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Investigating the effects of education and labour market challenges on income inequality

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Abstract. *This paper examines the impact of education and labour market challenges on the income inequality in European Union (27 Member States) within the period 2012-2022, this being calculated using the Panel EGLS method. Even if the effects are clearly visible from a theoretical point of view, in the latest years there were not many authors focusing their studies on the effects of the unemployment and early drop-out from school and training on income inequality. In this regard, updating the figures, the impact coefficients and the theoretical background increase the understanding of the statistical processes and their results in the new economic context. Our results confirmed a positive relationship between unemployment rate and income inequality (measured by Gini coefficient), this being also the highest impact found, but also a positive link between the early leavers from education and training rate and income inequality. In addition, we used additional variables to catch the current economic challenges that are related to demographic changes and high energy prices. In this context, we found positive effects exerted by housing cost overburden rate and old-age dependency ratio on income inequality. Even if the model is limited to four income inequality drivers, we have demonstrated that the calculated coefficients are the best linear unbiased estimators.*

Keywords: *unemployment, education, income inequality, labour market, early leavers, Panel*

Introduction

Income inequality have negative effects in all countries, not only in Europe, but these challenges are more visible in European Union, taking into account the EU engagement to promote social inclusion through the EU programmes. In this regard, income inequality reduce the resilience of the economy, and make the economic growth unsustainable if the inequality is determined by political actions / institutions or if it is a consequence of historical inequality / other kind of inequalities. However, addressing income inequality challenges should not be an objective prioritised in any kind of situation by the national governments, since there are cases when income inequality promotes socio-economic development. In particular, if income inequality is a consequence of the greater individual efforts / performances of the population to increase their incomes or of the acquired competencies, inequality should not be treated as a challenge, since such kind of inequality it is not detrimental to growth.

In this context, the motivation for focusing this paper on this research area is reflected in the high capacity of income inequality to affect individual lives, economic resilience and sustainable development, labour market and educational performances being the most notorious

factors that may reverse the increasing trend of income inequality. To this end, estimating the effects of unemployment rate and early leavers from education and training rate on income inequality has a particular importance for the foundation of the economic policies. Even if the effects are clearly visible from a theoretical point of view, in the latest years there were not many authors focused their studies on the effects of unemployment and early drop-out from school and training on income inequality. In this regard, updating the figures, the impact coefficients and the theoretical background increase the understanding of the statistical processes and their results in the new economic context.

The general objective of the paper consists in estimating the effects of labour market and educational challenges on the income inequality, this being reached through other four specific objectives, as follows: (i) estimating the effect of unemployment rate on income inequality; (ii) estimating the effect of early leavers from education and training on income inequality; (iii) estimating the effects of other income inequality determinants (such as old-age dependency ratio and housing costs overburden rate); (iv) performing the necessary tests to validate the accuracy of the estimators. An important process in the objective achievement is related to the hypotheses setting. In our case, we took into consideration two general hypotheses reflecting the positive association between unemployment and income inequality, but also a positive relationship between early drop-out from school and training and income inequality.

In order to reach the presented objectives, we structured our paper as follows: (a) literature review, where we presented the main literature findings in this field; (b) methodology, where we presented the methods used to ensure the proper achievement of the papers` objective; (c) results and discussions, where we presented the results and interpreted them; (d) conclusion, where we presented the main conclusions, the policy implications and the limits of the study.

Literature review

According to the scientific literature, inequality has been defined as a situation in which some individuals have more opportunities than others, differences that may also result from the rule of law setting. (United Nations, 2015). In economic science, several forms of inequality prevail, the most well-known being income inequality.

Income inequality refers to the distribution of income across the population and is accompanied by inequality of wealth. The most used indicators for measuring inequality are the Lorenz curve (Lorenz, 1905) and the Gini coefficient (Gini, 1912, 1921, 2005). The Lorenz curve is a graphical method that represents the cumulative share of income earned by the poorest population and the income shared equally among the population, which is represented by the 45-degree line. If income is not equally distributed, the Lorenz curve lies below the 45 degree line, and the further the curve is from the equality line, the income is more unequally distributed. On the other hand, the Gini coefficient captures income inequality in a limited way, without going into a detailed analysis of household income (Blesch et al., 2022).

The main factors contributing to increasing income inequality are globalization (as a result of industrial production moving to areas where labour is cheaper), technological progress (through the process of automation, which has resulted in the loss of jobs for the working class), differences of gender and ethnicity, level of education (workers with higher education are better paid), economic conditions (high unemployment, lack of investment, turbulence in the financial system), respectively the taxation system.

The Gini coefficient, the most common indicator used to measure inequality, is defined as the area between the Lorenz curve and the 45 degree curve. This index takes values between 0 and

1 (or 100), where value 0 is considered "perfect equality", and value 1 (100) occurs when there is only one person who gains all the income. The lower the value of the Gini coefficient, the more equal the society is considered to be.

The theory of human capital indicates that the level of education is a main source of the income increase, and may reduce the level of income inequality. On the other hand, this should be carefully interpreted, since educational expansion may also lead to the increase of income inequalities given that higher education has a greater contribution in terms of obtaining a job than pre-university education (Mincer, 1974; Yang and Qiu, 2016).

The family environment is also an important factor in terms of access to education, given the fact that young people who are part of disadvantaged / vulnerable groups will not be able to attend to college (Hendel et al., 2005). In this respect, if there are fewer people able to access a form of higher education, employers will keep wages low for unskilled workers, leading to a significant wage gap between graduates and non-graduates persons.

When estimating the impact of education on income inequality, the costs of education must be also considered. In this context, Maoz and Moav (1999) stated that the education costs to income ratio will decrease as incomes rise, while wealthy parents will invest more in their children's education (Zhu and Vural, 2013).

Also, the link between educational opportunities and income inequality has also been examined (Baliamoune-Lutz and McGillivray, 2015), which demonstrated that the difference in the enrolment rate of women and men is directly associated with lower incomes for women.

The economic literature supports the finding suggesting a positive relationship between income inequality and the unemployment rate (Cysne, 2009; Sheng, 2011, Mwakalila, 2022). In addition, Castells-Quintana and Royuela (2012) have shown that income inequality affects economic growth, especially when there is persistent unemployment. Other authors (Manfort et al., 2018) demonstrated that there is no trade-off between inequality and the unemployment rate for governments to call upon as redistributive capacity to reduce unemployment.

On the other hand, other authors (Bussolo et al., 2018) consider that income inequality is an important characteristic of a society to create a functioning economic system and a function of economic development (Moller et al., 2009), but it must be carefully monitored at the household level.

To reduce income inequality, government intervention is necessary if it is not the result of individual efforts / performances, when the free market is ineffective in raising incomes. The policies proposed by the government must be focused on lowering tax burden on labour, respectively on improving social systems, such as the access to high quality public education and health systems.

Methodology

In this section, we presented the data and the methods used to estimate the impact of education and labour market on income inequality. In this respect, we used the following Eurostat annual data, covering the period 2012-2022 for European Union Member States (27 countries data, excluding United Kingdom):

- ✓ Gini coefficient after social transfers - used as a proxy indicator for income inequality;
- ✓ the rate of early leavers from education and training (aged between 18-24 years) – used as a proxy indicator for educational system;
- ✓ unemployment rate (aged between 15-74 years) – used as a proxy indicator for labour market developments;

To catch a higher dimension of income inequality, we used additional relevant data for its drivers, as follows:

- ✓ housing cost overburden rate (percentage of individuals living in a household where housing costs represents at least 40% of total household cost);
- ✓ old-age dependency ratio (the share of population aged 65 years or over in the population aged between 20-64 years).

The impact coefficients were calculated in Eviews 9.0 software, using Panel EGLS method weighted by Period SUR option to ex-ante correct the possible appearance of heteroskedasticity (which may endanger the feasibility of the results), to estimate the following equation:

$$gini_{it} = \alpha_0 + \alpha_1 early_leavers_{it} + \alpha_2 unempl_{it} + \alpha_3 housing_cost_overb_{it} + \alpha_4 old_age_dep_{it} + \varepsilon_t \quad (1)$$

, where:

i represents the country name, while *t* reflects the year, $\alpha_0, \dots, \alpha_4$ are the calculated impact coefficients, ε_t is the error term, *gini* reflects the Gini coefficient (scaled from 0 to 100), *early_leavers* catches the rate of people aged between 18-24 years dropped out from education and training, *unempl* is the unemployment rate (specific to the people aged between 15-74 years), *housing_cost_overb* represents the percentage of individuals living in a household where housing costs represents at least 40% of total household cost and *old_age_dep* is the old age dependency ratio (the share of population aged 65 years or over in the population aged between 20-64 years).

However, calculating the impact coefficients of income inequality drivers does not ensure the maximum verosimilarity of the estimators. In this context, there was a need to perform additional tests to verify the feasibility of the results, as follows:

- cross-section dependence tests: Breusch-Pagan LM and Pesaran CD;
- normality test: Jarque-Bera;
- statistical validity of the estimation: Fisher test;
- multicollinearity test: variance inflation factors;
- existence of a constant variance or a variance close to zero of the residuals.

Finally, we interpreted the R-squared value and the calculated coefficients according to the theoretical background.

Results and discussions

In this section, we presented the main results obtained following the application of the corresponding methodology. Income inequality remains a real issue at European countries, some countries facing significant challenges in this field, while others report lower levels of income inequality.

According to Figure 1, the highest levels of Gini coefficient (high inequality) are reported in BG, LT, LV, IT and RO, while the lowest levels (low inequality) are found in SK, SI, CZ, BE and NL. These data indicate that the most vulnerable countries in terms of social inclusion are the EU Baltic countries, BG and RO which were accepted in EU in 2007 and the Southern EU countries.

However, this analysis treats EU Member States as a whole, since the calculations were performed by using Panel EGLS method. In this context, we calculated the impact of income inequality drivers, which were presented in Table 1. According to the results, an increase in the

early leavers rate with 1 percentage point (pp) determined a rise in the Gini coefficient by 0.18 deviation points in the analysed period, this effect being explained by the fact that low skilled workers are exposed to social risks due to their low capacity to obtain wages close to the average wage. In addition, low skilled potential workers may face unemployment challenges, taking into account that finding a job is not an easy process for this social group.

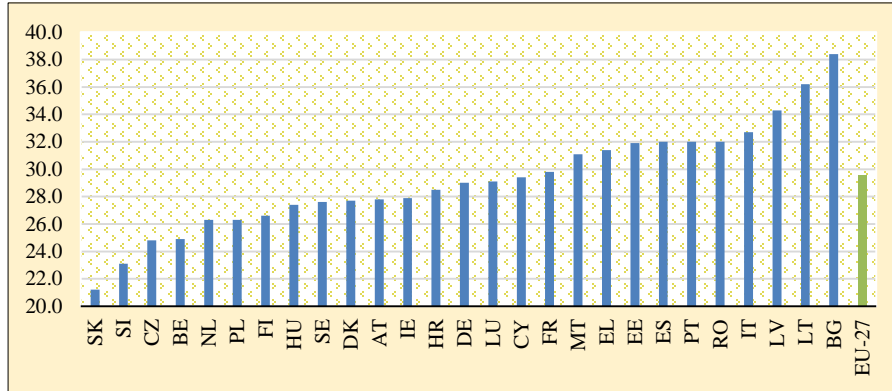


Figure 1. Gini coefficient in European Union (2022)

Source: own processings based on Eurostat data.

Table 1. Results of the model

Dependent Variable: GINI				
Method: Panel EGLS (Period SUR)				
Date: 02/25/24 Time: 11:54				
Sample: 2012 2022				
Periods included: 11				
Cross-sections included: 27				
Total panel (balanced) observations: 297				
Linear estimation after one-step weighting matrix				
Period SUR (PCSE) standard errors & covariance (d.f. corrected)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
EARLY_LEAVERS	0.182446	0.034679	5.261005	0.0000
UNEMPL	0.206102	0.031187	6.608621	0.0000
HOUSING_COST_OVERB	0.075865	0.022154	3.424449	0.0007
OLD_AGE_DEP	0.122182	0.040720	3.000539	0.0029
C	21.80430	1.456870	14.96654	0.0000
Weighted Statistics				
R-squared	0.262899	Mean dependent var	1.786455	
Adjusted R-squared	0.252802	S.D. dependent var	5.991768	
S.E. of regression	0.980698	Sum squared resid	280.8366	
F-statistic	26.03669	Durbin-Watson stat	2.000461	
Prob(F-statistic)	0.000000			
Unweighted Statistics				
R-squared	0.255820	Mean dependent var	29.79192	
Sum squared resid	3388.757	Durbin-Watson stat	0.085588	

Source: own calculations in Eviews 9 software.

Regarding the unemployment effect, we found that an increase in its value with 1pp determined a growth of Gini coefficient by 0.20 deviation points. The positive impact can be argued by the low capacity of unemployment benefits to compete with wages or other kind of incomes, these only representing a labour integration instrument, which not provides high opportunities on medium or long term.

Next, we analysed the impact of housing cost overburden rate and we found that a hike in its value by 1pp has led to an increase in Gini coefficient by 0.07 deviation points in the analysed period. This effect is clearly visible, since higher households housing costs reduce the households disposable income. The calculated effect should be also taken into consideration by the political dimension, especially in the current economic context affected by high energy prices.

Lastly, the results obtained demonstrated that demographic changes have a real role in driving the income inequality. In this respect, our results confirmed a positive relationship between the share of old-aged population and income gap, an increase with 1pp in the old-age dependency ratio determining a rise of Gini coefficient by 0.12 deviation points. Our results confirmed the statistical significance of all calculated coefficient taking into account their associate probabilities that are lower than 5%, but also the low standard errors for each coefficient.

In addition, the Fisher test result confirmed the statistical validity of the model (prob. F-statistic < 5%), while the R-squared value indicates that the selected independent variables explain 26.28% of the Gini coefficient evolution, which indicates that there are also other factors that influence income inequality and were not included in the analysis.

However, the tests performed confirm the adequacy of the calculated coefficients. In addition, Figure 2 demonstrate the constant variance of the residuals, which is close to zero, this being one important hypothesis in econometrics that confirms the accuracy of the model. Moreover, according to Figure 3, the residuals are normally distributed, since the Jarque-Bera probability is higher than 5%, while Kurtosis and Skewness statistics are close to the values (K - 3 and S - 0) confirming a normal distribution.

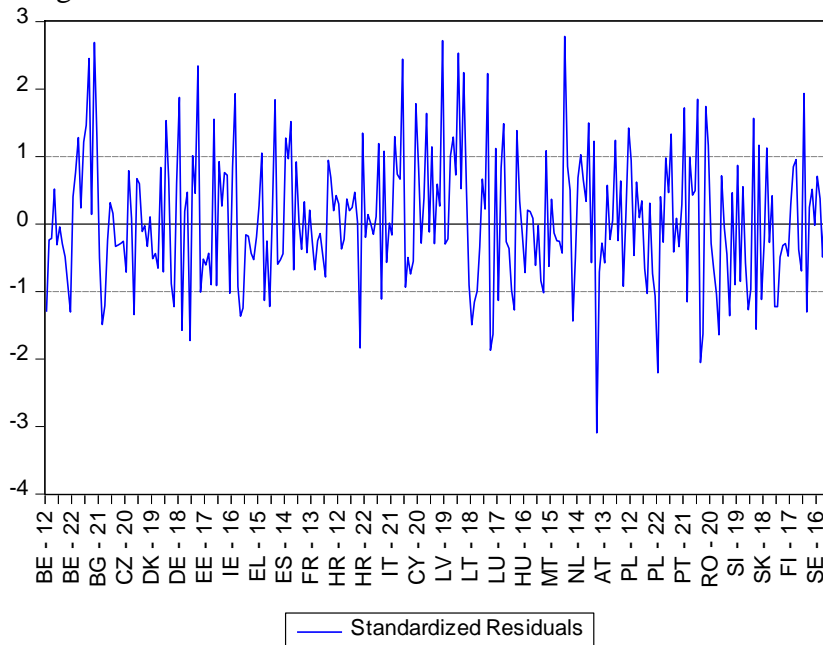


Figure 2. Model residuals

Source: own processings in Eviews 9 software.

In panel technique, the results may be significantly affected by cross-section effects and in this regard, there is a need to confirm its absence. In this context, we performed three tests (presented in Table 2: Breusch-Pagan LM, Pesaran scaled LM and Pesaran CD), all confirming that the model is not affected by cross-section dependence, since their specific probabilities are higher than 5%.

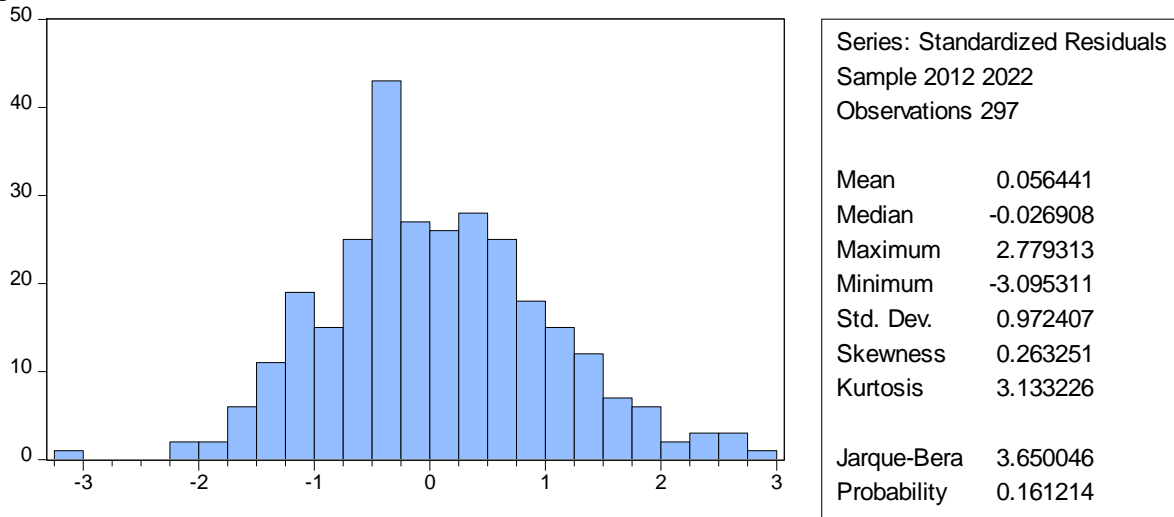


Figure 3. Distribution of the residuals
Source: own processings in Eviews 9 software.

Table 2. Cross-section dependence tests

Residual Cross-Section Dependence Test			
Null hypothesis: No cross-section dependence (correlation) in weighted residuals			
Equation: MODEL_GINI			
Periods included: 11			
Cross-sections included: 27			
Total panel observations: 297			
Note: non-zero cross-section means detected in data			
Cross-section means were removed during computation of correlations			
Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	308.8348	351	0.9489
Pesaran scaled LM	-1.591423		0.1115
Pesaran CD	1.052213		0.2927

Source: own processings in Eviews 9 software.

The last hypothesis we checked is the presence of multicollinearity, this being undesirable as if the independent variables are linked, these may cause spurious regression results. To this end, we used the Variance Inflation Factors test, the obtained results (Table 3) confirming that the results of the model are not affected by multicollinearity as the centered VIF coefficients are lower than 4, a threshold that indicates its presence in a low extent, while the 10 threshold confirms severe multicollinearity.

Table 3. Variance Inflation Factors test - multicollinearity

Variance Inflation Factors			
Date: 02/25/24 Time: 11:57			
Sample: 2012 2022			
Included observations: 297			
Variable	Coefficient Variance	Uncentered VIF	Centered VIF
EARLY_LEAVERS	0.001203	2.362607	1.044960
UNEMPL	0.000973	2.036637	1.294715
HOUSING_COST_OVERB	0.000491	1.444932	1.050612
OLD_AGE_DEP	0.001658	20.61377	1.243332
C	2.122470	26.35804	NA

Source: own processings in Eviews 9 software.

Conclusion

This paper confirms the positive relationship between unemployment rate and income inequality. It worth to mention that the unemployment rate impact coefficient is the highest one obtained, taking into account that we also analysed the impact of early leavers from education and training rate, the one of old-age dependency ration and the one of housing cost overburden rate. We also found a positive effect of the early leavers from education and training rate on Gini coefficient. These confirms that unfavorable labour market / educational developments are associated to income inequality increase which may endanger the socio-economic development.

We also demonstrated a positive effect of housing cost overburden rate on Gini coefficient, respectively a positive association between old-age dependency ratio and income inequality. These results should raise the awareness on the effects of the energy and demographic challenges on social dimension. Last edition of the Ageing Report also highlights the risks triggered by old-age dependency ratio, which is forecasted to significantly increase until 2070. This may be tackled by focusing the political support on the labour force activation and on the birth rate increase from the demographic changes perspective, but also providing temporary and targeted support for protecting households against significant housing cost increases.

The econometric methods used confirmed the accuracy of the results. However, the study does not provide an exhaustive view on the income inequality drivers. In this regard, our further work will try to accommodate other income inequality drivers to the current methodological framework, without creating model inadvertences such as multicollinearity, cross-section dependence or abnormal distribution of residuals. In addition, the interpretation of the results obtained is only valid when referring to the European Union as a whole, not to European Union as individual Member States. Extending the interpretation to also catch the effects at the level of each Member State will be possible by using another estimation technique such as Pooled Mean Group / ARDL model, which needs an increase in the total observations per country.

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