Theoretical and Practical Approaches on the Relation between Taxation and Indicators of Inequality

Florina Popa
Institute of National Economy, Romanian Academy, Bucharest, Romania
florinapopa289@gmail.com

Abstract

The aim of the paper is to signalize different aspects that stand out from the theoretical review concerning the influence of different taxes on the inequality (Gini coefficient) and poverty and those from regression models aimed to observe the degree of influence of each independent variable on the dependent variable - Gini coefficient (inequality) and Poverty Rate (Persons at risk of poverty or social exclusion). Conclusions emphasize on the final results of the research drawn from theoretical review on the topic studied and the econometric regression analysis. The methodology used was: researching the scientific literature in the field, synthesize and giving the own author's interpretation of the ideas and ending in a new research achieved in the field of study; collecting statistical data and the analyses of the situations derived from the econometric regression models. The study was achieved for Member States of European Union (EU 27), on 2014-2022 period.

Key words: taxes, income inequality (Gini coefficient), poverty rate, impact, regression models.
J.E.L. classification: C20, D63, H71, I30, I32

1. Introduction

Increasing inequality gained concernment during the last decades, considering to be influenced by globalization. Luebker (2011) There is a large interest on the implication of taxation systems in tackling inequality. Direct taxes and indirect taxes impact on inequality and they are subject of many policies and strategies at governmental level, in direction to reduce disparities, limit as much as possible, the risk of poverty, social exclusion, supporting inclusive growth. A fair distribution of taxes is an aspect that countries take into consideration, in their step to meet the need for increased revenues. (OECD 2024).

Efforts to diminish poverty in developing countries are trammelled by income inequality, considered as an obstacle to economic development. Thus, in this purpose the World Bank has outlined initiatives in order to diminish as maximum as possible, the poverty and increasing wealth and living standard of people, by diminishing inequality. (Omar and Inaba, 2020). In this sense, financial inclusion leads to social inclusion, a process through which the poverty and income inequality are combated, by opening ways of progress, for the disadvantaged and marginalized. (Omar and Inaba, 2020).

Inequality is known to be an increasing problem, all over the world, given the influence by different factors: the crisis challenged by Coronavirus, which emphasized the inequality, the digitalization which has increasingly penetrated different areas of activity and influence labour force, development gaps between regions that strengthen inequality. This influence elements and many others calls for efforts at the governmental level, to reduce inequality, through fiscal policies of income redistribution and other types of strategies, so that the risk of poverty, marginalization and social exclusion can be avoided or limited, as much as possible. (Lei, X.-T.; Xu, Q.-Y.; Jin, C.-Z (2022); Nadezhina, O.; Avduevskaia, E. (2021) Azarenko, N.; Kazakov, O.; Kulagina, N, Rodionov, D. 2020; Rodionov, D.G.; Kudryavtseva, T.J.; Skhvediani, A.E.(2018) ; Rodionov, D.; Zaytsev, A.; Konnikov, E.; Dmitriev, N.; Dubolazova, Y. M (2021); Volodin, A.; Ivanov, M. Djanelidze, M.; Sokolitsyn, A. (2019); Victorova, N.; Rytova, E.; Koroleva, L.; Pokrovskaia,

N.(2020); Belov, A.(2021) Nesterov, I.O.(2021) quoted in Dianov, Koroleva, Pokrovskaia, Victorova and Zaytsev (2022).

2. Theoretical background

Different authors tried to identify different models concerning the impact of taxation.

In their study, authors Sergey Dianov, Lyudmila Koroleva, Natalia Pokrovskaia, Natalia Victorova and Andrey Zaytsev (2022) tried to observe possible models in studying the influence of direct taxation on income inequality, in the economy. They highlighted the assumption proved, that direct taxation has an important impact on inequality, relating to the measure of economic evolution and the specific nature of country's fiscality. They noticed that among different European Union countries, taxes have a different impact on income inequality, depending on the conjuncture of every country taxation reforms. (Dianov, Koroleva, Pokrovskaia, Victorova and Zaytsev, 2022).

Bakar & Pathmanathan (2020) (quoted in Dianov, Koroleva, Pokrovskaia, Victorova and Zaytsev, 2022) used different models to achieve the influence of income indicators on inequality indicators (Gini coefficient).

In their model, Pastor and Pietro (2015) (quoted in Gill, 2016), provide the idea that as tax rates increase, the productivity rise in economy. They developed a model according to which increasing tax rates discourage and remove entrepreneurs with low skills and low resilience for risk, remaining those entrepreneurs which invest in efficient projects which bring them increased returns. In addition to their previous study, Pastor and Veronesi (2015) analysed tax rates on thirty four countries, in the interval 1980 - 2013 and they found a more strengthen relation between tax rates, productivity, and inequality.

Also, Bertotti and Modanese (2016) (quoted in Dianov, Koroleva, Pokrovskaia, Victorova and Zaytsev, 2022) analysed different aspects: the relationship between income inequality and the economic mobility (changes on economic status of people – assessed in income, as a rule – (*Economic mobility*, Wikipedia, https://en.wikipedia.org/wiki/Economic_mobility); the correlation between income inequality (Gini coefficient) and the level of tax evasion, where they researched different types of human behaviour in relation to tax evasion (shadow economy) and their impact on income redistribution. They reached the conclusion that as tax evasion raises, the inequality (Gini coefficient) increases for all population.

Authors Omar and Inaba (2020) achieved a study on the way the financial inclusion influence on diminishing rate of poverty and income inequality in developing countries, developed for the interval of 2004–2016 years. Their paper proves a strengthen observation that financial inclusion is of a substantial influence in diminishing poverty and income inequality in developing nations. The result obtained is valid for developing nations but does not match for individual countries. (Omar and Inaba, 2020).

Park and Mercado (2018) (quoted in Omar and Inaba, 2020) developed a study on the different nations effect of financial inclusion on poverty and income inequality. The results achieved show that a financial inclusion raise is correlated with an increase in economic growth and a reduction of poverty rate. The result proved to be valid just to countries with increased and middle income.

Duncan and Peter (2012) determined the relationship between progressive taxes on personal income and income inequality (Gini coefficient). The results they obtained show that progressive taxes have an impact of diminishing in income inequality (Gini coefficient).

3. Research methodology

The paper was accomplished by: *researching the scientific literature in the field, synthesize and giving the own author's interpretation of the ideas and ending in a new research achieved in the field of study; collecting statistical data* from the European Commission, DG Taxation and Customs Union based on Eurostat data, Data on Taxation Trends; Eurostat database, Eurostat: Gini Coefficient of equivalised disposable income by age; Eurostat: Persons at risk of poverty or social exclusion by age and sex and the analysis of the situations derived from the econometric regression

models. The analysis was achieved for Member States of European Union (EU 27), for the period 2014-2022.

Each regression model ends with conclusions drawn on the aspects derived from the values taken by the coefficients, probability, coefficient of determination R^2 which gives different influence and correlations between the independent and dependent variables.

The paper ends with conclusions which highlight the final results of the research.

4. Findings

4.1. Simple regressions between variations in taxation and indicators of inequality

In the model below, observation of the correlation between variations in taxation and indicators of inequality is attempted. The aim is to observe the level of influence of each independent variable on the dependent variable - the Gini coefficient (inequality) and Poverty Rate (Persons at risk of poverty or social exclusion).

"Income inequality is the differences in how income is distributed among the population". (OECD *Income inequality Indicator, Income inequality* (disposable income, Gini coefficient https://www.oecd.org/en/data/indicators/income-inequality.html) Gini coefficient is an index of measuring income inequality. (OECD *Income inequality Indicator, Income inequality (disposable income) Gini coefficient* https://www.oecd.org/en/data/indicators/income-inequality.html) .

"Poverty rate is the ratio of the population whose income falls below the poverty line" (OECD, *Poverty rate* Indicator, https://www.oecd.org/en/data/indicators/poverty-rate.html).

For this analysis, simple regression models were used through *the method of the smallest squares (Least Squares)* – a method of estimating parameters, achieved in each individual model. (Wikipedia, *Least squares*, https://en.wikipedia.org/wiki/Least_squares).

Dependent variables: Gini coefficient (inequality), Persons at risk of poverty or social exclusion by age and sex,

Independent variables: total taxes (% in GDP); direct taxes (% of GDP); tax revenue (% in GDP); indirect taxes (% in GDP); VAT (% of GDP).

4.2. Models with dependent variables: Gini coefficient (inequality)

MODEL 1 1) COEFGINI = F(IMPTOTALPIB)

Independent variable total taxes (% in GDP) IMPTOTALPIB

The coefficient (-0,27) shows that the independent variable *total taxes* (% in GDP) has a negative influence on the dependent variable, the *Gini coefficient (inequality).* A 1-unit increase in the independent variable, total taxes is associated with a decrease of 0.27, of the dependent variable, Gini coefficient (inequality), which signifies a positive effect for income inequality (Gini coefficient). This decrease shows that between the independent variable total taxes and the dependent variable Gini coefficient; there is an inversely proportional relation.

Probability 0.0 < 0.05 shows a *statistically significant influence* of the independent variable, total taxes on the dependent variable, the Gini coefficient (inequality) which means that the tax changes are statistically reflected on the level of inequality.

The coefficient of determination R^2 0.16 < 0.6 shows a *weak* link between the independent variable total taxes (% in GDP) and the dependent variable Gini coefficient (inequality). This means that only 16% of the dependent variable Gini coefficient (inequality) is due to the contribution of the independent variable total taxes. **(Table 1, see Annex)**

Conclusion

The model shows a significant influence of independent variable, total taxes, on the dependent variable, the Gini coefficient (inequality), the two variables being in inversely proportional relation, the independent variable having a positive effect on the dependent one. 16% of the dependent variable Gini coefficient (inequality) is due to the contribution of the independent variable, total taxes.

MODEL 2 2) COEFGINI = F(IMPDIRLPIB, IMPINDIRPIB)

Independent variable: direct taxes (% in GDP) (IMPDIRPIB)

The coefficient of the independent variable (-0,22) shows that the independent variable *direct taxes* (% in GDP) has a negative influence on the dependent variable, *the Gini coefficient (inequality)*. A 1-unit increase in the independent variable direct taxes is associated with a decrease of 0.22, of the dependent variable Gini coefficient (inequality), which signifies a positive effect for income inequality. This decrease shows that between the independent variable direct taxes and the dependent variable, Gini coefficient, there is an inversely proportional relation.

Probability 0.0 < 0,05 shows a statistically significant influence of the independent variable, direct taxes on the dependent variable, the Gini coefficient (inequality), which means that the changes in taxation are statistically reflected on the level of inequality.

The coefficient of determination R^2 0.08 < 0.6 shows a weak link between the independent variable direct taxes (% in GDP) and the dependent one, Gini coefficient (inequality). This means that 8% of the dependent variable Gini coefficient (inequality) is due to the contribution of the independent variable direct taxes. **(Table 2, see Annex)**

Conclusion

The independent variable direct tax has a significant influence on the dependent variable, Gini coefficient (inequality), the effect being positive, of diminishing the income inequality, with the mention that only 8% of the dependent variable Gini coefficient (inequality) is due to the contribution of the independent variable.

Independent variable: indirect taxes (% in GDP) (IMPINIDIRPIB)

The coefficient 0.04 shows that the independent variable indirect taxes (% in GDP) has a positive influence on the dependent variable, Gini coefficient (inequality). An increase of 1 unit of the independent variable, indirect taxes is associated with an increase with 0.04, of the dependent variable, Gini coefficient (inequality), which signifies a negative effect for income inequality. This increase shows that between the independent variable, indirect taxes and the dependent variable Gini coefficient, there is a directly proportional relation.

Probability 0,61 > 0,05 shows a *statistically insignificant influence* of the independent variable (indirect taxes) on the dependent variable, Gini coefficient (inequality).

The coefficient of determination R2 0,08 < 0,6 shows a *weak* link between the independent variable indirect taxes (% in GDP) and the dependent one, the Gini coefficient (inequality). This means that only 8% of the dependent variable Gini coefficient (inequality) is due to the contribution of the independent variable indirect taxes. **(Table 2, see Annex)**

Conclusions *The model shows an insignificant influence of the independent variable, indirect taxes on the dependent variable, Gini coefficient (inequality), the effect on it being negative, of increasing income inequality; between the two variables there is a directly proportional relationship. Only 8% of the dependent variable, Gini coefficient (inequality) is due to the contribution of the independent variable, indirect taxes.*

MODEL 3 3) COEFGINI= F(IMPDIRPIB, VENITURIPIB)

Independent variable: direct taxes (% in GDP) (IMPDIRPIB)

The coefficient (- 0.18) shows that the independent variable, direct taxes (% in GDP) has a negative influence on the dependent variable, Gini coefficient (inequality). A 1-unit increase in the independent variable, direct taxes is associated with a decrease of 0.18, of the dependent variable, Gini coefficient (inequality), which signifies a positive effect for income inequality. This decrease shows that between the independent variable direct taxes and the dependent variable Gini coefficient, there is an inversely proportional relation.

Probability 0,0002 < 0,05 shows a statistically significant influence of the independent variable, direct taxes, on the dependent variable, Gini coefficient (inequality), which means that the changes in taxation are statistically reflected on the level of inequality.

The coefficient of determination R2 0.12 < 0,6 shows a weak link between the independent variable, direct taxes (% in GDP) and the dependent one, Gini coefficient (inequality). This means that only 12% of the dependent variable Gini coefficient (inequality) is due to the contribution of the independent variable, direct taxes. **(Tabel 3, see Annex)**

Conclusion *The independent variable direct taxes exert a significant influence on the dependent one (Gini coefficient), its effect, being of diminishing the income inequality (Gini coefficient), between the two variables there is an inversely proportional relation. 12% of the dependent variable, Gini coefficient (inequality) is due to the contribution of the independent variable, direct taxes.*

Independent variable: tax revenues (% in GDP) (VENUURIPIB)

Coefficient (- 0.64) shows that the independent variable tax revenues (% in GDP) has a negative influence on the dependent variable, Gini coefficient (inequality). A 1-unit increase in the independent variable, tax revenues is associated with a decrease of 0.64, of the dependent variable, Gini coefficient (inequality), which signifies a positive effect for income inequality. This decrease shows that between the independent variable, tax revenues and the dependent variable, Gini coefficient there is an inversely proportional relation.

Probability 0.02 < 0.05 shows a statistically significant influence of the independent variable, tax revenues, on the dependent variable, Gini coefficient (inequality), which shows that the changes in taxation are statistically reflected on the level of inequality.

The coefficient of determination R2 0.12 < 0.6 shows a weak link between the independent variable, tax revenues (% in GDP) and the dependent variable, Gini coefficient (inequality). This means that only 12% of the dependent variable Gini coefficient (inequality) is due to the contribution of the independent variable, tax revenues. **(Tabel 3, see Annex)**

Conclusion *The model shows that the independent variable, tax revenues exert a significant influence on the dependent variable, its effect being positive, of diminishing the income inequality (Gini coefficient); between the two variables there is an inversely proportional relation. 12% of the dependent variable, Gini coefficient (inequality) is due to the contribution of the independent variable, tax revenues.*

MODEL 4 4) COEFGINI= F(IMPINDIRPIB, TVAPIB)

Independent variable: indirect taxes (% in GDP) (IMPINIDIRPIB)

Coefficient (- 0.11) shows that the independent variable, indirect taxes (% in GDP) has a negative influence on the dependent variable, Gini coefficient (inequality). A 1-unit increase in the independent variable, indirect taxes is associated with a decrease of 0.11 of the dependent variables, Gini coefficient (inequality), which signifies a positive effect for income inequality. This decrease shows that between the independent variable, indirect taxes and the dependent variable, Gini coefficient there is an inversely proportional relation.

Probability 0.36 > 0.05 shows a statistically insignificant influence.

The coefficient of determination R2 0.005 < 0.6 shows a weak link between the independent variable, indirect taxes (% in GDP) and the dependent variable, Gini coefficient (inequality). This means that only 0.5% of the dependent variable, Gini coefficient (inequality) is due to the contribution of the independent variable, indirect taxes. **(Tabel 4, see Annex)**

Conclusion *The model shows that the independent variable, indirect taxes exerts an insignificant influence on the dependent variable (Gini coefficient), its effect being positive, of diminishing the income inequality (Gini coefficient), between the two variables existing an inversely proportional relation. 0.5% of the dependent variable, Gini coefficient (inequality) is due to the contribution of the independent variable, indirect taxes.*

Independent variable: VAT (% in GDP) (TVAPIB)

The coefficient 0.26 shows that the independent variable VAT (% in GDP) has a positive influence on the dependent variable, the Gini coefficient (inequality). An increase of 1 unit of the independent variable VAT is associated with an increase of 0.26, of the dependent variable, Gini coefficient (inequality), which signifies a negative effect, for income inequality. This decrease shows that between the independent variable VAT and the dependent variable, Gini coefficient, there is a directly proportional relation.

Probability 0.26 > 0.05 shows a statistically insignificant influence of the independent variable on the dependent variable.

The coefficient of determination R2 0.005 < 0.6 shows a weak link between the independent variable VAT and the dependent variable, Gini coefficient (inequality). This means that only 0.5% of the dependent variable, Gini coefficient (inequality) is due to the contribution of the independent variable, VAT. **(Tabel 4, see Annex)**

Conclusion *The independent variable VAT exerts an insignificant influence on the dependent one (Gini coefficient), this having a negative effect, of increasing the income inequality, between the two variables, existing a directly proportional relation. Only 0.5% of the dependent variable, Gini coefficient (inequality) is due to the contribution of the independent variable VAT.*

Descriptive statistics. For the 4 models developed, 5 independent variables were used: total taxes, direct taxes, tax revenues, indirect taxes, VAT, expressed as % in GDP and the dependent variable, GINI coefficient (inequality). There is a number of 243 observations, for each variable. **(Tabel 5, see Annex)**

4.3. Models with dependent variable - poverty rate (Persons at risk of poverty or social exclusion)

MODEL 1

1) RISCAREXCLSOC= F(IMPTOTALPIB)

Independent variable, total taxes (% in GDP) (IMPTOTALPIB)

Coefficient -0.46 shows a negative influence of the independent variable, total taxes (% in GDP), on the dependent variable, the poverty rate (Persons at risk of poverty or social exclusion). A 1-unit increase in the independent variable, total taxes is associated with a decrease of 0.46 in the dependent variable, poverty rate (Persons at risk of poverty or social exclusion), which means a positive effect for the poverty rate. This decrease shows that between the independent variable, total taxes and the dependent variable, poverty rate (Persons at risk of poverty or social exclusion), there is an inversely proportional relationship.

Probability 0.0 < 0.05 shows a statistically significant influence of the independent variable, total taxes on dependent variable poverty rate (Persons at risk of poverty or social exclusion) which means that changes in taxation are statistically reflected on the level of inequality.

The coefficient of determination R2 0.18 < 0.6 shows a weak link between the independent variable, total taxes (% in GDP) and the dependent variable, the poverty rate (Persons at risk of poverty or social exclusion). This indicates that only 18% of the dependent variable, poverty rate is due to the contribution of the independent variable, total taxes. **(Tabel 6, see Annex)**

Conclusion *The model shows the significant influence of the independent variable, total taxes, on the dependent variable, poverty rate (Persons at risk of poverty or social exclusion), with a positive effect on the poverty rate, by reducing it, with the mention that only 18% of the dependent variable poverty rate is due to the contribution of the independent variable, total taxes.*

MODEL 2 2) RISCAREXCLSOC= F(IMPDIRPIB, IMPINDIRPIB)

Independent variable: direct taxes (% in GDP) (IMPDIRPIB)

Coefficient (- 0.44) shows that the independent variable, direct taxes (% in GDP) exerts a negative influence on the dependent variable, the poverty rate (Persons at risk of poverty or social exclusion). An increase of 1 unit of the independent variable VAT is associated with a decrease of 0.44 of the dependent variable, poverty rate, which signifies a positive effect. This decrease shows that between the independent variable, direct taxes and the dependent variable poverty rate there is an inversely proportional relationship.

Probability 0.0 < 0.05 shows a statistically significant influence of the independent variable, direct taxes, on the dependent variable, poverty rate (Persons at risk of poverty or social exclusion). This shows the link between tax changes and the poverty rate (Persons at risk of poverty or social exclusion).

The coefficient of determination R2 0.12 < 0.6 indicates a weak link between the independent variable, direct taxes (% in GDP) and the dependent variable, poverty rate (Persons at risk of poverty or social exclusion). This shows that only 12% of the dependent variable, poverty rate (Persons at risk of poverty or social exclusion) is due to the contribution of the independent variable, direct taxes. **(Tabel 7, see Annex)**

Conclusion *The model signalizes the significant influence of the independent variable, direct taxes on the dependent variable, poverty rate (Persons at risk of poverty or social exclusion), with a positive effect on the poverty rate, by reducing it, with the mention that only 12% of the dependent variable, poverty rate is due to the contribution of the independent variable, direct taxes.*

Independent variable: indirect taxes (% in GDP) (IMPINDIRPIB)

Coefficient 0.11 shows a positive influence of the independent variable, indirect taxes (% in GDP), on the dependent variable, the poverty rate (Persons at risk of poverty or social exclusion). A 1-unit increase in the independent variable, indirect taxes is associated with an increase of 0.11 in the dependent variable, poverty rate (Persons at risk of poverty or social exclusion), which signifies a negative effect for the poverty rate. This increase shows that between the independent variable, indirect taxes and the dependent variable, poverty rate there is a directly proportional relationship.

Probability 0.42 > 0.05 shows a statistically insignificant influence of the independent variable, indirect taxes, on the dependent variable, poverty rate (Persons at risk of poverty or social exclusion).

The coefficient of determination R2 0.12 < 0.6 shows a weak link between the independent variable, indirect taxes (% in GDP) and the dependent variable, the poverty rate (Persons at risk of poverty or social exclusion). This shows that only 12% of the dependent variable, poverty rate (Persons at risk of poverty or social exclusion) is due to the contribution of the independent variable, indirect taxes. **(Tabel 7, see Annex)**

Conclusion *The model shows the insignificant influence of the independent variable, indirect taxes, on the dependent variable, poverty rate (Persons at risk of poverty or social exclusion). The independent variable (indirect taxes) exerts a negative effect on the dependent one (poverty rate), mentioning that only 12% of the dependent variable, poverty rate (Persons at risk of poverty or social exclusion) is due to the contribution of the independent variable, indirect taxes.*

MODEL 3 3) RISCSAREXCLSOC= F(IMPDIRPIB, VENITURIPIB)

Independent variable: direct taxes (% in GDP) (IMPDIRPIB)

Coefficient (-0.34) shows a negative influence of the independent variable direct taxes (% in GDP) on the dependent variable, poverty rate (Persons at risk of poverty or social exclusion). A 1-unit increase in the independent variable, direct taxes is associated with a decrease of 0.34 in the dependent variable, which signifies a positive effect for the poverty rate (Persons at risk of poverty or social exclusion). This decrease shows that between the independent variable, direct taxes and the dependent variable poverty rate, there is an inversely proportional relationship.

Probability 0.0 < 0.05 shows a statistically significant influence of the independent variable, direct taxes and the dependent variable, poverty rate (Persons at risk of poverty or social exclusion.). This shows the link between tax changes and the poverty rate.

The coefficient of determination R2 0.18 < 0.6 shows a weak link between the independent variable, direct taxes (% in GDP) and the dependent one, the poverty rate (Persons at risk of poverty or social exclusion). This indicates that only 18% of the dependent variable, poverty rate is due to the contribution of the independent variable, direct taxes. (**Tabel 8, see Annex**)

Conclusion *The model signals the significant influence of the independent variable, direct taxes, on the dependent variable, poverty rate (Persons at risk of poverty or social exclusion). The direct taxes have a positive effect on the poverty rate, of reducing it, with the mention that only 18% of the dependent variable, the poverty rate (Persons at risk of poverty or social exclusion) is due to the contribution of the independent variable, direct taxes.*

Independent variable: tax revenues (% in GDP) (VENITURIPIB)

Coefficient (- 1.39) shows a negative influence of the independent variable tax revenues (% in GDP), on the dependent variable, the poverty rate (Persons at risk of poverty or social exclusion). A 1-unit increase in the independent variable, tax revenues is associated with a decrease of 1.39% in the dependent variable, which means a positive effect for the poverty rate (Persons at risk of poverty or social exclusion). This decrease shows that between the independent variable, tax revenues and the dependent variable, poverty rate, there is an inversely proportional relationship.

Probability 0.0 < 0.05 shows a statistically significant influence of the independent variable, tax revenues on the dependent variable, poverty rate (Persons at risk of poverty or social exclusion). This shows the link between tax changes and the poverty rate (Persons at risk of poverty or social exclusion).

The coefficient of determination R2 0.18 < 0.6 shows a weak link between the independent variable, tax revenues (% IN GDP) and the dependent variable, poverty rate (Persons at risk of poverty or social exclusion). It indicates that only 18% of the dependent variable, the poverty rate (Persons at risk of poverty or social exclusion) is due to the contribution of the independent variable, tax revenues. **(Tabel 8, see Annex)**

Conclusion *The model signalizes the significant influence of the independent variable, tax revenues, on the dependent variable, poverty rate (Persons at risk of poverty or social exclusion). Tax revenues have a positive effect on the poverty rate, of reducing it, with the mention that only 18% of the dependent variable, poverty rate is due to the contribution of independent variable, tax revenues.*

MODEL 4 4) RISCSAREXCLSOC= F(IMPINDIRPIB, TVAIPIB)

Independent variable: indirect taxes (% in GDP) (IMPINDIRPIB)

Coefficient 0.11 shows a positive influence of the independent variable, indirect taxes (% in GDP) on the dependent variable, poverty rate (Persons at risk of poverty or social exclusion). An increase of 1 unit of the independent variable, indirect taxes is associated with an increase of 0.11 of the dependent variable, poverty rate (Persons at risk of poverty or social exclusion), which signifies a negative effect, for the poverty rate. This increase shows that between the independent variable, indirect taxes and the dependent variable, poverty rate, there is a directly proportional relationship.

Probability 0.62 > 0.05 shows a statistically insignificant influence of the independent variable, indirect taxes on the dependent variable, poverty rate (Persons at risk of poverty or social exclusion).

The coefficient of determination R2 0.001 < 0.6 shows a weak link between the independent variable, indirect taxes (% in GDP) and the dependent one, poverty rate (Persons at risk of poverty or social exclusion). It indicates that only 0.1% of the dependent variable, poverty rate (Persons at risk of poverty or social exclusion) is due to the contribution of the independent variable, indirect taxes. **(Tabel 9, see Annex)**

Conclusion *The model shows an insignificant influence, of the independent variable, indirect taxes, on the dependent variable, poverty rate (Persons at risk of poverty or social exclusion) and a negative effect of its increase, on the of poverty rate, noting that only 0.1% of the dependent variable poverty rate is due to the contribution of the independent variable, indirect taxes.*

Independent variable: VAT (% in GDP) (TVAPIB)

Coefficient (-0.23) shows a negative influence of the independent variable, VAT (% in GDP) on the dependent variable, poverty rate (Persons at risk of poverty or social exclusion). A 1-unit increase in the independent variable, VAT is associated with a decrease of 0.23 in the dependent variable, poverty rate (Persons at risk of poverty or social exclusion), which means a positive effect for the poverty rate. This decrease shows that between the independent variable VAT and the dependent variable, poverty rate, there is an inversely proportional relationship.

Probability 0,56 > 0,05 shows a statistically insignificant influence of the independent variable VAT on the dependent variable poverty rate (Persons at risk of poverty or social exclusion).

The **coefficient of determination R^2** 0.001 < 0.6 shows a weak link between the independent variable VAT (% in GDP) and the dependent variable, the poverty rate (Persons at risk of poverty or social exclusion). This indicates that only 0.1% of the dependent variable poverty rate is due to the contribution of the independent variable, VAT. **(Tabel 9, see Annex)**

Conclusion *The model signalizes the insignificant influence of the independent variable, VAT on the dependent variable, poverty rate (Persons at risk of poverty or social exclusion). VAT has exerted a positive effect on the poverty rate, of reducing it, with the mention that only 0.1% of the dependent variable, poverty rate is due to the contribution of the independent variable VAT.*

Descriptive statistics. For the four models developed, five independent variables were used: total taxes, direct taxes, tax revenues, indirect taxes, VAT, expressed as % in GDP and the dependent variable, poverty rate (Persons at risk of poverty or social exclusion). There is a number of 216 observations for each variable. (**Tabel 10, see Annex**)

5. Conclusions

From the study undertaken in the present paper it can be observed essential elements that drive on the results concerning the impact of different types of taxes on inequality (Gini coefficient). Thus, from theoretical background it can be observed that different authors developed significant researches on this topic area - the impact of taxation on inequality (Gini coefficient), using different models and reached relevant conclusions on this subject.

The idea that can stand out is that various elements intervenes and influence the impact of taxes on inequality (Gini coefficient), as for example: the level of economic development and specificity of country's tax system, conjuncture of country reforms, human behaviour in relation to tax evasion, financial inclusion, progressive taxes, risk resilience of entrepreneurs and their skills to invest in efficient projects, changes on people′s economic status – assessed in income and others.

For finding on the relations between the variations of taxation and the indicators of inequality (Gini coefficient) and poverty rate (Persons at risk of poverty or social exclusion), regression models were used. For that purpose, data on taxes, as well as those from the structure of taxation, respectively, total taxes, direct taxes and indirect taxes, VAT, along with the indicators of inequality (Gini coefficient) and poverty rate (Persons at risk of poverty or social exclusion) were taken into account.

Eight simple regression models that show the variations in taxation and indicators of inequality were developed with the *dependent* variables: Gini coefficient (inequality) and poverty rate (Persons at risk of poverty or social exclusion) and *independent* variables: total taxes (% in GDP); direct taxes (% of GDP); tax revenue (% in GDP); indirect taxes (% in GDP); VAT (% of GDP). Each four models were developed for each two dependent variables. From each model it could be drawn conclusions on the basis of the influence of the independent variable on the dependent variable, taking into account the variations of values taken by the coefficients, probability, coefficient of determination R^2 which gives different influence and correlations between the independent variables and dependent variables.

5. Acknowledgment

This article is a part of the research paper achieved in the year 2024, by a research team of Institute of National Economy, Romanian Academy "Fiscalitate și inegalitate: provocări pentru creștere economică robustă și incluziune socială pentru toți" [Taxation and inequality: challenges for robust economic growth and social inclusion for all].

6. References

- Azarenko, N.; Kazakov, O.; Kulagina, N.; Rodionov, D., 2020, The model of human capital development with innovative characteristics in digital economy. *IOP Conference Series Materials Science and Engineering*, Vol. 940, International Scientific Conference "Digital Transformation on Manufacturing, Infrastructure and Service" 940(1):012032. https://doi.org/10.1088/1757-899X/940/1/012032
- Bakar, S.A.A.; Pathmanathan, D., 2020, Income modeling with the Weibull mixtures. *Communications in Statistics - Theory and Methods* 2020, 51, Vol. 51, Issue 11, pp.3612-3628, https://doi.org/10.1080/03610926.2020.1800737
- Belov, A., 2021, Economic Policy of Japan in the Time of Pandemic. *World Economy and International Relations*, Vol. 65, no. 1, pp. 33-41, https://doi.org/10.20542/0131-2227-2021-65-1-33-41
- Bertotti, M.L.; Modanese, G., 2014, Micro to macro models for income distribution in the absence and in the presence of tax evasion. *Applied Mathematics and Computation*, Vol. 244, 1, pp.836-846, https://doi.org/10.48550/arXiv.1403.0015

- Bertotti, M.L.; Modanese, G., 2016, Economic inequality and mobility in kinetic models for social sciences. *The European Physical Journal Special Topics*. Vol. 225, Issue 10, pp. 1945–1958. https://doi.org/10.1140/epjst/e2015-50117-8
- Bertotti, M.L.; Modanese, G., 2016, Microscopic models for the study of taxpayer audit effects. *International Journal of Modern Physics C.* Vol. 27, No. 09, 1650100. https://doi.org/10.1142/S012918311650100X
- Bertotti, M.L.; Modanese, G., 2018, Mathematical models describing the effects of different tax evasion behaviors. *Journal of Economic Interaction and Coordination*, Vol. 13, pp. 351–363, https://doi.org/10.1007/s11403-016-0185-9
- Dianov S., Koroleva L., Pokrovskaia N., Victorova N. and Zaytsev A., 2022, The Influence of Taxation on Income Inequality: Analysis of the Practice in the EU Countries, *Sustainability*, 14(15), 9066; https://doi.org/10.3390/su14159066
- Duncan, D., Peter, Sabirianova K. 2016, Unequal inequalities: Do progressive taxes reduce income inequality?, *International Tax Public Finance*, Vol. 23, pp. 762–783, https://doi.org/10.1007/s10797-016-9412-5
- Gill D., 2016, Do Higher Taxes Reduce Inequality?, *Chicago Booth Review (CBR) Economics*, February 26. [online] Available at: https://www.chicagobooth.edu/review/do-higher-taxes-reduce-inequality
- Lei, X.-T.; Xu, Q.-Y.; Jin, C.-Z., 2022, Nature of property right and the motives for holding cash: Empirical evidence from Chinese listed companies. *Managerial and Decision Economics*, 43, pp.1482–1500, https://doi.org/10.1002/mde.3469
- Luebker M., 2011, The impact of taxes and transfers on inequality, *TRAVAIL Policy Brief No. 4* International Labour Organisation, International Labour Office Geneva, [online] Available at: https://www.ilo.org/sites/default/files/wcmsp5/groups/public/@ed_protect/@protrav/@travail/documents/publication/wcms_160436.pdf
- Nadezhina, O.; Avduevskaia, E., 2021, Genesis of Human Capital Theory in the Context of Digitalization. In Proceedings of the European Conference on Knowledge Management, ECKM 2021, Coventry University, Coventry, UK, pp. 577–584. https://dx.doi.org/10.34190/EKM.21.193
- Omar, M.A.; Inaba, K., 2020, Does financial inclusion reduce poverty and income inequality in developing countries? A panel data analysis. *Journal Economic Structures* 9, Article 37 (2020), https://doi.org/10.1186/s40008-020-00214-4
- Pastor L. and Veronesi P., 2015, Income Inequality and Asset Prices under Redistributive Taxation, NBER Working Paper, Working Paper 21668. *Journal of Monetary Economics*, Vol. 81, pp. 1-20, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2674633; https://doi.org/10.1016/j.jmoneco.2016.03.004
- Park, Cyn-Young and Mercado, Rogelio, 2018. Financial Inclusion: New Measurement and Cross-Country Impact Assessment. *ADBI Working Paper* 539, Manila, Philippines, Available at https://doi.org/10.22617/WPS189270-2
- Rodionov, D.G.; Kudryavtseva, T.J.; Skhvediani, A.E., 2018 Human Development and Income Inequality as Factors of Regional Economic Growth. *European Research Studies Journal*, Vol. XXI, 21, Special Issue 2, 323-337. [online] Available at: https://ersj.eu/journal/1259
- Rodionov, D.; Zaytsev, A.; Konnikov, E.; Dmitriev, N.; Dubolazova, Y., 2021, Modeling changes in the enterprise information capital in the digital economy. *Journal of Open Innovation: Technology, Market, and Complexity*, Volume 7, Issue 3, 166. https://doi.org/10.3390/joitmc7030166
- Volodin, A.; Ivanov, M.; Djanelidze, M.; Sokolitsyn, A., 2019. An analytical model of economic inequality in the Russian regions and its correlation with the global trend in the digital economy. In Proceedings of the SPBPU IDE'19: *International Scientific Conference on Innovations in Digital Economy 2019,* Saint Petersburg, Russia, 24–25 October 2019. SPBPU IDE '19: Proceedings of the 2019 International SPBPU Scientific Conference on Innovations in Digital Econom Article No.: 47, pp. 1 – 4, https://doi.org/10.1145/3372177.3373350
- Victorova, N.; Rytova, E.; Koroleva, L.; Pokrovskaia, N. 2020, Determinants of Tax Capacity for a Territory (The Case of the Russian Federal Districts). *International Journal of Technology,* Vol 11, No 6, 1255. https://doi.org/10.14716/ijtech.v11i6.4421
- Nesterov, I. 2021, Accommodative Monetary Policy, Fiscal Stimulus and Foreign Exchange Reserves within the Framework of Russian National Economic Interests: Long-Standing Problems and New Challenges. Vestn. *St Petersburg University Journal of Economic Studies,* 37(3):371-394, https://doi.org/10.21638/spbu05.2021.301

- European Commission, 2024*, DG Taxation and Customs Union, based on Eurostat data, Data on Taxation Trend, data*. [online] Available at: https://taxation-customs.ec.europa.eu/taxation/economic-analysis/data-taxation-trends_en
- Eurostat, *Gini coefficient of equivalised disposable income by age*. [online] Available at: https://ec.europa.eu/eurostat/databrowser/view/ilc_di12/default/table?lang=en
- Eurostat, *Persons at risk of poverty or social exclusion by age and sex*, Eurostat DOI: 10.2908/ilc_peps01n; [online] Available at: https://ec.europa.eu/eurostat/databrowser/view/ilc_peps01n/default/table?lang=en.
- Eurostat Database, [online] Available at: https://ec.europa.eu/eurostat
- OECD, 2024. *Taxation and Inequality: OECD Report to G20 Finance Ministers and Central Bank Governors.* OECD Publishing, Paris, 25 July 2024, Brazil OECD 2024, https://doi.org/10.1787/8dbf9a62-en
- OECD, *Income inequality. Indicator, Income inequality (disposable income, Gini coefficient).* [online] Available at: https://www.oecd.org/en/data/indicators/income-inequality.html
- OECD, *Poverty rate. Indicator.* [online] Available at: https://www.oecd.org/en/data/indicators/poverty-rate.html
- Wikipedia, *Least squares*. [online] Available at: https://en.wikipedia.org/wiki/Least_squares
- Wikipedia, *Economic mobilit*y. [online] Available at: https://en.wikipedia.org/wiki/Economic_mobility
- World Bank. 2014. *Global Financial Development Report 2014: Financial Inclusion*. Washington, DC: World Bank. License: Creative Commons Attribution CC BY 3.0, https://doi.org/10.1596/9780821399859
- World Bank. 2016. *Poverty and Shared Prosperity 2016: Taking on Inequality.* Washington, DC: World Bank. License: Creative Commons Attribution CC BY 3.0 IGO, [online] Available at: https://openknowledge.worldbank.org/server/api/core/bitstreams/bebd3e0f-05ed-5c5f-9031-4764534449ae/content.

ANNEX

Models with dependent variable - Gini coefficient (inequality)

TABLE 1
MODEL 1

Dependent Variable: COEFGINI
Method: Panel Least Squares
Sample: 2014 2022
Periods included: 9
Cross-sections included: 27
Total panel (balanced) observations: 243

Variable	Coefficient	Std. Error	t-Statistic	Prob.
IMPTOTALPIB	-0.276019	0.039575	-6.974536	0.0000
C	39.84456	1.460853	27.27487	0.0000

R-squared	0.167945	Mean dependent var	29.78765
Adjusted R-squared	0.164492	S.D. dependent var	3.995195
S.E. of regression	3.651853	Akaike info criterion	5.436543
Sum squared resid	3213.983	Schwarz criterion	5.465292
Log likelihood	-658.5400	Hannan-Quinn criter.	5.448123
F-statistic	48.64416	Durbin-Watson stat	0.076033
Prob(F-statistic)	0.000000		

Source: processing data from European Commission, 2024, DG Taxation and Customs Union based on Eurostat data, Data on Taxation Trends, https://taxation-customs.ec.europa.eu/taxation/economic-analysis/data-taxation-trends_en; Eurostat Database, https://ec.europa.eu/eurostat; Eurostat: Gini coefficient of equivalised disposable income by age, Eurostat https://ec.europa.eu/eurostat/databrowser/view/ilc_di12/default/table?lang=en; Eurostat: Persons at risk of poverty or social exclusion by age and sex, Eurostat https://ec.europa.eu/eurostat/databrowser/view/ilc_peps01n/default/table?lang=en

TABLE 2
MODEL 2

Dependent Variable: COEFGINI
Method: Panel Least Squares
Sample: 2014 2022
Periods included: 9
Cross-sections included: 27
Total panel (balanced) observations: 243

Variable	Coefficient	Std. Error	t-Statistic	Prob.
IMPDIRPIB	-0.227797	0.047348	-4.811142	0.0000
IMPINDIRPIB	0.042525	0.084542	0.503007	0.6154
C	31.79196	1.265987	25.11238	0.0000

R-squared	0.088022	Mean dependent var	29.78765
Adjusted R-squared	0.080423	S.D. dependent var	3.995195
S.E. of regression	3.831176	Akaike info criterion	5.536490
Sum squared resid	3522.699	Schwarz criterion	5.579614
Log likelihood	-669.6835	Hannan-Quinn criter.	5.553860
F-statistic	11.58217	Durbin-Watson stat	0.061809
Prob(F-statistic)	0.000016		

Source: processing data from European Commission, 2024, DG Taxation and Customs Union based on Eurostat data, Data on Taxation Trends, https://taxation-customs.ec.europa.eu/taxation/economic-analysis/data-taxation-trends_en; Eurostat Database, https://ec.europa.eu/eurostat; Eurostat: Gini coefficient of equivalised disposable income by age, Eurostat https://ec.europa.eu/eurostat/databrowser/view/ilc_di12/default/table?lang=en; Eurostat: Persons at risk of poverty or social exclusion by age and sex, Eurostat https://ec.europa.eu/eurostat/databrowser/view/ilc_peps01n/default/table?lang=en

TABLE 3
MODEL 3

Dependent Variable: COEFGINI

Method: Panel Least Squares

Sample: 2014 2022

Periods included: 9

Cross-sections included: 27

Total panel (balanced) observations: 243

Variable	Coefficient	Std. Error	t-Statistic	Prob.
IMPDIRPIB	-0.180725	0.048292	-3.742327	0.0002
VENITURIPIB	-0.648205	0.213113	-3.041608	0.0026
C	33.68329	0.725403	46.43390	0.0000

R-squared	0.120946	Mean dependent var	29.78765
Adjusted R-squared	0.113621	S.D. dependent var	3.995195
S.E. of regression	3.761385	Akaike info criterion	5.499720
Sum squared resid	3395.524	Schwarz criterion	5.542845
Log likelihood	-665.2160	Hannan-Quinn criter.	5.517090
F-statistic	16.51041	Durbin-Watson stat	0.068664
Prob(F-statistic)	0.000000		

Source: processing data from European Commission, 2024, DG Taxation and Customs Union based on Eurostat data, Data on Taxation Trends, https://taxation-customs.ec.europa.eu/taxation/economic-analysis/data-taxation-trends_en; Eurostat Database, https://ec.europa.eu/eurostat; Eurostat: Gini coefficient of equivalised disposable income by age, Eurostat https://ec.europa.eu/eurostat/databrowser/view/ilc_di12/default/table?lang=en; Eurostat: Persons at risk of poverty or social exclusion by age and sex, Eurostat https://ec.europa.eu/eurostat/databrowser/view/ilc_peps01n/default/table?lang=en

TABLE 4
MODEL 4
Dependent Variable: COEFGINI
Method: Panel Least Squares
Sample: 2014 2022
Periods included: 9
Cross-sections included: 27
Total panel (balanced) observations: 243

Variable	Coefficient	Std. Error	t-Statistic	Prob.
IMPINDIRPIB	-0.119974	0.131519	-0.912217	0.3626
TVAPIB	0.268638	0.241995	1.110099	0.2681
C	29.36667	1.362519	21.55322	0.0000

R-squared	0.005174	Mean dependent var	29.78765
Adjusted R-squared	-0.003117	S.D. dependent var	3.995195
S.E. of regression	4.001416	Akaike info criterion	5.623442
Sum squared resid	3842.719	Schwarz criterion	5.666567
Log likelihood	-680.2483	Hannan-Quinn criter.	5.640812
F-statistic	0.624064	Durbin-Watson stat	0.056683
Prob(F-statistic)	0.536630		

Source: processing data from European Commission, 2024, DG Taxation and Customs Union based on Eurostat data, Data on Taxation Trends, https://taxation-customs.ec.europa.eu/taxation/economic-analysis/data-taxation-trends_en; Eurostat Database, https://ec.europa.eu/eurostat; Eurostat: Gini coefficient of equivalised disposable income by age, Eurostat https://ec.europa.eu/eurostat/databrowser/view/ilc_di12/default/table?lang=en; Eurostat: Persons at risk of poverty or social exclusion by age and sex, Eurostat https://ec.europa.eu/eurostat/databrowser/view/ilc_peps01n/default/table?lang=en

TABLE 5
Descriptive statistics for models with dependent variable GINI Coefficient

	COEFGINI	IMPTOTALPIB	IMPDIRPIB	VENITURIPIB	IMPINDIRPIB	TVAPIB
Mean	29.78765	36.43550	11.42917	2.823339	14.09104	7.860157
Median	29.20000	36.69826	10.36562	2.633215	14.00928	7.655952
Maximum	40.80000	48.90441	32.79244	6.604745	22.50157	13.30266
Minimum	20.90000	19.77849	4.695796	0.156021	6.428112	3.398645
Std. Dev.	3.995195	5.931727	5.247098	1.189010	2.938630	1.597078
Skewness	0.344703	-0.299419	1.727368	1.156216	0.590600	0.663938
Kurtosis	2.718741	2.700847	7.087308	4.312194	3.775050	5.074987
Jarque-Bera	5.613164	4.537000	289.9930	71.57558	20.20886	61.44683
Probability	0.060411	0.103467	0.000000	0.000000	0.000041	0.000000
Sum	7238.400	8853.826	2777.288	686.0713	3424.124	1910.018

Sum Sq. Dev.	3862.703	8514.864	6662.754	342.1262	2089.802	617.2593
Observations	243	243	243	243	243	243

Source: processing data from European Commission, 2024, DG Taxation and Customs Union based on Eurostat data, Data on Taxation Trends, https://taxation-customs.ec.europa.eu/taxation/economic-analysis/data-taxation-trends_en; Eurostat Database, https://ec.europa.eu/eurostat; Eurostat: Gini coefficient of equivalised disposable income by age, Eurostat https://ec.europa.eu/eurostat/databrowser/view/ilc_di12/default/table?lang=en; Eurostat: Persons at risk of poverty or social exclusion by age and sex, Eurostat https://ec.europa.eu/eurostat/databrowser/view/ilc_peps01n/default/table?lang=en

Models with dependent variable - poverty rate (people at risk of poverty or social exclusion)

TABLE 6
MODEL 1
Dependent Variable: RISCSAREXCLSOC
Method: Panel Least Squares
Sample: 2015 2022
Periods included: 8
Cross-sections included: 27
Total panel (balanced) observations: 216

Variable	Coefficient	Std. Error	t-Statistic	Prob.
IMPTOTALPIB	-0.467006	0.066824	-6.988608	0.0000
C	38.82129	2.468373	15.72748	0.0000

R-squared	0.185818	Mean dependent var	21.79398
Adjusted R-squared	0.182014	S.D. dependent var	6.431269
S.E. of regression	5.816606	Akaike info criterion	6.368527
Sum squared resid	7240.241	Schwarz criterion	6.399780
Log likelihood	-685.8009	Hannan-Quinn criter.	6.381153
F-statistic	48.84064	Durbin-Watson stat	0.050736
Prob(F-statistic)	0.000000		

Source: processing data from European Commission, 2024, DG Taxation and Customs Union based on Eurostat data, Data on Taxation Trends, https://taxation-customs.ec.europa.eu/taxation/economic-analysis/data-taxation-trends_en; Eurostat Database, https://ec.europa.eu/eurostat; Eurostat: Gini coefficient of equivalised disposable income by age, Eurostat https://ec.europa.eu/eurostat/databrowser/view/ilc_di12/default/table?lang=en; Eurostat: Persons at risk of poverty or social exclusion by age and sex, Eurostat https://ec.europa.eu/eurostat/databrowser/view/ilc_peps01n/default/table?lang=en

TABLE 7
MODEL 2
Dependent Variable: RISCSAREXCLSOC
Method: Panel Least Squares
Sample: 2015 2022
Periods included: 8
Cross-sections included: 27
Total panel (balanced) observations: 216

Variable	Coefficient	Std. Error	t-Statistic	Prob.
IMPDIRPIB	-0.448987	0.079659	-5.636343	0.0000
IMPINDIRPIB	0.110700	0.138734	0.797925	0.4258
C	25.37588	2.091670	12.13188	0.0000

R-squared	0.129829	Mean dependent var	21.79398
Adjusted R-squared	0.121658	S.D. dependent var	6.431269
S.E. of regression	6.027379	Akaike info criterion	6.444293
Sum squared resid	7738.140	Schwarz criterion	6.491172
Log likelihood	-692.9836	Hannan-Quinn criter.	6.463232
F-statistic	15.88969	Durbin-Watson stat	0.046075
Prob(F-statistic)	0.000000		

Source: processing data from European Commission, 2024, DG Taxation and Customs Union based on Eurostat data, Data on Taxation Trends, https://taxation-customs.ec.europa.eu/taxation/economic-analysis/data-taxation-trends_en; Eurostat Database, https://ec.europa.eu/eurostat; Eurostat: Gini coefficient of equivalised disposable income by age, Eurostat https://ec.europa.eu/eurostat/databrowser/view/ilc_di12/default/table?lang=en; Eurostat: Persons at risk of poverty or social exclusion by age and sex, Eurostat https://ec.europa.eu/eurostat/databrowser/view/ilc_peps01n/default/table?lang=en

TABLE 8
MODEL 3
Dependent Variable: RISCSAREXCLSOC
Method: Panel Least Squares
Sample: 2015 2022
Periods included: 8
Cross-sections included: 27
Total panel (balanced) observations: 216

Variable	Coefficient	Std. Error	t-Statistic	Prob.
IMPDIRPIB	-0.343192	0.080361	-4.270611	0.0000
VENITURIPIB	-1.391286	0.352648	-3.945250	0.0001
C	29.69439	1.201903	24.70614	0.0000

R-squared	0.186662	Mean dependent var	21.79398
Adjusted R-squared	0.179025	S.D. dependent var	6.431269
S.E. of regression	5.827222	Akaike info criterion	6.376749
Sum squared resid	7232.737	Schwarz criterion	6.423628
Log likelihood	-685.6889	Hannan-Quinn criter.	6.395688
F-statistic	24.44193	Durbin-Watson stat	0.062130
Prob(F-statistic)	0.000000		

Source: processing data from European Commission, 2024, DG Taxation and Customs Union based on Eurostat data, Data on Taxation Trends, https://taxation-customs.ec.europa.eu/taxation/economic-analysis/data-taxation-trends_en; Eurostat Database, https://ec.europa.eu/eurostat; Eurostat: Gini coefficient of equivalised disposable income by age, Eurostat https://ec.europa.eu/eurostat/databrowser/view/ilc_di12/default/table?lang=en; Eurostat: Persons at risk of poverty or social exclusion by age and sex, Eurostat https://ec.europa.eu/eurostat/databrowser/view/ilc_peps01n/default/table?lang=en

TABLE 9
MODEL 4
Dependent Variable: RISCSAREXCLSOC
Method: Panel Least Squares
Sample: 2015 2022
Periods included: 8
Cross-sections included: 27
Total panel (balanced) observations: 216

Variable	Coefficient	Std. Error	t-Statistic	Prob.
IMPINDIRPIB	0.111413	0.224916	0.495353	0.6209
TVAPIB	-0.235752	0.412881	-0.570993	0.5686
C	22.08102	2.289131	9.646027	0.0000

R-squared	0.001573	Mean dependent var	21.79398
Adjusted R-squared	-0.007802	S.D. dependent var	6.431269
S.E. of regression	6.456307	Akaike info criterion	6.581784
Sum squared resid	8878.672	Schwarz criterion	6.628663
Log likelihood	-707.8326	Hannan-Quinn criter.	6.600723
F-statistic	0.167815	Durbin-Watson stat	0.038505
Prob(F-statistic)	0.845622		

Source: processing data from European Commission, 2024, DG Taxation and Customs Union based on Eurostat data, Data on Taxation Trends, https://taxation-customs.ec.europa.eu/taxation/economic-analysis/data-taxation-trends_en; Eurostat Database, https://ec.europa.eu/eurostat; Eurostat: Gini coefficient of equivalised disposable income by age, Eurostat https://ec.europa.eu/eurostat/databrowser/view/ilc_di12/default/table?lang=en; Eurostat: Persons at risk of poverty or social exclusion by age and sex, Eurostat https://ec.europa.eu/eurostat/databrowser/view/ilc_peps01n/default/table?lang=en

TABLE 10

Descriptive statistics for models with dependent variable ***poverty rate (People at risk of poverty or social exclusion)***

	RISCSAREXCLSOC	**IMPDIRPIB**	**IMPINDIRPIB**	**IMPTOTALPIB**	**TVAPIB**	**VENITURIPIB**
Mean	21.79398	11.44829	14.07622	36.46056	7.869745	2.854517
Median	20.10000	10.19548	14.01428	36.73123	7.737172	2.680879
Maximum	46.00000	32.18018	22.50157	47.57925	13.30266	6.604745
Minimum	10.70000	4.695796	6.428112	19.77849	3.398645	0.156021
Std. Dev.	6.431269	5.199823	2.985659	5.936334	1.626431	1.184932
Skewness	1.225958	1.682852	0.557141	-0.381699	0.609732	1.077487
Kurtosis	4.753925	6.851558	3.723829	2.774043	4.981268	4.174809
Jarque-Bera	81.79329	235.4622	15.88998	5.704511	48.71266	54.21682
Probability	0.000000	0.000000	0.000354	0.057714	0.000000	0.000000
Sum	4707.500	2472.830	3040.464	7875.481	1699.865	616.5756
Sum Sq. Dev.	8892.662	5813.204	1916.545	7576.614	568.7350	301.8737
Observations	216	216	216	216	216	216

Source: processing data from European Commission, 2024, DG Taxation and Customs Union based on Eurostat data, Data on Taxation Trends, https://taxation-customs.ec.europa.eu/taxation/economic-analysis/data-taxation-trends_en; Eurostat Database, https://ec.europa.eu/eurostat; Eurostat: Gini coefficient of equivalised disposable income by age, Eurostat https://ec.europa.eu/eurostat/databrowser/view/ilc_di12/default/table?lang=en; Eurostat: Persons at risk of poverty or social exclusion by age and sex, Eurostat https://ec.europa.eu/eurostat/databrowser/view/ilc_peps01n/default/table?lang=en