The Impact of Trade Union Dynamics on Income Inequality Trends in European Union Countries

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Acknowledgment

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1 Introduction

The ever-shifting landscape of the global economy has placed a spotlight on the intricate connection between labor practices and the growing issue of economic inequality (ILO, n.d.). Within the multifaceted mechanisms influencing labor market dynamics, collective bargaining emerges as a crucial tool for shaping fair employment conditions and equitable wage distribution (ILO, n.d.).

Collective bargaining, a well-established process of negotiation between employers and organized worker representatives, fosters agreements that regulate working conditions, salaries, benefits, and other aspects of worker compensation and rights. It has been championed as a potential equalizer within the labor market. The theory proposes that by empowering workers to negotiate collectively, they can achieve a more just distribution of income, enhance job security, and improve working conditions. This, in turn, could potentially address some of the root causes of economic inequality (Schmidt and Strauss 1976). However, the effectiveness and impact of collective bargaining are contingent upon various factors including the legal and regulatory framework, the strength and representativeness of labour unions, the economic context, and the adaptability of these institutions to changing labour market conditions.

The extent of decline and the changing composition of membership within European trade unions since 1980 have been profound, shaping the landscape of collective bargaining and labour representation. According to the European Trade Union Institute (ETUI), Trade union density has notably decreased in many European countries, with estimates indicating a decline from 32.6 percent in 1995 to 26.4 percent in 2001 across the EU25. This decline is particularly pronounced among new member states, where density plummeted from 42.7 percent to 20.4 percent between 1995 and 2001, while in the EU15, it decreased from 31.0 percent to 27.3 percent over the same period (Jeremy Waddington 2005). This declining trend can also be seen from the below graph, which describes the trend of Unions density and coverage over time, on average, for European countries.

This analysis, therefore, delves deeper into the complex relationship between collective bargaining and economic inequality. I will explore the theoretical underpinnings of

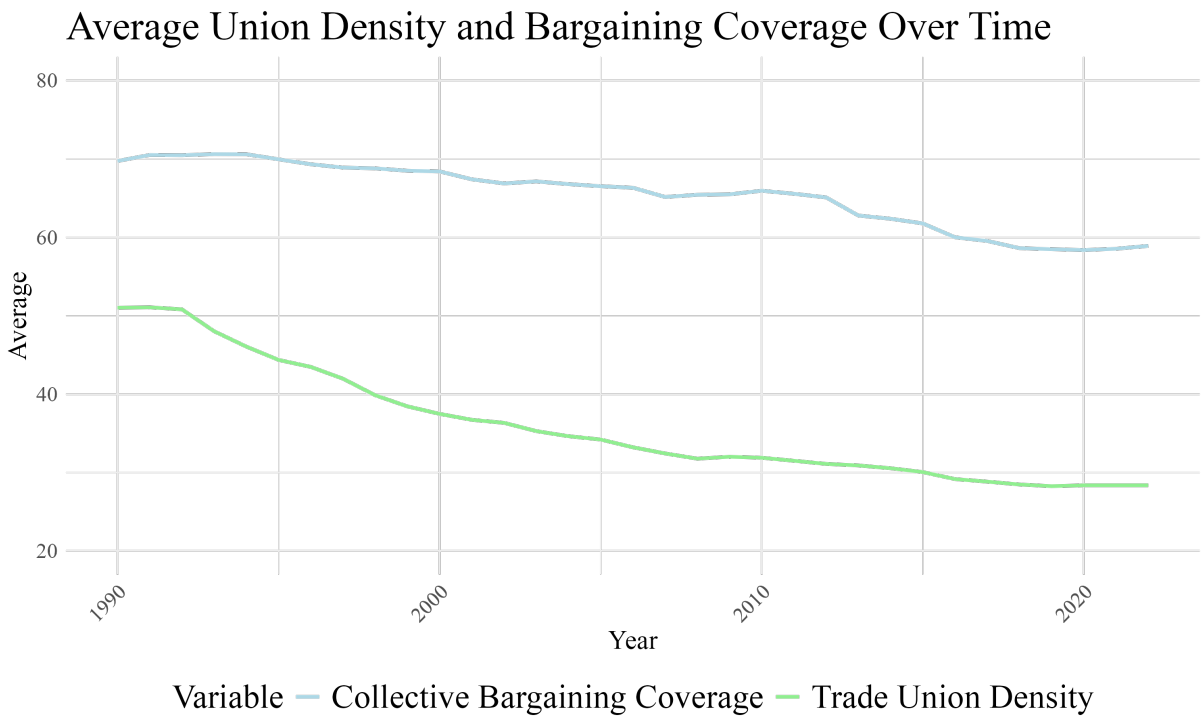

Figure 1: Average Over Time

collective bargaining as an equalizer and examine the empirical evidence regarding its effectiveness. I will also consider the various factors that influence the success of collective bargaining efforts and their ultimate impact on reducing economic inequality.

2 Methodology

The intricate relationship between trade union coverage and income inequality demands a nuanced exploration that transcends mere statistical correlations. This study delves deeper, aiming to illuminate the underlying mechanisms, societal impacts, and policy implications of this dynamic. Recognizing the contingent nature of collective bargaining effectiveness, we acknowledge several factors influencing its success: the legal and regulatory framework, union strength and representativeness, economic context, and adaptability to the evolving labour market's challenges, such as the rise of the gig economy and automation. This research drew inspiration from the work of David Card (2001) and Richard B. Freeman (1984), adopting a comprehensive approach that encompassed various perspectives (David Card 2001), (Richard B. Freeman, James L. Medoff 1985). By leveraging empirical evidence from sources like World Bank Dataset and OECD databases, focusing on data related to trade union coverage (encompassing both density and coverage rate), income inequality metrics (such as the Gini coefficient), and relevant control variables for EU countries[1] over the past two decades. This timeframe allows us to capture the potential impact of recent economic shifts, reforms, and the eastward expansion of the EU. Complementing this quantitative analysis, in-depth case studies will be conducted for a selection of EU countries exhibiting diverse levels of trade union coverage and density. These qualitative investigations will explore the specific mechanisms through which trade union activity shapes wage inequality within each chosen nation.

The selection criteria for case studies will focus on EU countries exhibiting diverse characteristics across four key dimensions. First, we will examine the legal frameworks of each country, assessing whether legal structures support and protect collective bargaining rights or conversely restrict union activity. Second, the strength and representativeness of unions will be evaluated. This includes analyzing how well-organized unions are and how effectively they represent the interests of a broad range of workers, particularly those in precarious or non-standard employment arrangements. Third, the economic structure of

[1]Focusing on Austria, Belgium, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, and the United Kingdom.

each chosen country will be considered. This involves investigating whether the sectoral composition favors industries traditionally associated with strong unions, like manufacturing, or those with lower unionization rates, such as the service sector. Finally, the historical trajectory of unionization in each country will be explored. This analysis will examine how past trends in unionization have shaped the current landscape of labor relations and income inequality. By considering these varied characteristics, the case studies will provide a nuanced understanding of the relationship between trade union coverage and income inequality within the EU.

Finally, to illuminate the causal pathways between trade union coverage and inequality, we will utilize established theoretical frameworks from labor economics and inequality studies. This include exploring theories of wage bargaining, monopsony power (where a single employer dominates a labor market), and rent-seeking behavior (where unions extract economic benefits for their members at the expense of others). This comprehensive approach goes beyond establishing correlations. By combining empirical evidence, case studies, and theoretical frameworks, this research aims to provide a robust analysis of the relationship between trade union density and income inequality within european countries. Ultimately, this project seeks to offer valuable insights for policymakers and stakeholders navigating the contemporary economic landscape. It can inform potential policies that leverage trade union coverage as a tool for addressing income inequality, while also acknowledging the challenges and opportunities presented by the evolving labor market's complexities.

3 The Importance of Trade Unions

Trade unions have historically been cornerstones of the workforce, advocating for workers' rights and ensuring fair treatment in the workplace (Engeman 2021). At the heart of trade union efforts is collective bargaining, a process that not only brings numerous advantages to the table but also presents certain challenges. This chapter delves into the critical role of trade unions and the nuanced dynamics of collective bargaining, underscoring its profound impact on both the workforce and broader society. Collective bargaining enhances compensation and support for union members significantly. Trade unions can achieve gains for workers that would be difficult, or even impossible, on an individual basis, often resulting in unionized workers enjoying wages that are substantially higher than their non-unionized counterparts. This is just one aspect, as collective agreements establish equitable workplace policies that promote justice and due process. Such frameworks benefit employees and employers alike, ensuring a fair and orderly work environment. A connection is frequently made in the literature between the process of unionization and the subsequent increase in job satisfaction and productivity, highlighting these as significant advantages. Union members often report greater satisfaction in their roles, attributed to enhanced pay, benefits, and workplace protections (Rafael Muñoz De Bustillo and Pablo De Pedraza, n.d.). Furthermore, collective bargaining plays a crucial role in promoting social justice by ensuring a more equitable distribution of economic gains. It helps reduce the wage gap between top executives and average workers, serving as a vital tool in the fight against economic inequality (George W. Angell 1974). Empowerment of workers is another critical aspect, as trade unions give workers a collective voice, allowing them to influence decisions and policies that affect their working conditions. This empowerment fosters a more democratic and responsive workplace environment.

The benefits of collective bargaining extend beyond the union members, offering stability during economic downturns and setting standards that raise the bar for non-union employers (ILO 2015). This leads to improved wages and benefits across the board and encourages a more diverse workforce, including higher participation rates among women and older workers. By redistributing income from capital to labour, collective bargaining

contributes to a reduction in economic disparities, supporting a fairer and more equitable society. Efficient dispute resolution mechanisms within union contracts minimize the need for arbitration or litigation, while the potential for innovation and adaptability arises from the collaboration between unions and management. Raising standards across industries compels non-union firms to elevate their practices to remain competitive, establishing a system of checks and balances that ensures corporate power is counterbalanced by a workforce with a voice in decisions impacting their livelihoods.

3.1 The Extent of Decline

Nowadays, trade unions represent a smaller proportion of the employed workforce in Europe than at any other time since 1950. However, it is important to state that in Nordic countries (Norway, Island, Denmark, Finland, Sweden) and Belgium, the decline is marginal, thanks in part to the Ghent system, where trade unions play a role in the administration of unemployment benefits and insurance (Jelle Visser 2019). Moreover, within the trend of declining membership, significant shifts have occurred in the composition of the unionized labour force over the past three decades. First, there is an increasing concentration of members employed in the public sector. This trend surpasses the rate of unionization in other sectors, such as industry and private sector services, in most countries. Second, there is a notable increase in the unionization of female workers. In several countries, women now comprise more than half of union membership. Union membership is becoming increasingly feminized, with women comprising more than half of union membership in several countries. Lastly, retired and unemployed individuals constitute a growing proportion of union membership, ranging from 15 to 20 per cent in the EU, with considerable variation among member states. The consequences of membership decline and shifts in composition are extensive for trade union organization. Shortages in financial and material resources limit the capacity to implement reforms necessary to address social challenges (Jeremy Waddington 2005). These shifts underscore the complex dynamics shaping the role and effectiveness of trade unions in Europe's evolving labour landscape, with implications for collective bargaining and efforts to address economic inequality (Jeremy Waddington 2005).

Unions have long been a cornerstone of worker representation and advocacy in the labour market. However, their role in the modern economy faces significant challenges. The reasons behind the decline in union membership come from both external pressures and internal shortcomings within trade unions themselves. At its core, this decline reflects a growing tension between the evolving social and economic landscape and the traditional structures of organized labour. One prevailing argument posits that the modern individual is increasingly inclined towards individualisation, potentially diminishing their inclination

to join trade unions (Jeremy Waddington 2005).

According to the literature, the primary drivers of the decline in union membership are typically categorized into two main groups: External pressures and Internal challenges. External pressures facing trade unions are complex, stemming from the broader context of globalization, heightened international competition, and deregulation. Among the more direct contributors to declining membership is escalating unemployment. Traditionally, trade unions provide limited assistance to the unemployed, causing many members to abandon their memberships when they lose their jobs. Additionally, shifting labor force dynamics, including the transition from industrial to service sector employment and the emergence of non-traditional work arrangements, present obstacles for union adaptation.

Key internal challenges for trade unions include rigidity and antiquity in organizational practices, a lack of diversity in leadership, inadequate representation, and a disconnection between leadership and membership. Many trade unions face criticism for their reluctance to modernize and adjust to contemporary necessities. The dominance of middle-aged men in leadership roles diminishes the appeal of unions to diverse demographics, and certain groups feel marginalized within union frameworks, hindering their involvement. Furthermore, union leaders are often perceived as disconnected from the current realities of workplaces. In essence, trade unions confront the dual challenge of diminishing resources and increasing membership diversity. Consequently, comprehensive reforms are imperative to ensure their relevance in an evolving labor landscape. This chapter endeavors to delve into these factors comprehensively, shedding light on the intricate dynamics driving the decline in union membership and proposing strategies to revitalize union effectiveness and relevance in the modern era.

4 Trade Union Density and Collective Bargaining Coverage in European Labour Markets

This analysis is rooted in datasets obtained from the Organisation for Economic Cooperation and Development (OECD) statistics and World Bank Data, targeting an array of variables pivotal to understanding the dynamics of labour markets and income distribution (Trapeznikova 2019). In the first place, before jumping to the model's results comparison, it is fundamental to understand the variables' choices in building the models. To measure Income Inequality, economists have been using other metrics such as the Gini Index, Decile Ratios, Palma Ratio, and Theil Index (Trapeznikova 2019). All of them carry benefits and limitations. This case study will use the Gini Index as the dependent variable. The OECD defines it as the comparison of cumulative proportions of the population against cumulative proportions of income they receive, and it ranges between 0 in the case of perfect equality and 1 in the case of perfect inequality ("Inequality - Income Inequality - OECD Data," n.d.). And in this case, income is defined as household disposable income for a specific year. It incorporates earnings, self-employment, capital income and public cash transfer. Therefore, the choice of adopting the Gini Coefficient also relies on the fact that it uses information from the entire income distribution and it is independent of the size of the country's economy and population. Moreover, the Gini Index allows for an easier interpretation of regression results. Now the focus moves to the two important independent variables: Trade Union Density and Collective Bargain Coverage. According to the European Industrial Relations Dictionary, Trade Union Density is defined as the ratio of salary and wage earners that are trade union members to the total number of wage and salary earners in the economy. It is a valuable metric to assess the power of trade unions across countries (EuroFound 2019). On the other hand, Collective Bargaining Coverage is a broader indicator that demonstrates how workers' employment is influenced by negotiations within their organization (EuroFound 2022). The spectrum in Europe is, according to the Eurofound, polarized with a group of countries which have almost complete coverage (Italy, Austria, Spain, Finland, France,

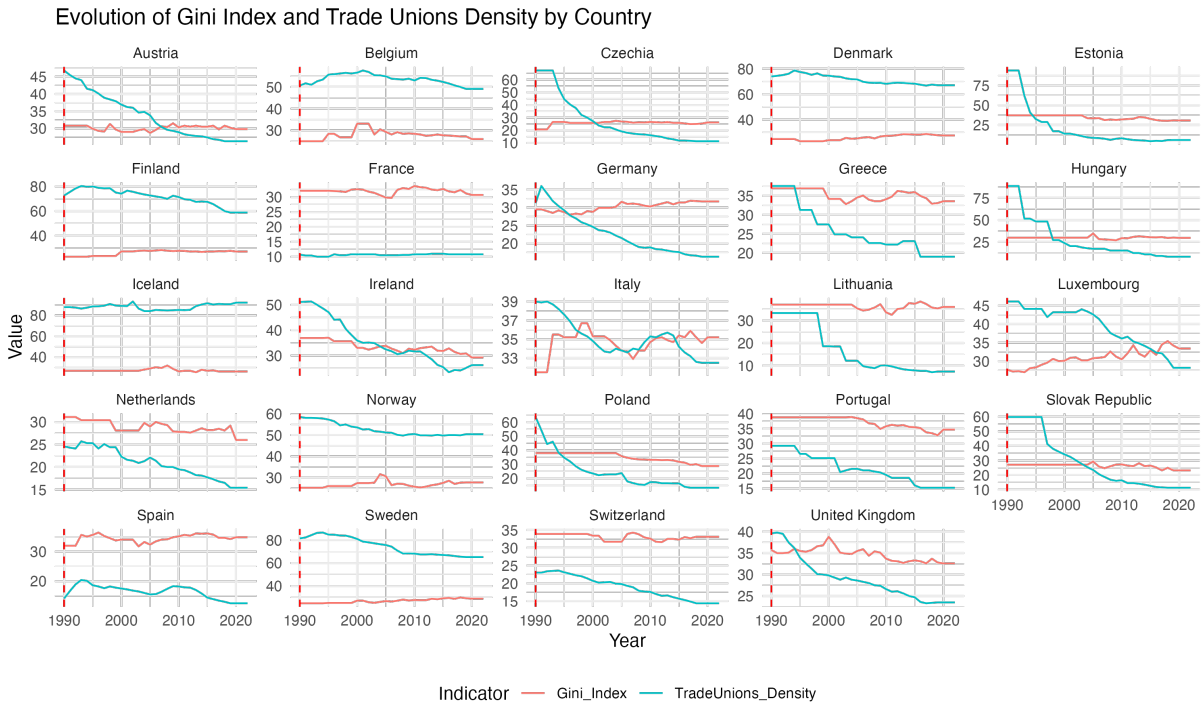

Figure 2: Evolution if Gini Index Over Time

Iceland, and Sweden) and at the other side of the spectrum, another group with hardly any coverage (Estonia, Czechia, Lithuania, Poland, United Kingdom, and Hungary) (EuroFound 2022), (Bental and Demougin 2010). Since the 1980s, trade union membership in most EU countries has declined, partly due to employees increasingly opting out of joining unions and the rise of non-standard employment (Onaran and Guschanski 2018). Moreover, as Bertal and Demougin showed, most european countries have undertaken substantial institutional reforms since the beginning of the 2000's. Meanwhile the industrial output has been significantly growing, the labor shares in national income have been decreasing (Bental and Demougin 2010). Despite this, trade union density, which calculates the proportion of unionized workers in the workforce, shows more stability, reflecting labour market trends. This stability was particularly evident during the recent economic downturn when the economy in the unions declined due to significant employment losses (Onaran and Guschanski 2018).

Union density varies widely across Europe, with Scandinavian countries maintaining high levels compared to the lower rates in Central and Eastern Europe, and a general declining trend observed across Continental and Mediterranean countries. Differences in

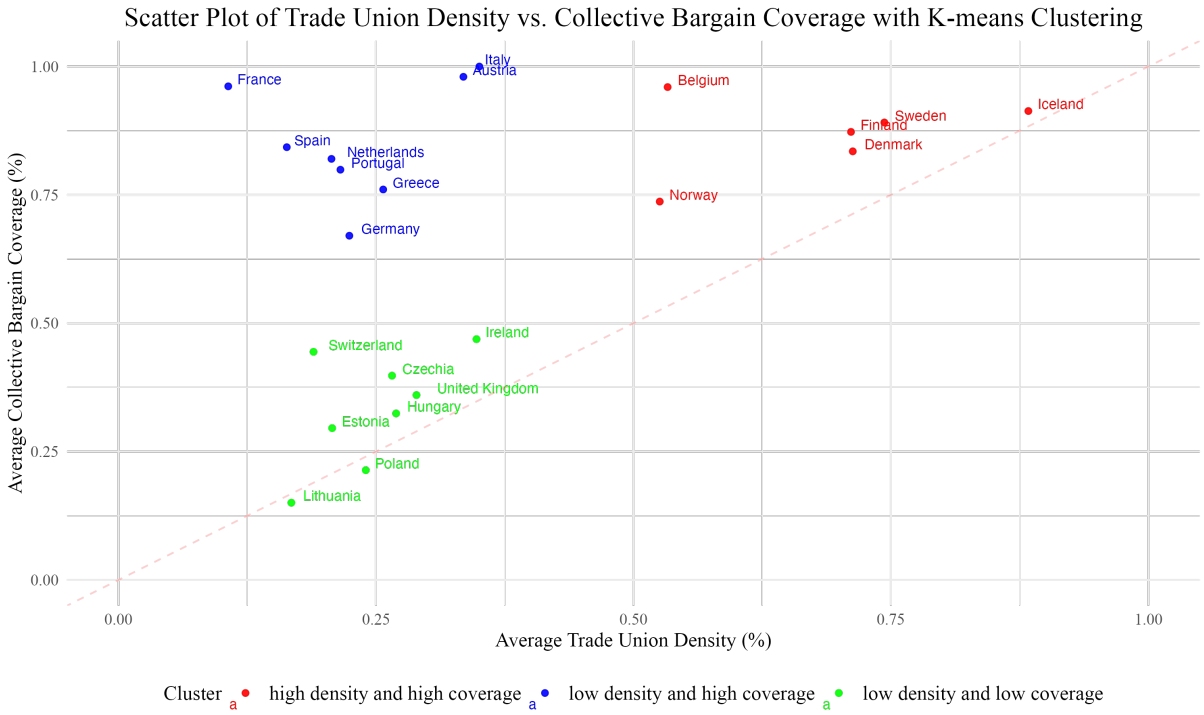

Figure 3: Evolution if Gini Index Over Time

union density are also pronounced between sectors within countries, with higher rates in the public sector due to better job security and working conditions (Bental and Demougin 2010). Factors influencing these differences include institutional arrangements like collective bargaining extension mechanisms, the services provided by unions, and their role in welfare systems. Notably, the Ghent system, which links unemployment benefits administration with trade unions or labor organizations, is more prevalent in Coordinated Market Economies (CMEs) where collective bargaining and collaboration between employers, employees, and the state are more pronounced, contrasting with Liberal Market Economies (LMEs) where such systems are less prevalent due to a greater reliance on market mechanisms and individual responsibility for social welfare provision.

4.1 The non linear relationship between Density and Gini Index

The results from the analysis underscore the necessity of considering non-linear interactions when evaluating the impact of Trade Unions Density on the Gini Index. Initially, the linear model suggested a straightforward positive relationship between union density and income inequality, with a significant coefficient (Estimate = 0.0345, p ¡ 0.001). However, this model's explanatory power was limited, as indicated by an R-squared value of only 0.023. When a quadratic term for Trade Unions Density was introduced in the non-linear model, a more nuanced relationship emerged. The non-linear model revealed a significant positive coefficient for the linear term (Estimate = 0.2574, p ¡ 0.001) and a significant negative coefficient for the quadratic term (Estimate = -0.2425, p ¡ 0.001). This indicates that the effect of union density on income inequality diminishes at higher levels of union density, suggesting a curvilinear relationship. The non-linear model also demonstrated a much higher R-squared value of 0.173, indicating a better fit to the data.

Table 1: Regression Results

	Dependent variable:	
	Gini Index	
	(1)	(2)
Trade Unions Density	0.035^{***}	0.257^{***}
	(0.009)	(0.022)
Trade Unions Density Squared		-0.242^{***}
		(0.022)
Observations	726	726
R^2	0.023	0.173
Adjusted R^2	-0.055	0.105
Note:	*p<0.05; **p<0.01; ***p<0.001	

Furthermore, the Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC) provided additional support for the non-linear model. The linear model had an AIC of -5945 and a BIC of -5940. In contrast, the non-linear model had significantly lower AIC and BIC values -6063 and -6054, respectively. Lower AIC and BIC values imply a better model fit while accounting for model complexity. The substantial reduction in both AIC and BIC in the non-linear model compared to the linear model indicates that

the non-linear model provides a more accurate representation of the data, despite its increased complexity. This improvement reflects that the non-linear model captures the underlying dynamics of how Trade Unions Density affects the Gini Index more effectively than the linear model.

Model	AIC	BIC
Linear Model	-5945.00	-5940.41
Non-linear Model	-6063.37	-6054.19

Table 2: AIC and BIC for Linear and Non-linear Models

The overall analysis suggests that the non-linear model provides a more accurate representation of the relationship between Trade Unions Density and the Gini Index compared to the linear model. This underscores the importance of considering non-linear dynamics to fully capture the impact of union density on income inequality.

Additionally, Quantile-Quantile (QQ) plots were employed to assess whether the residuals of the models followed a normal distribution. The QQ plot for the linear model indicated some deviations from normality, particularly at the tails, suggesting that the model's residuals were not perfectly normally distributed. This deviation implies potential issues with the linear model's ability to capture all underlying patterns in the data. Conversely, the QQ plot for the non-linear model showed a better alignment of the residuals with the theoretical quantiles of a normal distribution. This alignment indicates that the non-linear model provides a more accurate representation of the data structure, resulting in residuals that are closer to normally distributed. The need to modulate Density in a non-linear way becomes evident from these results. A linear approach oversimplifies the complex interactions and fails to account for the diminishing returns of union density on reducing income inequality. By adopting a non-linear model, we achieve a more accurate and comprehensive understanding of how collective bargaining influences economic disparities. This approach not only improves model fit but also provides more reliable insights for policymakers aiming to address income inequality through labour union strategies.

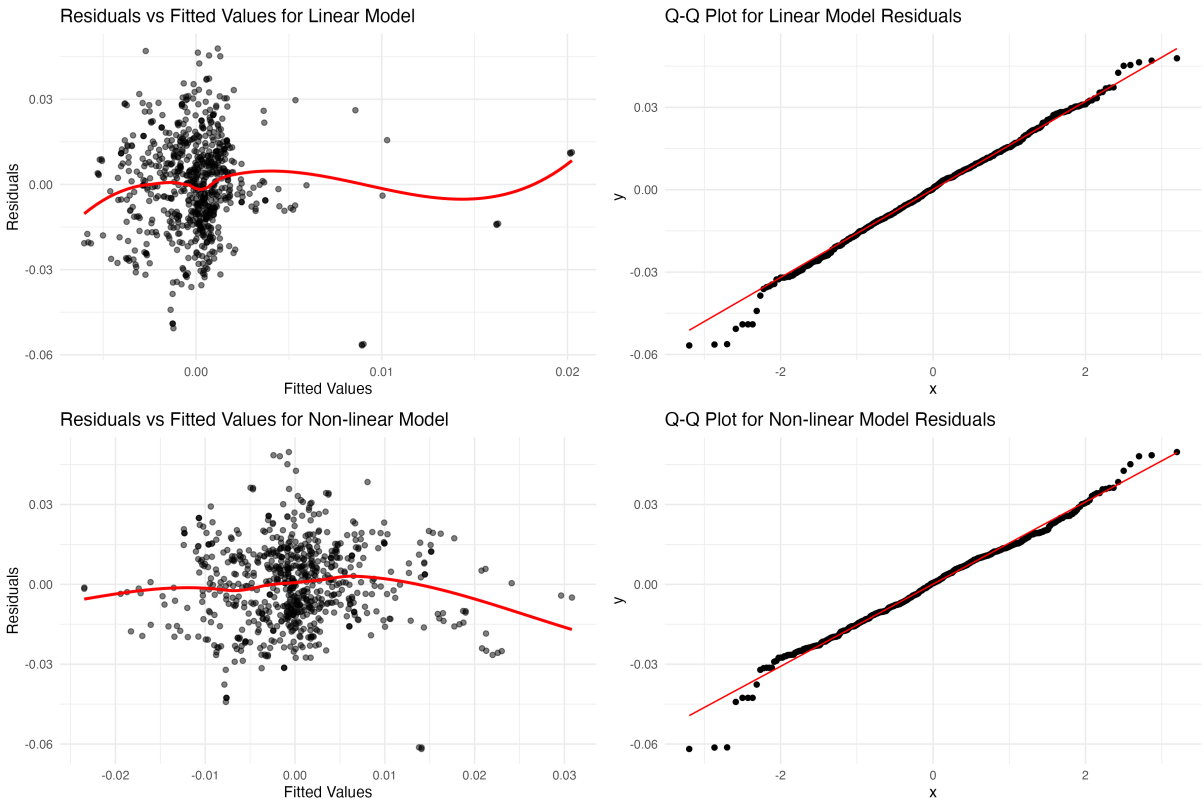

Figure 4: Residuals and Fitted Values for Linear and Non-Linear Model

5 Model Selection

The research employs the fixed-effects model as the primary analytical tool to investigate the impact of trade union activity on income inequality across European countries. This methodological choice is particularly well-suited due to the inherent socio-economic heterogeneity present within the European Union. Unlike other approaches, the fixed-effects model excels at isolating the causal effect of trade union shifts by meticulously controlling for unobserved, country-specific factors. These unobserved factors, often referred to as fixed effects, encompass a wide range of enduring national characteristics that exert a significant and consistent influence on labor dynamics. Examples include established legal frameworks governing worker rights and collective bargaining, deeply ingrained cultural norms regarding work and social mobility, and historical patterns of industrial development.

$$\text{Gini Index}_{it} = \alpha + \beta_1 \times \text{density2}_{it} + \beta_2 \times X_{it} + \cdots + \mu_i + \lambda_t + \epsilon_{it} \tag{1}$$

While these features remain relatively constant within a single country over time, they exhibit significant variation across the diverse landscape of the European Union. The fixed-effects model effectively disentangles the intrinsic impact of trade union activities from the confounding influence of these immutable national traits. This approach allows for a more nuanced understanding of the relationship between trade unionism and income inequality. Furthermore, the application of the fixed-effects model is particularly adept at capturing the incremental yet meaningful changes that occur within individual countries over time. It allows for illumination of how trade unions affect income distribution within the intricate interplay of country-specific factors. This focus on within-country variation distinguishes this analysis from studies that rely on cross-sectional approaches, which may be susceptible to biases arising from pre-existing national differences. This methodological commitment to the fixed-effects model underscores a rigorous approach aimed at discerning subtle patterns in the data. By meticulously controlling for fixed effects, the analysis strives to extract causally interpretable inferences that reflect the genuine power of trade union action in influencing income distribution across the multifaceted economic terrain of the European Union.

Before proceeding with the creation of the models, one main factor had to be taken into consideration: multicollinearity. This situation arises when the $X'X$ matrix is near singular, i.e., when the columns of X are close to linearly dependent. One potential complication that might arise from near singularity of matrices is that the numerical reliability of calculation may be reduced.

$$\frac{1}{n}X'X = \begin{pmatrix} 1 & \rho \\ \rho & 1 \end{pmatrix} \tag{2}$$

And

$$\text{var}\left(\beta \mid X\right) = \frac{\sigma^2}{n}\left(\begin{pmatrix} 1 & \rho \\ \rho & 1 \end{pmatrix}\right)^{-1} = \frac{\sigma^2}{n(1-\rho^2)}\begin{pmatrix} 1 & -\rho \\ -\rho & 1 \end{pmatrix} \tag{3}$$

The correlation ρ indexes collinearity, since as ρ approaches 1, the matrix becomes

singular. For this reason, two specific tests have been addressed: in primis, the Eigenvalue test and, following that, the VIF test in order to double-check for any other issues. This might be the case since the number of regressors is large. Another issue that arises with multicollinearity is that individual coefficient estimates may be imprecise.

Nevertheless, the results showed that there is no trace of multicollinearity since all the values of the VIF are below the threshold (5).

Table 3: Eigenvalues and VIF of Independent Variables

	Variables	Eigenvalue	VIF
demo	Democratic Governance	2.333	2.038
density2	Trade Unions Density	2.067	2.524
CollectiveBargain_Coverage	Bargaining Coverage	1.341	2.096
Inflation	Inflation	1.278	1.111
WageGrowth	Wage Growth	0.967	1.288
Gov_debt	Government Debt (%)	0.837	1.283
ln_labor	Log of Labor participation	0.691	2.397
WomenUnemployment_rate	Women Unemployment Rate	0.580	1.631
net_export	Net Export	0.447	1.979
net_FDI	Net FDI	0.274	1.151
Tax_contribution	Tax Contribution	0.184	1.675

The evaluation of multicollinearity is pivotal in ensuring the integrity and reliability of the regression model. Thus, the thorough assessment of multicollinearity underscores its significance in robust statistical modeling.

5.1 Instrument Variable and Endogeneity

A second major issue which can arise is endogeneity. It can be identified, in the linear model, when

$$\text{Gini Index}_i = \text{density2}_i \times \beta + \epsilon_i$$

If with β, $\mathbb{E}(\text{density2}_i, \epsilon_i) \neq 0$. Therefore, β would need a structural interpretation because it is defined by a linear projection. In this case, to avoid the issue of endogeneity, an Instrumental Variable has been introduced.

In the instrumental variables (IV) analysis, the variable "density2" was initially identified as potentially endogenous concerning the Gini Index, suggesting the need for an

instrumental variable approach to obtain unbiased and consistent estimates. Demo has been selected as an instrument, hypothesizing that it affects the Gini Index only through its impact on unions2.

The initial phase involves regressing the potentially endogenous variable, Bargaining Power, on the instrumental variable, Democratic Governance, alongside other control variables including Collective Bargaining Coverage, Inflation, Wage Growth, Government Debt, Logarithm of Labor Force, and Women's Unemployment Rate. This step aims to validate the instrument's relevance by ensuring it significantly predicts the endogenous variable. The summary of this first-stage regression indicates significant coefficients, notably for Democratic Governance (Estimate = 0.4693, $p < 7.38 \times 10^{-15}$). This significant relationship confirms the instrumental variable's relevance in explaining variations in Bargaining Power. The analysis additionally reveals a high F-statistic of 113.9. This, coupled with the exceptionally low p-value (less than 2.2×10^{-16}), provides compelling statistical evidence that the instrument effectively explains the variation in Bargaining Power. The correlation between demo and the residuals from the first-stage regression is approximately 0. This suggests that demo is uncorrelated with the error term in the first-stage regression, supporting the assumption of exogeneity.

The next stage focuses on the true relationship of interest. The Gini Index, our dependent variable, is regressed on the estimated Bargaining Power values (obtained from the first stage) alongside the original control variables. This approach aims to isolate the unbiased effect of Bargaining Power on the Gini Index, free from potential endogeneity issues. The second-stage results reveal a marginally significant coefficient (Estimate = -0.0537, p = 0.05403) for the fitted Bargaining Power values (at a 10

The overall results from the 2SLS regression suggest that using "demo" as an IV helps address the endogeneity of "density2," leading to more reliable estimates of its effect on income inequality. Furthermore, the analysis highlights the significant impact of other control variables on the Gini Index. This comprehensive IV analysis underscores the validity and strength of Democratic Governance as an instrument for Bargaining Power. More importantly, it sheds light on the intricate relationship between Bargaining Power

Table 4: First-Stage Regression Results

	Dependent variable:
	density2
Demo	0.469^{***}
	(0.059)
Collective Bargain Coverage	0.227^{***}
	(0.024)
Inflation	0.0002^{***}
	(0.0001)
Wage Growth	0.003
	(0.002)
Government Debt	0.001^{***}
	(0.0002)
Log Labor	-0.095^{***}
	(0.005)
Women Unemployment Rate	-0.005^{***}
	(0.001)
Constant	1.080^{***}
	(0.087)
Country	No
Year	No
Observations	726
R-squared	0.526
Adjusted R-squared	0.522
Residual Std. Error	0.156
Correlation between demo and residuals	0
Observations	726
R^2	0.526
Adjusted R^2	0.522
Residual Std. Error	0.156 (df = 718)
F Statistic	113.946^{***} (df = 7; 718)
Note:	*p<0.1; **p<0.05; ***p<0.01

and the Gini Index. This reinforces the crucial role of selecting and validating strong instrumental variables to achieve unbiased and accurate econometric results.

Table 5: Second-Stage Regression Results

	Dependent variable:
	Gini_Index
Fitted Density Squared	-0.054^{*}
	(0.028)
Collective Bargain Coverage	-0.028^{***}
	(0.010)
Inflation	0.00003^{*}
	(0.00002)
Wage Growth	-0.0002
	(0.0004)
Net Export	-0.00005
	(0.00004)
ln_labor	-0.0003
	(0.003)
WomenUnemployment_rate	0.003^{***}
	(0.0004)
net_export	0.0001
	(0.0001)
Constant	0.327^{***}
	(0.047)
Country	No
Year	No
Observations	726
R-squared	0.32
Adjusted R-squared	0.313
Residual Std. Error	0.034
Observations	726
R^2	0.320
Adjusted R^2	0.313
Residual Std. Error	0.034 (df = 717)
F Statistic	42.253^{***} (df = 8; 717)
Note:	*p<0.1; **p<0.05; ***p<0.01

However, the near-threshold significance level of the "fitted values of density2 " coefficient implies that there may still be some residual endogeneity or other issues affecting the precision of the estimates. Therefore, while the IV approach with "demo" appears to mitigate endogeneity concerns to a large extent, further robustness checks or alternative

instruments might be necessary to fully confirm the causal relationship between union density and income inequality.

6 Model Results

The fixed effects regression model with instrumental variables (IV) offers a more robust approach to examining the causal impact of key labour market variables on income inequality, measured by the Gini Index. By introducing the instrumental variable 'demo' (Democratic Governance), the IV model isolates the causal effect of stronger collective bargaining on income inequality.

The consistently negative coefficient of 'density2' across various model specifications (ranging from -0.021* to -0.027***, with standard errors around 0.011) indicates a statistically significant relationship between stronger collective bargaining and reduced income inequality. Additionally, the model results show a negative Average Treatment Effect (ATE) of Trade Union Density on the Gini Index, reinforcing the role of unionization in diminishing income disparity. Higher levels of unionization not only correlate with lower income inequality but also underscore the substantial bargaining power that unions hold in the labour market. This suggests that labour unions are a powerful mechanism for promoting more equitable income distribution across different European countries.

The application of the IV model, particularly with 'demo' as the instrumental variable, allows us to interpret these relationships as causal, not simply correlational. This implies that the observed relationships are less likely to be influenced by omitted variable bias or reverse causality. These findings contribute valuable insights into policy discussions aimed at reducing income inequality and improving labour market outcomes. This is in line with traditional views on the role of unions in promoting fair wages and reducing income disparities suggested by David Card (David Card 2001). Increased union density signifies a larger portion of the workforce having their salaries negotiated by unions, leveraging collective representation to advocate for policies and wage negotiations benefiting a wider spectrum of employees, beyond just high earners. The analysis brings to light the substantial influence of additional control variables, notably Wage Growth, on the Gini Index. Wage Growth plays a pivotal role in shaping income inequality by directly impacting the earnings of individuals across different income brackets. As wages increase or decrease, so too does the disparity in income distribution. Higher wage growth may lead

Table 6: Regression Results

	Dependent variable:		
	Gini_Index		
	(1)	(2)	(3)
Density Squared	−0.027***	−0.024**	−0.021*
	(0.011)	(0.011)	(0.011)
Collective Bargain Coverage	0.022***	0.024***	0.026***
	(0.008)	(0.008)	(0.008)
Inflation	−0.001	−0.001	−0.001
	(0.002)	(0.002)	(0.002)
Wage Growth	0.003	0.003	0.002
	(0.002)	(0.002)	(0.002)
Female Workers	−0.00000	0.00000	−0.00000
	(0.00001)	(0.00001)	(0.00001)
Log Minimum Wage	−0.001***	−0.001**	−0.0005**
	(0.0002)	(0.0002)	(0.0002)
Log GDP	−0.001	−0.001	−0.001
	(0.001)	(0.001)	(0.001)
lnGDP	−0.038***	−0.038***	−0.037***
	(0.004)	(0.004)	(0.004)
Female_Workers	−0.001***	−0.001***	−0.001***
	(0.0002)	(0.0002)	(0.0002)
density2:cluster2	0.002	0.002	0.003
	(0.007)	(0.007)	(0.007)
density2:cluster3	−0.001	−0.001	−0.0003
	(0.007)	(0.007)	(0.007)
Constant	0.959***	0.936***	0.882***
	(0.201)	(0.201)	(0.202)
Country	Yes	Yes	Yes
Year	Yes	Yes	Yes
Government Debt	Yes	Yes	Yes
Log Labor	Yes	Yes	Yes
Part-time Employment	Yes	Yes	Yes
Women Unemployment Rate	Yes	Yes	Yes
Net Export	No	Yes	Yes
Net FDI	No	No	Yes
Tax Contribution	No	No	Yes
Observations	726	726	726
R-squared	0.865	0.865	0.867
Adjusted R-squared	0.851	0.851	0.853
Residual Std. Error	0.016	0.016	0.016
Observations	726	726	726
R^2	0.865	0.865	0.867
Adjusted R^2	0.851	0.851	0.853
Residual Std. Error	0.016 (df = 657)	0.016 (df = 656)	0.016 (df = 654)

Note: *p<0.1; **p<0.05; ***p<0.01

to a more equitable distribution of income, as individuals across various income levels experience proportionate increases in earnings, thereby potentially reducing the Gini Index. This comprehensive IV analysis not only emphasizes the robustness of the methodology but also sheds light on the pivotal role of Democratic Governance as a determinant of Bargaining Power within labour unions. In European countries, where political factors often intertwine with labour dynamics, the strength of labour unions can be significantly influenced by the political landscape. Democratic Governance serves as a critical instrument in shaping the bargaining power of unions, as it reflects the extent to which labour rights are protected, and collective bargaining is enshrined within the legal framework. As Richard Hyman underlined, strong democratic institutions facilitate a conducive environment for unions to negotiate fair wages, benefits, and working conditions on behalf of workers (Hyman 2007). More importantly, it sheds light on the intricate relationship between Bargaining Power and the Gini Index. In summary, the fixed effects regression model with IV, incorporating 'demo' as the instrumental variable, provides a robust framework for understanding the causal impact of labour market variables on income inequality. The findings highlight the crucial role of collective bargaining and trade union density in reducing income disparities, supported by the significant and negative coefficients of key variables across different model specifications.

7 Policy Implication

The empirical findings from the regression analysis have significant policy implications. The demonstrated negative relationship between collective bargaining, trade union density, and the Gini Index suggests that strengthening labour unions and collective bargaining processes could be an effective policy lever for reducing income inequality. Governments might, therefore, consider enacting and enforcing legislation that protects the right to organize and collectively bargain, as well as policies that encourage higher union membership. Moreover, supporting a fair minimum wage could serve as a complementary policy measure to narrow income disparities further. These strategies, alongside broader collective bargaining coverage, can not only promote a more equitable income distribution but also contribute to a stable and motivated workforce, which is beneficial for the overall economy. As such, policymakers should view the empowerment of trade unions and the facilitation of collective bargaining not only as a matter of labour rights but also as a central component of a comprehensive strategy to tackle economic inequality.

7.1 Heterogeneity of Effects: Who Benefits Most?

The impact of collective bargaining on income inequality varies significantly depending on worker characteristics and industry-specific factors. Low-skilled workers often gain more substantial wage increases through collective bargaining, as unions help elevate their wages and improve working conditions. In contrast, highly skilled workers, who already have greater individual bargaining power, might see relatively smaller wage gains but still benefit from improved job security and additional negotiated benefits. Women may particularly benefit from collective bargaining efforts aimed at reducing gender pay gaps and promoting workplace equality. Younger workers, entering the labor market with less experience, also see significant advantages from union representation, which helps secure fair wages and advancement opportunities. Industry-specific effects are evident, with manufacturing sectors, having higher union presence, experiencing more uniform wage structures and reduced income inequality compared to the more fragmented service sector. The public sector, with its higher unionization rates, tends to have more equitable pay scales and comprehensive benefits, while the impact in the private sector varies widely. Geographic variation further influences the effectiveness of collective bargaining, with urban areas focusing on aggressive wage negotiations due to higher living costs, and rural areas emphasizing job security and benefits. Subgroup analyses are essential to gain a nuanced understanding of how collective bargaining shapes income distribution, informing targeted policies that enhance its positive effects across different workforce segments, ensuring widespread and equitable benefits.

7.2 Complementary Mechanisms: Beyond Wages

Beyond wage adjustments, collective bargaining influences income inequality through several complementary mechanisms. Unions often advocate for policies that enhance job security, ensuring that workers have stable employment and are less susceptible to income fluctuations. They also push for access to training programs, which can improve workers' skills and employability, leading to better career opportunities and higher long-term earnings. Additionally, unions play a crucial role in strengthening social safety nets, such as healthcare benefits, retirement plans, and unemployment insurance, which provide financial security and reduce the risk of falling into poverty during economic downturns or personal crises. These additional mechanisms help to narrow income disparities beyond the direct effect on wages. By addressing various aspects of workers' economic well-being, unions contribute to a more holistic approach to reducing income inequality. Future research could delve deeper into the relative importance of these complementary mechanisms, examining how each contributes to a more equitable income distribution and identifying which policies are most effective in different contexts. This comprehensive understanding could inform more targeted and effective strategies for promoting income equality through collective bargaining and other labor market interventions.

Dynamic Effects: A Long-Term Perspective

The relationship between collective bargaining, union density, and income inequality is dynamic, reflecting broader economic and institutional changes over time. The significant decline in unionization rates in many countries over recent decades has likely exacerbated income disparities as collective bargaining power weakened. Analyzing longitudinal data allows for a deeper understanding of how changes in collective bargaining strength or union density impact income inequality. This approach provides insights into the long-term dynamics of these relationships, highlighting how institutional changes in the labor market influence income distribution over time (David Card 2001) (Hyman 2007). By investigating heterogeneity, complementary mechanisms, and dynamic effects, we can transcend the limitations of an average treatment effect and gain a richer understanding of the multifaceted ways in which collective bargaining shapes income inequality. For instance, unionization might have a more pronounced impact on low-skilled workers who benefit more substantially from collective bargaining agreements, as opposed to highly skilled workers who can individually negotiate higher wages. Moreover, the effects of collective bargaining might vary across industries, with stronger impacts in sectors with high union presence, such as manufacturing, compared to service sectors with lower unionization rates (David Card 2001). Additionally, while wage adjustments are a central mechanism through which collective bargaining influences income inequality, unions also promote income equality by advocating for policies that enhance job security, provide access to training programs, and strengthen social safety nets. These complementary mechanisms can significantly reduce income disparities beyond the direct effect on wages. Future research should explore the relative importance of these mechanisms in achieving a more equitable income distribution (Hyman 2007). Assessing the Internal Validity and Potential Further Research The internal validity of this analysis appears to be relatively strong, given the use of a fixed effects regression model with instrumental variables (IV) to address endogeneity concerns. By isolating the causal effect of key labour market variables on income inequality, the study employs rigorous statistical techniques to ensure the robustness of its findings. However, further research could enhance the internal validity by

conducting sensitivity analyses to test the robustness of the results to alternative model specifications and instrumental variables. Additionally, employing alternative econometric approaches, such as propensity score matching or difference-in-differences analysis, could provide complementary insights into the causal relationships under investigation. Moreover, exploring potential mechanisms and mediators underlying the observed associations, such as the impact of specific labour market policies or institutional factors, could deepen our understanding of the dynamics driving income inequality. By addressing these avenues for further research, future studies can strengthen the internal validity of the analysis and provide more nuanced insights into the complex interplay between labour market dynamics and income distribution.

8 Conclusions

In conclusion, the intricate investigation into the dynamics of labour unions and collective bargaining across EU countries has illuminated their profound influence on income inequality. The use of fixed effects regression models with instrumental variables provides a compelling narrative on the causal relationships inherent in the labour market. The findings explicitly demonstrate that collective bargaining and trade union density play instrumental roles in shaping equitable economic outcomes, as evidenced by their significant negative impact on the Gini Index. Collective bargaining strength, encapsulated in the 'bargain1' variable, emerged as a robust determinant in mitigating income inequality. Enhanced bargaining power, indicated by the ATE, is associated with a reduction in the Gini Index, suggesting that strong collective bargaining mechanisms are central to achieving income equity. The persistence of trade union density, despite the observed decline in membership, underscores the enduring importance of unions in the quest for social justice. The inclusion of Democratic Governance as an instrumental variable underscores the necessity of robust democratic institutions and practices in supporting effective labour representation. This factor alone has the potential to influence the very fabric of labour dynamics, as it encapsulates the degree to which citizens can engage in the socioeconomic decisions that affect their lives. From a policy perspective, these insights stress the importance of supporting and strengthening labour unions and collective bargaining frameworks. This support could take the form of favourable legislation, incentives for union membership, and initiatives that foster collective bargaining, especially in the face of a changing labour market landscape. Such measures not only address immediate economic disparities but also fortify the foundations for a resilient and inclusive economy. This study contributes to the ongoing discourse on labour economics and social equity by providing empirical evidence of the mechanisms through which collective bargaining and trade union density can influence income distribution. As we navigate the complexities of a globalized economy, it becomes increasingly clear that the pursuit of inclusive growth must consider the pivotal role of labour institutions in fostering equitable labour market outcomes.

9 Bibliography