberger, 2020; Cardoso and Carvalho 2023). The literature consistently reports a significant rise in income inequality in the short and medium term following the implementation of austerity measures.

Some authors, however, also estimate the effects on market income inequality. Ciminelli et al. (2019), with a focus on tax-based measures, find that the responses of disposable income and market income are similar. This leads to the conclusion that "*then we could hypothesize that changes in disposable income inequality are mostly driven by changes in the market income distribution*" (Ciminelli et al., 2019, p.114), thus challenging the assumption made by Agnello and Sousa (2014) and Woo et al. (2013). Klein and Winkler (2019) and Heimberger (2020) estimate both impacts and conclude that they yield similar results, with the impact on market income inequality being more pronounced.

As the literature focuses on the "final", or overall, impact of austerity on income inequality, by investigating the impact on disposable (post-fiscal) income inequality, some explanations for the increase in inequality include: i) reductions in social transfers may disproportionately affect households in the lower income strata; ii) increases in taxes, especially if they rely on regressive measures, tend to affect the lower end of the income spectrum more (Rawdanowicz et al., 2013; Heimberger, 2020; Cardoso and Carvalho, 2023; Woo et al., 2013; Furceri et al., 2018; Jalles, 2017; Agnello and Sousa, 2014). We refer to this mechanism as the "redistributive channel" (see Figure 1).

In the literature about the decomposition of the Gini index, Lerman and Yitzhaki (1985) and Francese and Mulas-Granados (2015) suggest three more channels through which austerity impacts income inequality, besides the redistributive one (which affects disposable income inequality, representing

the overall/final effect): wage inequality, functional distribution inequality, and the non-labor income inequality channel. These channels affect the market income inequality.

The literature about austerity's effects on inequality has, to some extent, examined some of the channels pointed out by the Gini decomposition literature individually. For instance, Klein and Winkler (2019) focus on the redistributive channel by assessing the impact of austerity measures on the "redistributive measure", which is the disparity between market and disposable income inequalities. They found that the redistribution measure increases in the short-term following fiscal adjustments due to the influence of automatic stabilizers (Klein and Winkler, 2019) and the social safety net (Heimberger, 2020).

The second channel indicated by the Gini decomposition analysis is the "wage inequality channel", which impacts market income inequality. Nevertheless, it is important to note that the econometric literature surveyed in Table 1 has not yet delved into the wage inequality channel. The inequality among workers, on the other hand, has been suggested as a possible channel through which austerity measures affect income inequality (Klein and Winkler (2019), Cardoso and Carvalho (2023), and Heimberger (2020)). Klein and Winkler (2019) call this channel the "earnings inequality channel".

The earnings inequality channel takes into account not only wage disparities but also employment, considering that earnings result from both wages and the hours worked. We introduce this as an additional channel to be investigated, which we will refer to as the "employment channel", combining the wage inequality with the employment channels. Some studies have already explored the employment channel in isolation by estimating the negative (positive) effects of austerity measures on employment (unemployment) (Klein and Winkler, 2019; Ball et al., 2013; Woo et al., 2013; Castro, 2018). These authors suggest that the employment channel is pertinent in influencing income inequality. However, there is currently no study that estimates the impact of austerity measures on earnings inequality, nor on wage inequality.

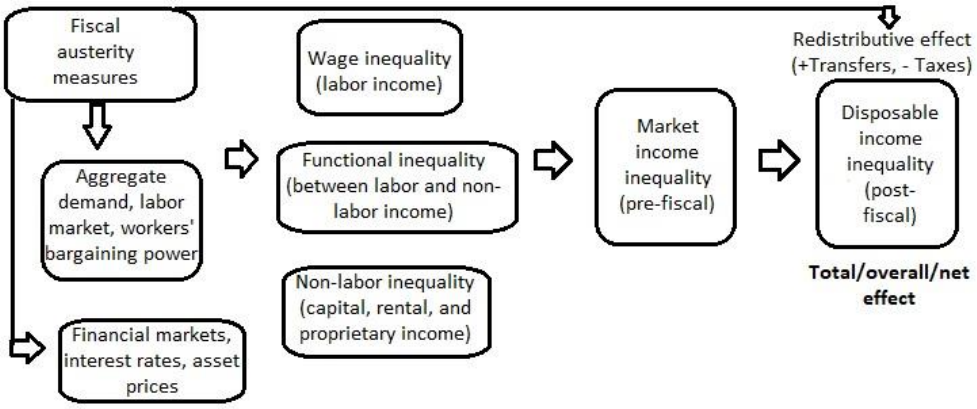
The third channel suggested by the Gini decomposition is the "income composition channel" - as termed by Klein and Winkler (2019) (we call "functional distribution channel"). According to this channel, households at the lower end of the income distribution primarily rely on labor income, while wealthier households derive a larger share of their income from capital. As austerity measures negatively impact GDP (Heimberger, 2017; Guajardo et al., 2014), the recessions induced by restrictive fiscal policies tend to weaken workers' bargaining power, leading to a reduction in their income share. This idea is well-illustrated by the Goodwin-inspired Kaleckian empirical literature, which emphasizes the importance of expanding aggregate demand to strengthen workers' bargaining power and increase the labor share in GDP (Barbosa Filho and Taylor, 2006; Kiefer and Rada, 2015). The functional distribution channel was analyzed by Klein and Winkler (2019), Ball et al. (2013), and Furceri et al. (2016). These studies typically estimate that austerity measures diminished the portion of income allocated to workers.

Finally, the fourth channel implied by the Gini decomposition is the non-labor income inequality channel. Albeit we do not estimate the effect on this channel directly, we can infer its sign by using the Gini decomposition equation (even though we cannot investigate its magnitude). Figure 1 illustrates how the individual channels interact to produce the overall or net distributional impact (the effect on the disposable income inequality). Although not the central focus of this study, monetary policy is included in Figure 1 due to the substantial research on its influence on inequality (see Kappes, 2023).

This paper aims to contribute to the macroeconometric literature concerning the link between austerity measures and income inequality that applies the "narrative approach" (Devries et al., 2011) to provide additional evidence on the effects of fiscal austerity in OECD countries. We have three main contributions. First, our study is the first to investigate the channels through which austerity measures increase income inequality in order to assess the individual role of each channel using the Gini index decomposition (Lerman and Yitzhaki, 1985; Francese and Mulas-Granados, 2015). We

address the gap in the literature related to the assumption in studies that there is only the overall effect of austerity on income inequality - that is, the effect on disposable income inequality (Woo et al., 2013; Agnelo and Sousa, 2012; Agnelo and Sousa, 2014).

Figure 1: Channels through which austerity measures affect inequality



Source: author's elaboration.

On the contrary, our hypothesis is that changes in disposable income inequality are also driven by changes in market income inequality, beyond the impact of austerity on inequality via taxes and transfers. Using this approach, we are able to infer the relative importance of each channel in the decomposition of the Gini index in the short and medium runs. Although the literature has examined some of these channels individually, they were analyzed in isolation[2]. Secondly, our study is pioneering in this econometric literature by incorporating wage inequality, referred to as the "wage inequality channel". Third, our research is the first to estimate the effects of austerity measures on earnings inequality. Prior studies exploring this channel solely focused on employment (as done by Klein and Winkler, 2019; Ball et al., 2013; Woo et al., 2013; Castro, 2018).

The remainder of this paper is organized as follows: Section 2 reviews the econometric literature on the macroeconomic effects of fiscal consolidation measures on inequality. In Section 3, we elaborate on the econometric methodology and the data employed in this study. Section 4 presents the baseline empirical results, as well as a discussion about the channels. In Section 5, we draw our conclusions.

2) Related literature

Table 1 provides an overview of the relevant econometric literature concerning the connection between fiscal consolidation episodes and income inequality. With the exception of Agnello and Sousa (2012), the other fourteen studies reveal that fiscal consolidations typically result in an increase in disposable income (post-fiscal) inequality, as measured by the Gini index. This impact is more pronounced in the medium run, manifesting after a few years. The literature also suggests that spending-based fiscal consolidations have more relevant distributive consequences than tax-based ones.

[2] For instance, as previously mentioned, the redistributive channel has been analyzed by Klein and Winkler (2019) and Ciminelli et al. (2019), while the functional distribution channel has been examined by Klein and Winkler (2019), Ball et al. (2013), and Furceri et al. (2016).

Table 1: Econometric literature on the relationship between fiscal austerity and income inequality

Study	Country	Period	Fiscal consolidation data	Econometric method
Agnello and Sousa (2012)	18 OECD countries	1970-2010	CAPB	Panel static method (SUR).
Ball et al. (2013)	17 OECD countries	1978-2009	Devries et al. (2011)	Panel dynamic method (IRFs based on Jordà, 2005).
Woo et al. (2013)	17 OECD countries	1978-2009	Devries et al. (2011)	Panel static methods (FEE and SUR), and IRFs.
Schaltegger and Weder (2014)	17 OECD countries	1978-2009	Devries et al. (2011)	Panel static approach (FEE).
Agnello and Sousa (2014)	18 OECD countries	1978-2009	Devries et al. (2011)	Panel static approach (SUR).
Furceri et al. (2016)	17 OECD countries	1978-2009	Devries et al. (2011)	Panel dynamic approach (IRFs based on Jordà, 2005).
Agnello et al. (2016)	13 European countries	1980-2008	Devries et al. (2011)	Panel static method (FEE) and IRFs.
Jalles (2017)	28 emerging economies	1980-2014	CAPB	Panel data static and dynamic methods (SUR and IRFs based on Jordà, 2005).
Schneider et al. (2017)	12 European countries	2006-2013	CAPB	Panel data static method (FEE).
Furceri et al. (2018)	103 emerging economies	1990-2015	Forecast errors method	Panel dynamic approach (IRFs based on Jordà, 2005).
Castro (2018)	15 European countries	1990-2012	Devries et al. (2011)	Panel dynamic approach (Least Squares dummy variable estimator).
Klein and Winkler (2019)	17 OECD countries	1980-2011	Devries et al. (2011)	Panel dynamic approach (IRFs based on Jordà, 2005).

Study	Country	Period	Fiscal consolidation data	Econometric method
Ciminelli et al. (2019)	16 OECD countries	1978-2012	Devries et al. (2011) and Alesina et al. (2015)	Panel dynamic approach (PVAR).
Heimberger (2020)	17 OECD countries	1978-2013	Devries et al. (2011) and Alesina et al. (2015)	Panel dynamic approach (IRFs based on Jordà, 2005).
Cardoso and Carvalho (2023)	9 South American countries	1991-2017	David and Leigh (2018)	Panel dynamic approach (IRFs based on Jordà, 2005).

Source: author's elaboration. IRFs: Impulse Response Functions. CAPB: Cyclically- Adjusted Primary Balance. FEE: Fixed Effects Estimator. SUR: Seemingly Unrelated Regressions. PVAR: Panel Vector Autoregressive.

To identify discretionary changes in fiscal policy, this literature has primarily employed two main approaches. The first approach is the CAPB (Cyclically Adjusted Primary Balance) procedure, often referred to as the "conventional approach". The second approach is the narrative method, primarily relying on the dataset compiled by Devries et al. (2011) (see Table 1). As Cardoso and Carvalho (2023) contend, in the 1990s and early 2000s, the empirical literature addressing the identification of fiscal episodes relied on the CAPB approach. This method involves accounting for the effects of the business cycle on government revenues and expenditures (Giavazzi and Pagano, 1996; Agnello and Sousa, 2012; Jalles, 2017; Schneider et al., 2017).

However, since the 2010s, certain limitations associated with this statistical concept have been brought to light (Devries et al., 2011; Ball et al., 2013; Agnello and Sousa, 2012; Heimberger, 2020; Agnello and Sousa, 2014; David and Leigh, 2018; Cardoso and Carvalho, 2023). Devries et al. (2011) and David and Leigh (2018) point out that cyclical adjustment methods suffer from endogeneity problems, which means that the identified fiscal shocks may be correlated with the economic cycle and may not accurately represent discretionary changes in fiscal policy. Furthermore, the authors argue that even if the CAPB accurately reflects discretionary changes in fiscal policy, such changes may be driven by responses to cyclical fluctuations: "*For example, governments may cut government spending in an overheating economy, implying a positive correlation between fiscal policy tightening and rapid growth*" (Devries et al., 2011, p.3).

The so-called "narrative approach" represents a second major strategy in the econometric literature to cope with endogeneity caveats (Ramey and Shapiro, 1998; Ramey, 2011). This approach draws inspiration from the seminal paper by Romer and Romer (2010), which uses governments' budget documents to identify the size, timing, and principal motivation for all significant postwar tax policy actions in the United States. Through this method, they identify measures motivated primarily by deficit reduction and construct an "exogenous" measure of fiscal policy, which is expected to reflect discretionary changes unaffected by economic cycle fluctuations.

The narrative approach, however, can also have some drawbacks. According to Jordà and Taylor (2016), this methodology largely relies on subjective judgment and may not eliminate endogeneity problems entirely. Despite potential pitfalls related to the narrative approach, this method to identify fiscal shocks has been extensively applied in the most recent macro-

econometric literature on the link between fiscal policy and income distribution (see Table 1) to tackle the endogeneity issues described above.

Following the Romer and Romer (2010) strategy, Devries et al. (2011) constructed a new dataset of fiscal consolidation episodes for 17 OECD economies during 1978-2009, examining contemporaneous policy documents to identify the motivation and budgetary impact of fiscal policy changes. As can be seen in Table 1, most studies in the econometric literature use the Devries et al. (2011) database to estimate the effects of discretionary fiscal policy shocks on income inequality. Albeit the database built by Devries et al. (2011) has become popular in the recent econometric literature, our study utilizes the narrative dataset for fiscal shocks developed by Alesina et al. (2019), which comes with two notable advantages: i) It spans a more extended time frame compared to the dataset used by most studies, specifically Devries et al. (2011) (1978-2009), covering the period from 1978 to 2014; ii) This dataset offers a decomposition of fiscal shocks into components of taxes and expenditures, providing an intriguing avenue for extending our study, as we can analyze the channels by also disaggregating fiscal shocks[3] .

3) Data and Methodology

3.1) Data

As outlined in Section 1, this paper aims to assess the influence of austerity on inequality by examining the various channels through which it operates. To comprehensively evaluate this impact, our methodology involves seven key exercises for 17 OECD countries, as we will explain in Section 3.2. The first exercise estimates the effect of fiscal consolidations on disposable income inequality, encompassing post-fiscal or post-tax and transfer income. The second exercise, on the other hand, excludes the influence of the tax and transfer system, allowing us to estimate the effect of austerity measures on market income inequality (pre-fiscal income). To conduct our analysis, we utilized Gini indices for disposable income and market income data sourced from the Standardized World Income Inequality Database (SWIID) (Solt, 2020), version 9.5. This database, widely referenced in the literature in Table 1, provides harmonized data with a high level of comparability across countries (Heimberger, 2020).

The third exercise focuses on estimating the impact of consolidation programs on gross wage inequality, a pre-fiscal measure as in the case of market income. For this purpose, we gathered Gini index data for gross wages from the Luxembourg Income Study (LIS)[4]. To explore the employment channel in the dynamics of the effects of austerity on inequality, we retrieved data from the Comparative Welfare States Data Set by Brady et al. (2020, 2014, 2004). These authors collected gross earnings inequality data from the OECD, Database on Trends in Earnings Dispersion (various years) and OECD, Labour Force Statistics (database). We initially used the most recent dataset (2020). We were also able to gather more data by using previous versions of the same dataset (2014 and 2004), especially older data, and also from OECD directly. We collected three distinct measures of gross earnings inequality: the inequality between the top of the earnings distribution and the bottom (Percentile Ratio 90/10), between the middle and the bottom (Percentile Ratio 50/10), and between the top and the middle (Percentile Ratio 90/50)[5]. Lastly, to investigate the effects of austerity

[3] I am currently working on a second paper about this topic by doing this disaggregation.

[4] The data present varying initial points for each country. Consequently, the panel data for this particular analysis is unbalanced. Linear interpolation was applied to fill gaps in the data for Australia, Finland, Denmark, and the Netherlands (as in Heimberger, 2020). We conduct a robustness check by excluding these countries from the sample in order to show they are robust. Moreover, data for Italy, Japan, and Portugal are insufficient and therefore not included in this exercise.

[5] As some data points are missing, the panel data is characterized by its unbalanced nature. In addressing this, we applied linear interpolation for the missing data, a method also employed in similar studies such as Heimberger (2020) and conducted alternative exercises. Results were robust.

measures on the disparity between capitalists and workers, we assess its influence on the functional income distribution, specifically utilizing the "share of labor compensation in GDP at current national prices", sourced from the Penn World Table, version 10.0.

Following recent empirical literature (refer to Section 2 for details), the empirical analysis in this paper is based on fiscal consolidation measures identified through the "narrative approach", using data by Alesina et al. (2019) to identify the fiscal shocks for the years 1978-2014. Finally, we incorporate control variables to mitigate potential estimation biases arising from unobservable factors affecting inequality dynamics in the econometric analyses. These variables are included to ensure the robustness of our findings, which indeed prove to be resilient. We test the following variables recommended by the literature: i) real GDP per capita (denominated in US dollars in 2015 prices and constant PPP); ii) trade openness (trade-to-GDP); iii) unemployment rate; iv) GDP growth rate; v) inflation rate, annual, measured by the Consumer Price Indices (CPI). Variables i, iii, iv and v are retrieved from the OECD Stat Database. Variable ii is obtained from the World Development Indicators database (The World Bank).

3.2) Methodology

This paper focuses on the estimation of the distributional impacts induced by fiscal consolidation measures in the short- and medium-term contexts. Our analytical focus encompasses several dimensions of inequality, encompassing disposable income, market income, wage, and functional distributions, evaluated through the Gini index as well as earnings inequality measures. To account for the intricate dynamics associated with fiscal consolidation and its evolving impact on inequality, we adopt a dynamic methodology based on Jordà's (2005) proposition. Specifically, our approach involves estimating impulse response functions (IRFs) through local projections, aligning with recent advancements in econometric methodology studying the distributional effects of fiscal policy – see Table 1 (e.g., Ball et al., 2013; Furceri et al., 2016; Furceri et al., 2018; Klein and Winkler, 2019; Heimberger, 2020; Cardoso and Carvalho, 2023).

For each future period *k*, the following exercises are estimated on annual data by Ordinary Least Squares (OLS). In Exercises 2, 3, 5, 6, and 7 (See Table A, in Appendix), *k*=1, ..., 8 (Ball et al., 2013; Furceri et al., 2016; Heimberger, 2020; Carvalho e Cardoso, 2023). However, we include one more period in Exercise 1 since results show a higher persistent effect of austerity on disposable income inequality (its peak response occurs in the ninth period so that *k*=9). In contrast, Exercise 4 considers *k*=6 due to stationarity problems in the dependent variable when we estimate the impact considering *k* higher than six. We excluded periods seven and eight to avoid spurious relations in our results. Impulse-response functions are obtained by plotting the estimated β_n^k with confidence bands for the estimated functions being computed using the standard deviations associated with the estimated coefficients (Ball et al., 2013). Confidence intervals are estimated based on Driscoll and Kraay's (1998) standard errors, which are robust with respect to heteroskedasticity and serial and cross-sectional correlation (Klein and Winkler, 2019; Cardoso and Carvalho, 2023). We estimate the following equation:

$$Ineq_{i,t+k} - Ineq_{i,t} = \sum_{n=0}^{x} \beta_n^k \, S_{i,t-n} + \sum_{j=0}^{y} \delta_j^k \Delta Ineq_{i,t-j} \; + \gamma_k Z_{i,t} + \theta_i^k + \varphi_t^k + \epsilon_{i,t+k}^k \quad (1)$$

where $Ineq$ represents the inequality measure (in logarithm), S is the fiscal shock variable from Alesina et al. (2019), as % of GDP, β_n^k measures the distributional impact of fiscal consolidation episodes for each future period *k*; $\Delta Ineq$ denotes the lags in the change of the measure of inequality; $Z_{i,t}$ represents a vector of additional control variables; θ_i^k are country fixed effects and φ_t^k are time fixed effects. Finally, $\epsilon_{i,t+k}^k$ represents the residual term. Note *x* is the number of lags included in the

model for the fiscal shock to control its persistence (Furceri et al., 2016), while y denotes the lags in the change of the measure of inequality, to control its persistence since changes in inequality can be dependent on past changes (Heimberger, 2020). We included the number of lags that presented the best exercise[6]. However, we conducted many other alternative models and exercises are extremely robust to changes in the number of lags.

Table A in Appendix presents seven exercises. In each, $Ineq$ in Equation 1 corresponds to an inequality measure, as the Table indicates. Also, the Table shows the sample of countries included in each estimation. In our analysis, we initially assembled a sample of 17 countries. However, for the exercises, we adjusted the country inclusion based on data availability and to ensure the robustness of our findings. The dependent variables, included in differences in Exercises 1-7, are stationary[7]. Except for the GDP growth rate, the other four additional control variables are included in the first difference. Our baseline exercises do not include control variables.

We conducted various robustness tests for all exercises estimated in this paper, including: i) using an alternative number of lags for the inequality variable and for the fiscal shocks, ii) adding control variables (also with a lag for them), iii) testing alternative samples of countries, iv) using Devries et al. (2011) database for 1978-2009 and Alesina et al. (2019) for 2010-2014; v) using Gupta et al. (2017), which leverages Devries et al. (2011) for 1978-2009, Alesina et al. (2015)[8], for 2010-2013, and their dataset for 2014 (Gupta et al., 2017, for 2014) [9], vi) testing linear interpolated data for the series that have missing data, a method also employed in similar studies such as Heimberger (2020). The exercises presented in Section 4 are robust to all these changes.

4) Results

4.1) The impact of austerity measures on disposable and market income inequalities

Figure 2 (left side) displays the cumulative impact on disposable income inequality resulting from a 1% of GDP fiscal consolidation episode, as estimated by Exercise 1. The shaded regions in all the graphs represent the confidence intervals of the impulse response functions, calculated using a standard error band based on the estimated coefficients, which aligns with Ball et al. (2013), Furceri et al. (2016), Heimberger (2020), and Cardoso and Carvalho (2023). Table B in the Appendix shows the estimated coefficients, or the cumulative response of disposable income inequality (in %) to a fiscal consolidation equivalent to 1% of GDP, as shown in the impulse response functions in the left side of Figure 2.

Looking at the figure, it can be noted that fiscal consolidation episodes have long-lasting effects on income inequality. After a 1% of GDP fiscal adjustment episode, the Gini index for disposable income exhibits a notable increase of 0.703% nine years later (significant at 10% level) – see Table B in Appendix for all coefficients. This effect is also substantial in the shorter term. Our findings align with existing literature utilizing the "narrative approach" (Devries et al. 2011) on OECD countries (Table 1), which generally indicates that fiscal consolidation measures tend to result in a short- and medium-term increase in disposable income inequality. In comparison, Furceri et al. (2016) reported a similar effect of 0.9% for a comparable set of countries, after eight years.

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[6] For Exercise 1: x=2 and y=1; Exercise 2: x=2, y=1; Exercise 3: x=2, y=3; Exercise 4: x=3, y=1; Exercise 5: x=1, y=2; Exercise 6: x=1, y=1; Exercise 7: x=1, y=2.

[7] For Exercises 1, 2, and 7, we conducted the Levin-Lin-Chu test for balanced panels. For Exercises 3-6, we conducted the Fisher Test for panel unit root using an augmented Dickey-Fuller test recommended for unbalanced panel data (since there are some missing data for the dependent variable).

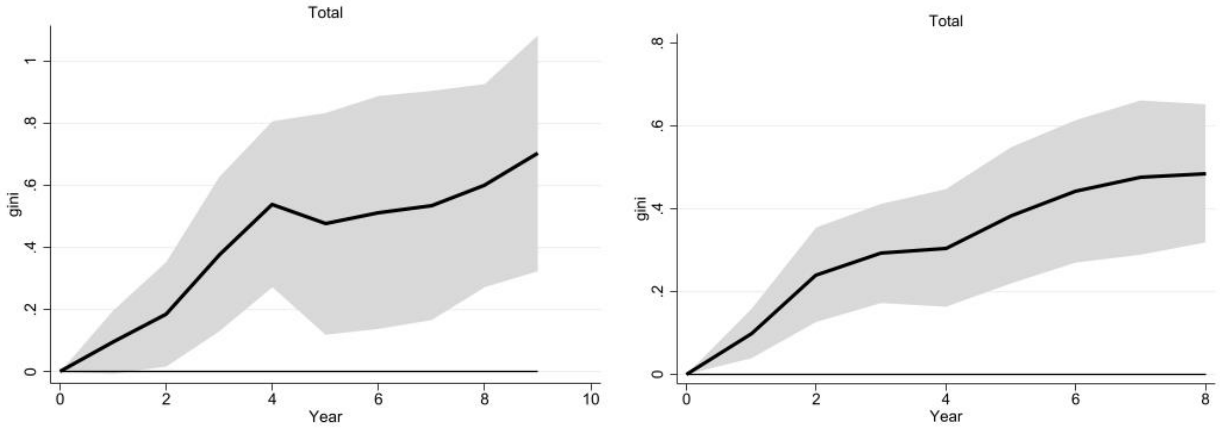
[8] The datasets by Alesina et al. (2015) and Alesina et al. (2019) are highly similar, but Alesina et al. (2019) is more current, encompassing data up to 2014.

[9] There is no data for the Netherlands in Alesina et al. (2015, 2019) databases for fiscal shocks. For this reason, we used Devries et al. (2011) for 1978-2009 and Gupta et al. (2017) for 2010-2014 for this country.

Figure 2 (right side) illustrates the cumulative response of market income inequality to a fiscal consolidation episode equating to 1% of GDP, obtained through the estimation of Exercise 2. After an austerity measure, the Gini index for market income increases by 0.486% and by 0.241% after eight and two years (significant at 1 and 5% levels, respectively).

Figure 2: Cumulative responses of disposable income and market income inequalities (change in %) to a fiscal consolidation shock of 1% of GDP

Disposable income **Market income**



Source: author's elaboration.

4.2) Investigating the channels

To analyze the role of each channel, we draw upon the work of Francese and Mulas-Granados (2015), and Lerman and Yitzhaki (1985), which involves decomposing the Gini index by income sources. A change in market income inequality can be further broken down into its components: a change in the functional inequality, a change in the labor income (wage) inequality and a change in the non-labor income inequality. In addition, we analyze the impact of transfers and taxation on inequality (the redistributive channel), as well as the employment channel (earnings inequality).

As demonstrated by Francese and Mulas-Granados (2015), variations in the overall Gini index for market income G_m occurring over a period starting at time $t_0$can be summarized by the equation:

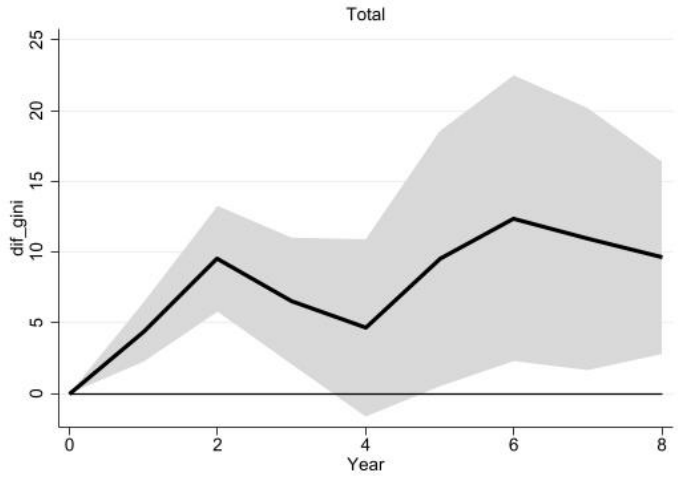
$$\Delta G_m = [\Delta s_l (C_l^0 - C_c^0)] + [s_l^0 \Delta C_l + s_c^0 \Delta C_c] + [\Delta s_l (\Delta C_l - \Delta C_c)] \qquad (2)$$

where s_l is the labor share in income, C_l is the pseudo-Gini coefficient for labor income, and C_c is the pseudo-Gini coefficient for capital income (which, here, we call "non-labor"' income, which includes all income sources that are not from labor). The first bracket is the "income shares impact" (functional distribution channel), and the second bracket is the "Gini coefficient for each income component impact" (which depends on each pseudo-Gini coefficient). It includes the wage inequality channel plus the inequality among capital income (non-labor). The third term is a residual close to zero (income shares and inequality tend to move slowly over time). Then, the impact of transfers and taxation on inequality, that we call "redistributive channel", can be measured by $\Delta G_m - \Delta G_y$, where ΔG_yrepresents variations in the Gini index for disposable income, and ΔG_m represents variations in the Gini index for market income.

4.2.1) The redistributive channel

As shown in Section 4.1, the market income inequality reacts more in the short term when compared to the index measuring disposable income inequality. To provide a more comprehensive evaluation of the redistributive aspect, we conducted an analysis inspired by Klein and Winkler (2019). Our approach began by calculating the difference between market income and disposable income inequalities (redistribution measure). Subsequently, we employed Equation 1 using this measure as the dependent variable[10]. In Figure 3, we illustrate the cumulative response of the redistributive effect to a fiscal consolidation equivalent to 1% of GDP.

Figure 3: Cumulative response of the redistributive measure (change in %) to a fiscal consolidation shock of 1% of GDP



Source: author's elaboration.

An increase in the "redistribution effect" means that disposable income inequality rises by a smaller extent than market income inequality in response to fiscal consolidations (Klein and Winkler, 2019). In Figure 3, we observe an increase in the redistribution measure in the short run (the following two years), significant at 5%. Our results align with the findings of Klein and Winkler (2019), who observed a positive redistributive effect in the short term, particularly during the first two years following austerity measures. Our findings are also in line with the results presented in Section.4.1, indicating that in the short term, market income inequality exhibits a more noticeable response in comparison to the disposable income inequality index.

A potential explanation for observing this effect in the short term is the role played by automatic stabilizers in the tax and transfer system (Espino and Gonzalez-Rozada, 2012), as well as the impact of the social safety net in alleviating immediate inequality effects (Wang et al., 2014; Cammeraat, 2020; Caminada et al., 2019; D'Agostino et al., 2020).

The automatic stabilizers can enhance the redistribution effect and mitigate the impact on income inequality through two main channels: i) direct effect: increasing unemployment benefits, for example, inherently reduces inequality (Jesuit and Mahler, 2004; Mahler and Jesuit, 2006); ii) indirect effect: unemployment benefits, with a substantial fiscal multiplier (Furceri and Zdzienicka, 2012; Cardoso et al., 2023), positively influence aggregate demand and employment, thereby reducing income inequality. This negative impact on inequality is supported by two bodies of empirical literature. The Goodwin cycle literature highlights the role of workers' bargaining power during periods of increasing demand, which diminishes functional income inequality (Barbosa-Filho and

[10] Using x=1 and y=2. We tested other specifications, using alternative numbers of lags and the exercise was robust to these changes.

Taylor, 2006; Kiefer and Rada, 2015). Research also suggests that income inequality tends to increase during economic downturns (Hoover et al., 2009; Maestri and Roventini, 2012; Geiger et al., 2020; Atems and Jones, 2015). Unemployment benefits, for example, could work as a stabilizer element for the aggregate demand and avoid increases in income inequality.

4.2.2) The wage inequality channel

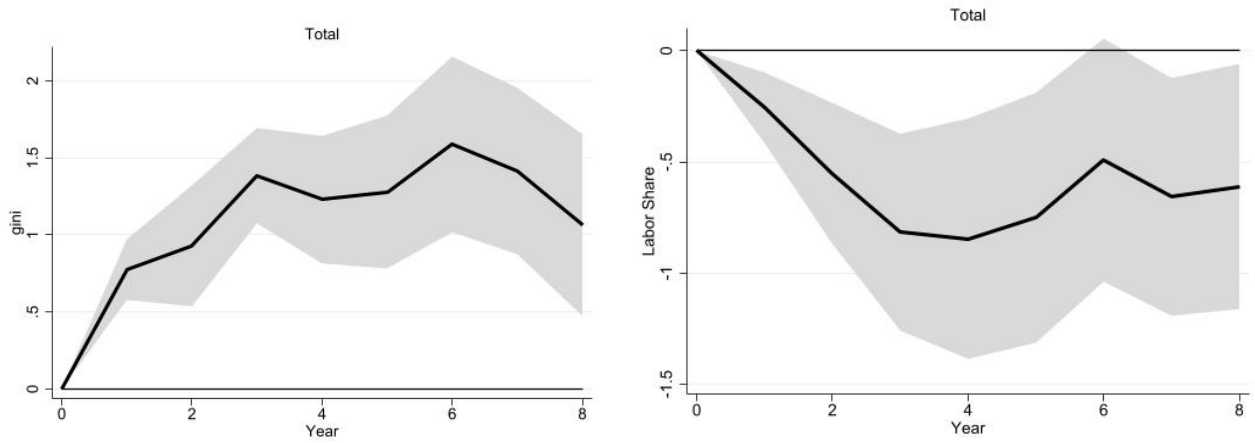
The second channel to be analyzed is the inequality among workers. Figure 4 (left side) presents the cumulative estimated response of gross wage inequality to a fiscal consolidation shock of 1% of GDP (Exercise 3). Notably, the response of wage inequality to a fiscal shock is statistically significant both in the short and medium run: the Gini index for gross wages increases by 1.588% and by 1.385% after six and three years (significant at 1% level)– see Table B in the Appendix.

Explanations for the strong response of wage inequality to austerity can be related to the fact that austerity measures negatively affect the aggregate demand (Heimberger, 2017; Blanchard and Leigh, 2014; Guajardo et al., 2014). The adverse effect on aggregate demand can lead to an increase in the unemployment rate (Ball et al., 2013), primarily affecting those at the lower end of the income distribution, thereby exacerbating inequality. This aligns with the empirical literature that demonstrates the countercyclical nature of income inequality (Hoover et al., 2009).

Studies on wage inequality and its relationship with the business cycle are less common. Morin (2019), for example, finds that observed wage inequality also follows a countercyclical pattern. Moreover, the empirical literature suggests that low-skilled workers at the bottom of the income distribution are more vulnerable to negative shocks in aggregate demand (Hoynes et al., 2012; Forsythe, 2022; Morin, 2019; Mueller, 2017). It suggests a possible channel through which austerity measures increase wage inequality.

Figure 4: Cumulative responses of the wage and functional inequalities (change in %) to a fiscal consolidation shock of 1% of GDP

Wage inequality **Labor share**



Source: author's elaboration.

4.2.3) The functional inequality channel

In this section, we present the results of Exercise 7: the impact of fiscal consolidation episodes on the labor share in income. Figure 4 (right side) depicts the cumulative responses of the labor share in income to an austerity shock of 1% of GDP. The findings consistently point towards a reduction in the income share allocated to wage earners as a consequence of fiscal consolidation measures. They

align with the studies by Ball et al. (2013), Furceri et al. (2016), and Klein and Winkler (2019), who also found significant results. Following the second and third years after the shock, the labor share in income experiences a reduction of 0.55% and 0.816% (both significant at 10% level, see Table B in the Appendix).

The first possible explanation for this result can be related to direct cuts in wages. Consolidation programs often include measures that entail wage cuts in the public sector. This mechanism operates through two distinct effects: i) the direct effect: these wage cuts, resulting from spending-based measures, directly impact the functional distribution of income. Specifically, they lead to a reduction in the labor share of income; ii) the indirect effect: government employees' compensation generates significantly positive multipliers, as observed in OECD countries by Konstantinou and Partheniou (2021). As fiscal multipliers are relevant (Cardoso et al., 2023; Deleidi et al., 2019), especially in recessions (Auerbach and Gorodninchenko, 2012), contractionary fiscal policies affect aggregate demand negatively, which, in turn, diminishes the labor share in income. This is due to the negative impact on workers' bargaining power, as suggested by the empirical literature on the Goodwin cycle (Barbosa Filho and Taylor, 2006).

Similar to the explanations for wage inequality in Section 4.2.2, the adverse impact of austerity measures on the labor share can also be attributed to the unemployment channel. Austerity measures, by dampening aggregate demand, tend to elevate unemployment rates. This disproportionately affects lower-income workers, thereby exacerbating the inequality between labor and capital.

Another potential explanation for the significant impact on the functional inequality channel in response to fiscal shocks lies in the implementation of austerity measures, particularly those centered on reducing expenditures. These measures diminish the “social wage” by curtailing the availability of public services, including access to public education and healthcare (Setterfield and Kim, 2020). The erosion of the social wage can significantly undermine workers' bargaining power, leading to an increase in their cost of job loss for a given level of employment. Importantly, this reduced bargaining effect is not solely correlated with the employment rate.

4.2.4) Comparing the channels

Referring to Equation 2, we have created two tables. Table 2 illustrates the short-term effects of austerity measures on various types of inequality. We have converted the impulse-response data from percentages (%) to percentage points (ppt)[11]. In constructing Table 2, we have focused on the peak response of each variable within the initial three years following the shock, all of which are observed in year 3. Table 3 holds a similar interpretation but is constructed for the medium run. As the peak responses in the medium run do not occur in the same year, we indicate by “t” the time it happens. In both Tables, we also display the statistical significance of each channel.

In the short run (first three years), we observe that the impact of austerity on market income inequality is more pronounced compared to its effect on disposable income inequality. While the latter does not exhibit a statistically significant response in the initial three years, the former shows a positive and significant response at the 5% level. This outcome aligns with our evaluation of the redistributive channel outlined in Section 4.2.1: given that market income inequality responds more robustly than disposable income inequality in the short term, both the automatic stabilizer and the social safety net may play pivotal roles in preventing an overall increase in (disposable income) inequality.

In the short term, wage and functional inequalities show similar responses, with positive and statistically significant coefficients. To summarize, in the short run, all three analyzed channels are

[11] Impacts are calculated in percentage points using the average Gini index/ labor share of the sample.

significant: both the wage and functional channels are similar and relevant, and the overall impact on inequality (specifically, disposable income inequality) is mitigated by the redistributive channel.

Table 2: Summary of the results - peak response in the short run (year 3)

	Short run impact
Effect on disposable income inequality (Total / Overall effect)	not statistically significant
Effect on market income inequality	0.137**
Effect on wage inequality	0.554***
Effect on functional inequality	0.497*

Source: author's elaboration. (***) significant at 1%, (**) significant at 5%, (*) significant at 10%.

Table 3: Summary of the results - peak response in the medium run (year "t")

	Medium run impact
Effect on disposable income inequality (Total / Overall effect)	0.204* (t=9)
Effect on market income inequality	0.227*** (t=8)
Effect on wage inequality	0.635*** (t=6)
Effect on functional inequality	not statistically significant

Source: author's elaboration. (***) significant at 1%, (**) significant at 5%, (*) significant at 10%.

In the medium term, the responses of disposable and market income inequalities align, suggesting that changes in disposable income inequality are primarily driven by shifts in market income inequality (Ciminelli et al., 2019). This implies that the redistributive channel lacks statistical significance. For instance, automatic stabilizers and the social safety net work to dampen the response of disposable income inequality, while the austerity shock itself tends to amplify the response of disposable income inequality. With both disposable and market income inequalities exhibiting similar responses, these opposing forces offset each other in the redistributive channel, resulting in disposable income inequality being predominantly influenced by changes in market income inequality. Furthermore, with the functional inequality channel losing statistical significance in the medium term at the 10% level, wage inequality emerges as the primary driver of inequality changes in this context.

Finally, the market income inequality responds less to austerity shocks than the wage and functional inequality channels combined in both short and medium runs. As market income inequality exhibits a smaller response compared to wage and functional inequality channels, we can infer, using Equation 2[12], that the impact of austerity on non-labor income inequality might be equalizing in both the short and medium run. However, it is important to note that this is an inference based on the Gini decomposition from Lerman and Yitzhaki (1985) (following Equation 2), as we do not directly estimate the impact on non-labor inequality.

In the short run, we estimated the labor share decreases due to an austerity shock. This shift in income composition benefits high-income households, mainly those who receive capital income, and it may contribute to a reduction in inequality within the domain of non-labor income sources. For example,

[12] According to Equation 2: a change in the market income inequality can be decomposed into: a change in the functional inequality, a change in the labor income (wage) inequality and a change in the non-labor income inequality. If the increase in the market income inequality is smaller than the increase in the functional and wage inequalities combined, then we can infer there is a decrease in the non-labor inequality.

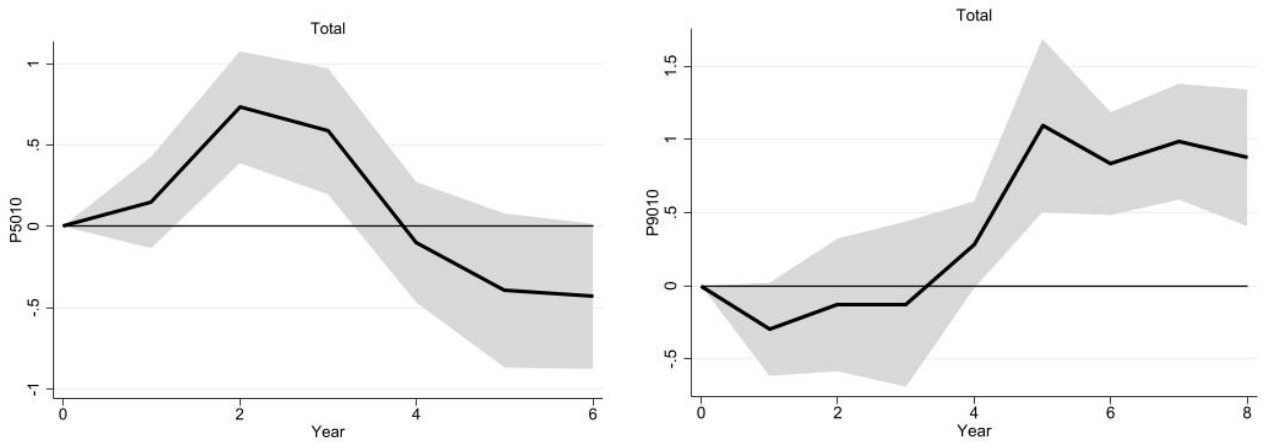
austerity measures tend to impact households that are more susceptible to economic fluctuations, especially those at the lower end of the income spectrum who heavily depend on wages and informal job earnings. In contrast, wealthier households at the top of the income ladder, who predominantly receive capital income, are less affected by these measures. These channels are also suggested by Cardoso and Carvalho (2023) and Klein and Winkler (2019).

4.2.5) The employment channel

We expand our analysis to encompass not only gross wage inequality but also gross earnings inequality. Given that earnings result from the multiplication of wages by hours worked, evaluating earnings inequality provides insight into the employment aspect in addition to wages. Estimating Exercises 4, 5, and 6 (see Table A, in the Appendix) allows us to gain a deeper understanding of the employment channel through which austerity impacts inequality.

Figure 5: Cumulative response of the percentile ratios (50/10) and (90/10) of gross earnings (change in %) to a fiscal consolidation shock of 1% of GDP

(50/10) (90/10)



Source: author's elaboration.

Figure 5 (left side) presents the cumulative estimated response of earnings inequality considering the percentile ratio 50/10 to a fiscal consolidation shock of 1% of GDP (Exercise 4). According to our findings, consolidation fiscal episodes affect the gross earnings inequality within the middle-to-bottom segment of the distribution significantly in the short run. Specifically, after two years, the percentile ratio 50/10 experiences a rise of 0.73% (significant at 5%).

Figure 5 (right side) shows the cumulative response of the percentile ratio 90/10 of gross earnings. As observed in the percentile ratio 50/10 exercise, earnings inequality responds positively to fiscal shocks. This effect is statistically significant only in the medium run: the earnings inequality within the top and the bottom of the distribution increases by 1.094% and 0.984% after five and seven years (significant at 10 and 5% levels), respectively.

We also estimated using the 90/50 percentile ratio. In contrast to the patterns observed in all other analyses, this specific examination indicates a decrease in gross earnings inequality between the top and middle-income segments (see Table B in Appendix). However, this result lacks robustness, becoming statistically non-significant when the model is altered. Due to the fragility of this finding, we choose not to emphasize it, and consequently, we do not display the impulse response function here.

The results in this subsection reveal a negative impact on the lower end of the earnings distribution. This outcome can be elucidated by the literature indicating that individuals at the bottom of the earnings spectrum are more susceptible to variations in the employment rate and, as a result, are disproportionately affected by unemployment (Hoover et al., 2009, Maestri and Roventini, 2012, Hoynes et al., 2012). Our findings also can be explained by the literature suggesting that earnings inequality exhibits a strong countercyclical pattern, as evidenced by Krueger et al. (2010), Heathcote et al. (2020) and Guvenen et al. (2022). Interestingly, the significance of austerity measures on earnings inequality emerges when considering the lower end of the income distribution, given that the percentile ratio 90/50 does not exhibit a statistically significant increase.

5) Concluding remarks

This paper has analyzed the dynamic effects of fiscal consolidation episodes on disposable income, market income, gross wage, and functional inequalities in the short and medium-runs, utilizing an annual data set covering OECD countries from 1978-2014. We have made significant contributions to the empirical literature by conducting the first econometric study that examines the channels through which austerity affects inequality (Figure 1).

In particular, our study delves into the channels through which austerity measures impact income inequality and assesses the individual role of each channel. This approach utilizes the Gini index decomposition, allowing us to gauge the relative importance of each channel in both the short and medium terms. While previous research has explored some of these channels separately, they often remained isolated in their analysis (Klein and Winkler, 2019; Ciminelli et al., 2019; Ball et al., 2013; Furceri et al., 2016). The channels implied by the Gini decomposition are i) the redistribution channel, ii) the wage inequality channel, iii) the functional income inequality channel, and iv) the non-labor inequality channel. In addition, we also analyzed the employment (earnings inequality) channel.

Using the methodology proposed by Jordà (2005), we derived impulse response functions through local projections. Our baseline findings reveal that following an austerity shock, the gross wage inequality index increases by 0.775% and 1.4% after one and seven years, respectively. In the second and third years post-shock, the labor share in income decreases by 0.55% and 0.816%. After nine and eight years, disposable income and market income inequalities rise by 0.703% and 0.486%, respectively.

In the short run (first three years), the impact of austerity on market income inequality outweighs its effect on disposable income inequality, underscoring the significance of automatic stabilizers and the social safety net in moderating overall inequality (disposable income). Furthermore, during this period, both wage and functional channels exhibit similar and statistically significant responses.

In the medium term, the responses of disposable and market income inequalities are similar, leading to a loss of significance in the redistributive effect. Additionally, functional inequality does not show a statistically significant response at the 10% level, while wage inequality emerges as the primary channel affecting market income inequality (significant at 1%). By employing a Gini index decomposition equation, we can infer that the impact of austerity on non-labor inequality may lead to an equalizing effect, in both short and medium runs.

Finally, the employment channel suggests that austerity measures exert a positive influence on earnings inequality. However, this impact on earnings inequality becomes robust and significant when including the lower end of the income distribution. Specifically, the earnings inequality, measured by the percentile ratio 50/10, increases by 0.73% two years after the consolidation shock. When considering the percentile ratio 90/10, this increase is more persistent and pronounced, rising

by 1.094% after five years. Our findings carry important implications for policymakers as they underscore the substantial impact of fiscal consolidation austerity episodes on inequality, both in the short and medium terms, in line with the literature.

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APPENDIX

Table A: Conducted exercises

Exercise	Countries included
Exercise 1: disposable income inequality	15 countries: Australia, Belgium, Canada, Denmark, France, Finland, Germany, Ireland, Italy, Japan, the Netherlands, Portugal, Sweden, the United Kingdom, and the United States.
Exercise 2: market income inequality	13 countries: Australia, Belgium, Canada, Denmark, France, Finland, Germany, Italy, Japan, the Netherlands, Portugal, the United Kingdom, and the United States.
Exercise 3: gross wage inequality	14 countries: Australia, Austria, Belgium, Canada, Denmark, France, Finland, Germany, Ireland, Netherlands, Spain, Sweden, the United Kingdom, and the United States.
Exercise 4: gross earnings inequality (percentile ratio 50/10)	14 countries: Australia, Austria, Belgium, Canada, Denmark, France, Finland, Germany, Ireland, Japan, Portugal, Sweden, the United Kingdom, and the United States.
Exercise 5: gross earnings inequality (percentile ratio 90/50)	15 countries: Australia, Austria, Belgium, Canada, Denmark, France, Finland, Germany, Ireland, Japan, the Netherlands, Portugal, Sweden, the United Kingdom, and the United States.
Exercise 6: gross earnings inequality (percentile ratio 90/10)	13 countries: Australia, Austria, Belgium, Canada, Denmark, France, Finland, Germany, Ireland, Japan, Sweden, the United Kingdom, and the United States.
Exercise 7: labor share in GDP	15 countries: Australia, Belgium, Canada, Denmark, France, Finland, Germany, Ireland, Italy, Japan, the Netherlands, Portugal, Sweden, the United Kingdom, and the United States.

Source: author's elaboration.

Table B: Impacts on each measure of inequality (%), following a fiscal adjustment episode of 1% of GDP (cumulative responses)

Impact/year	1	2	3	4	5	6	7	8	9
Disposable income	0.0956	0.185	0.379	0.539*	0.476	0.513	0.535	0.599*	0.703*
Market income	0.0984	0.241**	0.292**	0.306**	0.384**	0.442**	0.476**	0.486***	-
Wage	0.775***	0.929**	1.385***	1.229***	1.279**	1.588***	1.415**	1.064*	-
Labor share	-0.256	-0.552*	-0.816*	-0.846	-0.751	-0.492	-0.658	-0.610	-
50/10	0.148	0.733**	0.585	-0.0974	-0.394	-0.431	-	-	-
90/50	-0.522**	-0.559**	-0.456	-0.091	0.059	-0.151	-0.0938	0.125	-
90/10	-0.297	-0.13	-0.125	0.28	1.094*	0.834**	0.984**	0.874*	-

Source: author's elaboration. (***) significant at 1%, (**) significant at 5%, (*) significant at 10%.