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TAXES AND INCOME INEQUALITY IN THE EUROPEAN UNION: A QUANTILE REGRESSION APPROACH

Porezi i dohodovna nejednakost u Evropskoj uniji – pristup kvantilne regresije

Abstract

This paper tests the role of taxes in reducing income inequality in the European Union members. Using Eurostat data on Gini coefficients in a 14-year period, a slight growing trend of income inequality is found. The main findings indicate that taxes have a negative and statistically significant impact on income inequality, though this impact is relatively weak. A quantile regression estimates suggest that the redistributive power of taxes is highest in the most unequal societies and vice versa. It implies that taxes reduce income inequality mostly in the early stages of government efforts toward reducing income inequality. In the paper it is argued that combating cross-border tax avoidance is of the first-order importance for reducing income inequality instead of increasing statutory tax rates or progressivity of taxes. Research results are robust to changes of sampling period and lagging independent variables.

Keywords: *taxes, income redistribution, income inequality, Gini coefficient, European Union*

Sažetak

U radu se testira uloga poreza u smanjenju dohodovne nejednakosti u članicama Evropske unije. Koristeći podatke Eurostata o Gini koeficijentima u periodu od 14 godina, utvrđen je blagi rastući trend dohodovne nejednakosti. Glavni nalazi ukazuju na to da porezi imaju negativan i statistički značajan uticaj na dohodovnu nejednakost, premda je taj uticaj relativno slab. Rezultati kvantilne regresije ukazuju na to da je redistributivna snaga poreza najveća u društvima sa najvećom nejednakošću i vice versa. To ukazuje na to da porezi smanjuju dohodovnu nejednakost mahom u ranim fazama napora vlade ka umanjenju dohodovne nejednakosti. U ovom radu se tvrdi da je sprečavanje prekograničnog izbegavanja poreza od primarnog značaja za umanjenje dohodovne nejednakosti, pre nego povećanje propisanih poreskih stopa ili progresivnosti poreza. Rezultati istraživanja su robustni na promene perioda uzorkovanja i odloženih efekata nezavisnih varijabli.

Ključne reči: *porezi, redistribucija dohotka, dohodovna nejednakost, Gini koeficijent, Evropska unija*

Introduction

In modern societies, governments use taxes as a tool for fulfilling many different objectives. For instance, taxes may be used to allocate resources and provide public goods and services, to mitigate market imperfections or to alter the behavior of individuals and companies. In addition, taxes enable governments to deduct the wealth from certain economic agents and distribute it to the others.

Concerns about income inequality across the society are one of the main reasons for introducing taxes. In this regard, redistributive function of the public finance promotes the idea of the welfare state, though a degree to which developed countries intervene considerably differs [20]. Many authors [29] add that the redistributive function is one of the first-order factors in discussions on optimal taxation.

Government policies toward reducing income inequality have always been controversial, mostly due to traditional trade-off between efficiency and equality. In other words, governments had to compare social welfare gains from redistribution programs and the economic costs of taxing individuals and companies.

The extent to which taxes are able to reduce income inequality has become one of the most important questions for economists [12]. In this regard, Shin [39] argues that higher taxes are an effective tool for reducing income inequality only in near steady states, but not in the state at the early stage of economic development. The relation between taxes and income inequality becomes more complex if the indirect effects on income distribution (i.e. behavioral responses of economic agents to the tax system) are taken into account [35]. In addition, tax avoidance, tax evasion and tax-motivated hiding of wealth make the estimation of income inequality harder, thus complicating the relation between taxes and income inequality.

Given the importance of income inequality, many research studies dealt with the determinants (i.e. key drivers) of income inequality. However, the previous research did not reach a consensus regarding the key determinants. In particular, it is hard to reach a consensus in cross-country analysis [31]. Taxes are just one of the many factors that are believed to significantly impact income inequality.

The logic that underlies the impact of taxes on income inequality may be explained in at least two ways. First, taxes may have a redistributive role by themselves and, in this way, may impact income inequality directly. It especially refers to progressive taxes such as personal and, in many countries, corporate income tax. However, such impact may be mitigated by some other regressive taxes (in particular, value-added tax) and the implementation of flat personal and corporate income tax scheme. Second, higher tax burden means a higher government potential to reduce inequality as governments have more resources to redistribute to the low-income layers of society. In this way, taxes indirectly impact income inequality. As a result, a negative relation between tax burden and income inequality may be assumed.

Research subject in the paper is income inequality in the EU. In general, prior research studies on income inequality are inconclusive, primarily due to the diversity and inconsistency of estimation methods and datasets, including gaps and errors in the underlying data [4]. Therefore, income inequality is still an attractive research issue despite abundant past evidence. In addition, the attractiveness of income inequality stems from the ever-present changes in societies and economics and, as a result, changes in the level of income inequality. Some authors also find increasing income inequality in developed countries [7], [43], thus raising many concerns about the unequal developed societies.

Income inequality in the EU has been subject of extensive academic research in economic and sociology literature [23], [26]. This research issue became particularly attractive after the EU enlargement toward Eastern Europe countries [23].

There are two main objectives of the paper. Firstly, the paper aims to examine the impact that taxes have on income inequality in 28 EU members. In addition, given the variety in the EU-28 regarding tax burden and income inequality, the second objective of the paper is to examine the magnitude of the impact of taxes at the different levels of income inequality distribution.

Although many papers studied the impact of taxes on income inequality in the EU [6], [23], [26], to our knowledge, this is one of the first research to cover each

EU-28 country. In addition, motivated by the prior research [6], [26] finding that taxes impact income inequality at the different magnitude in different parts of the EU, this is the first such paper that employs quantile regression methodology. This methodology should help in determining the role of taxes in reducing income inequality at different levels of income inequality distribution.

The paper contributes to the existing literature on the ability of the EU governments to reduce income inequality by increasing the tax burden. This paper actualizes the research results on the income inequality in the EU and expands them across the whole EU-28 territory. In addition, the paper sheds the light on the potential different impact of taxes on the income inequality at different parts of the income inequality distribution. In other words, we suggest that taxes do not have universal impact on the income inequality, but that such impact depends on the level of income inequality of the specific country.

We believe that many interest groups may benefit from the research results. First, national governments that strive to reduce income inequality may benefit from the findings on the ability of taxes to reduce income inequality. Quantile regression should enable governments of both egalitarian and unequal societies to make conclusions about the magnitude of taxes in reducing income inequality. Second, the EU governing bodies strive to enhance economic and social cohesion across the whole Union. In addition, the EU actions toward tax harmonization should be expected in the future. Therefore, the research results may help the EU governing bodies when deciding on the optimal relation between taxes and income inequality and when analyzing the convergence between countries.

The paper is structured as follows. After the introduction, it is presented literature review and hypotheses development, followed by the section devoted to variable selection, data and methodology. Then, the research results are presented. The final section of the paper offers conclusion remarks and policy implications of the research results.

Literature review and hypotheses development

The first question regarding income inequality is whether the government wishes to alter income distribution

through redistributive policies or to leave the market to freely distribute income. Joumard et al. [27] argue that countries vary in terms of the volume of redistribution, as countries with more unequal distribution of market income tend to redistribute more. Doerrenberg & Peichl [18] conclude that world-wide governments seem to be interested in reducing income inequality as social-democratic and conservative economies appear to have lower income inequality. In addition, Eastern European countries experienced an important increase in income inequality after the transition from socialism to democracy in 1980s and 1990s, though income inequality in Eastern Europe was still lower than in many other regions in the world [30]. On the other hand, de Mello & Tiongson [16] find that unequal societies do spend less on redistribution.

Income inequality and the impact of taxation on income inequality have been widely studied in the past. However, there is much disagreement about the facts and explanations of income inequality [7]. In particular, research on these topics is abundant in developed territories. One of the reasons may be found in the fact that historical data on income inequality is, in general, more available in industrial countries and high-income developing countries [17]. Nolan et al. [31] provides the recent overview on the income inequality research in developed countries.

In the EU context, prior studies on the relation between taxes and income inequality only rarely captured the whole EU territory. In this regard, Jara & Tumino [26] and Avram et al. [6] worked with each-country sample (EU-27 at that time). In addition, Obadić et al. [32] cover each of the EU-28 countries.

Previous research find important differences in income inequality not only between European countries [6], [23], but also between regions within the European countries [13], [34], [36]. Giammatteo [24] showed that EU members have lower income inequality than other European countries. In addition, Milanovic [30] finds important cross-continental differences in income inequality. Perugini & Martino [34] argue that differences in income inequality may be attributed, *inter alia*, to institutional settings of labor market and regional labor market features. Čok et al. [14] find that even countries with the same socioeconomic background may have different income inequality levels.

On the other hand, Perugini & Martino [34] and Castells-Quintana et al. [13] find a positive impact of income inequality on regional growth, supporting the trade-off theory between efficiency and equality.

There are also conflicting findings on the trend of income inequality in recent decades. While some research find increasing trend, other research find the declining trend of income inequality. Increasing income inequality is observed in OECD (Organization for Economic Co-operation and Development) countries as a result of technological changes and globalization [7] and increased labor flexibility, decline in power of trade unions and retrenchment of public social spending [43].

Many research studies point out a declining trend of income inequality in EU-15 countries. Sylwester [41] compares income inequality (as measured by Gini coefficient) in 1970 and 1990 and shows the examples of France and Italy that reduced their Gini coefficients for more than twenty percent. Verbist & Figari [44] compare Gini coefficients in 1998 and 2008, finding that more EU-15 countries reduced rather than increased their Gini coefficients. On the other hand, Fuest et al. [23] stress that wide differences in income inequality in the EU are particularly evident after the EU enlargement toward Eastern Europe. Such findings may serve as a support for the concepts of the 'core vs. periphery in the EU' or 'two-speed EU' development.

Despite some efforts toward harmonization, national tax systems of EU members are still considerably different. Some countries, such as France or Scandinavian EU members impose relatively high tax burden (both to individuals and firms), while some other countries opted for lower tax rates. Lower tax rates are particularly evident in lower-income EU members and Vogiatzoglou [45] claims that relatively low tax burden enhanced foreign direct investments in Eastern EU members (Baltic countries, Visegrad Group countries and Slovenia). In fact, lowering tax rates is part of tax competition, intensified in the last three decades. Traub & Yang [42] develop a two-country model showing that tax competition increases income inequality.

While some EU countries impose relatively high statutory tax rates and/or have strong tax enforcement, some other EU members are considered tax havens or conduit

countries as a route to the tax havens. For instance, the Republic of Ireland has been accused of providing an illegal state aid that enabled US giant Apple to achieve enormous tax savings [10], Luxembourg offers tax benefits to the multinational companies through advanced tax rulings [25], while the Netherlands is considered the world-wide largest conduit country as a route to the tax havens [46].

Prior research studies in the EU find significant role of tax-benefit system in reducing income inequality [6], [23], [26], [32]. Taxes and social contributions are considered the most important contributors to the income inequality reduction [23], though a degree of this contribution differs across the EU countries [26]. Avram et al. [6] find that tax-benefit systems reduce income inequality least in some newer EU members, such as Bulgaria, Cyprus, Latvia, Lithuania and Malta.

Jara & Tumino [26] find that share of taxes and benefit in disposable income is relatively large in Nordic countries and less important in Southern and Eastern European countries. On the other hand, Rodriguez-Pose & Tselios [36] argue that income inequality is lower in regions with Nordic family structures. Such evidence on Nordic countries supports the assumption of a negative impact of taxes on income inequality.

A taxation system may also determine the effectiveness of taxes in reducing income inequality. In this regard, Burman [12], Duncan & Peter [19] and Zee [48] argue that progressive taxes may contribute more to the income inequality reduction. Zee [48] adds that progressive taxation system would reduce income inequality stronger the more unequal the income distribution is.

On the other hand, Tridico [43] analyses income inequality determinants in OECD countries and includes top tax rate on earned income and tax on dividends (both by firms and individuals) as independent variables. He finds negative, but statistically insignificant impact of these tax variables on income inequality. Avram [5] studies the effects of tax allowances and tax credits in personal income tax on income inequality and finds that these tax instruments tend to significantly impact income inequality only in one of the six studied EU countries (tax allowances in Germany and tax credits in Italy). Such results may imply that certain types of taxes do not impact

the income inequality, but the whole tax revenue taken altogether may reduce income inequality. Such conclusion is also supported by Joumard et al. [27], stating that some countries with relatively small taxes achieve the same redistributive impact as countries with higher taxes, as they rely more on progressive income taxes.

It should be noted that not only the volume of tax revenue determines income inequality, but also the way of allocating tax revenue resources across the society. D'Agostino et al. [15] find that some EU countries (such as Greece, Italy and Poland) were not able to significantly reduce income inequality despite high social transfers and emphasize the importance of quality institutions in preventing corruption and low efficiency of public spending. Filauro & Parolin [21] also emphasize the importance of strengthening the egalitarian institutions, adding that quality institutions are more consequential than economic convergence for reducing income inequality in the EU.

However, the relation between taxes and income inequality is far more complex than simple analysis of tax revenue and income inequality statistics. Many research studies point out that some parts of society hide considerable portion of their wealth due to tax avoidance motives. Atkinson et al. [8] particularly point to rich layers of society as they have a strong incentive to understate their taxable incomes, adding that both rich individuals and rich companies seek to maximize their wealth on the tax-favorable basis. Wong & Ribeiro [47] add that the richest groups of society that hide significant part of their wealth distort the income inequality statistics. These arguments may imply that the official income inequality is underestimated due to tax-motivated large hidden wealth.

Roine [37] develops a model suggesting that the richest part of the population will always invest in tax avoidance. Some papers [2], [3] point out the role of tax havens in the increase of income inequality, suggesting that a very little percent of the richest households evade a relatively high portion of their taxes, and that tax havens are a tax planning tool available exclusively to the richest layers of the society. Sikka [40] argues that a special role in increasing income inequality may be attributed to big accounting firms offering complicated tax avoidance schemes to rich individuals and rich companies. These

findings may imply that not only the taxes collected or increased statutory tax rates reduce inequality itself, but also the measures toward tackling tax avoidance implemented by national and supranational tax authorities.

Given the results of prior research in the EU that dominantly find that taxes contribute to the income inequality reduction, in the paper is hypothesized that taxes have a statistically significant negative impact on income inequality. In addition, there are wide differences across the EU countries regarding income inequality, tax burden and the degree to which taxes contribute to the income inequality reduction. Therefore, in the paper is also hypothesized that the impact of taxes on income inequality is different on the different parts of income inequality distribution. In this regard, the research hypotheses are formulated as follows:

H_1 : *Taxes have a statistically significant negative impact on income inequality.*

H_2 : *The impact of taxes of income inequality is different on the different parts of income inequality distribution.*

Variable selection, data and methodology

Several income inequality measures have been developed in the past. For instance, Frank [22] employs many different measures, such as Gini coefficient, Atkinson index or Theil entropy index. In this paper, we measure income inequality by Gini coefficient of equivalised disposable income (GINI). Gini coefficient is probably the most widely used statistical measure of income inequality [1] and most widely used measure in the EU-related research [6], [13], [23], [26], [34], [44]. On the other hand, Beblo & Knaus [11] and Rodriguez-Pose & Tselios [36] use Theil entropy index to measure income inequality in the EU.

Gini coefficient enables intuitive interpretation and comparison with other studies [23]. The value of Gini coefficient usually varies between 0 and 1, as value 0 implies perfect equality while value 1 implies perfect inequality. Analogously, following the Eurostat methodology, Gini coefficient in this paper varies between 0 and 100.

We measure tax burden in the country by total receipts from taxes and social contributions as a percent of gross domestic product (TAX). Alternatively, tax burden may

be measured using statutory tax rates. However, we have ignored this measure since statutory tax rates do not capture, for instance, the effects of tax credits, tax exemptions, tax deductions and company's tax planning [38].

The impact of taxes on income inequality is controlled for the impact of some macroeconomic and demographic factors. In line with the prior research [30], [36], [41], [43], the following control variables are used: gross domestic product per capita (GDP), unemployment rate (UNEMPL), population age (AGE) and education attainment (EDUC). Based on the findings of these prior research studies, we expect positive impact of GDP, UNEMPL and EDUC on income inequality, and negative impact of AGE on income inequality. Table 1 presents the definition of employed variables.

Many additional control variables were considered but not incorporated in the research model due to exceptionally high correlation with employed variables. For instance, total general government expenditure (Eurostat data code: gov_10a_main) appears to have Pearson's correlation coefficient r of 0.7977 with TAX, while at-risk-of-poverty rate (Eurostat data code: ilc_li02) has coefficient r of 0.8809 with GINI. Some other control variables were not considered due to data unavailability for the whole sampling period.

In order to ensure consistency and reliability of the research results, we retrieved the whole data from the Eurostat database (ec.europa.eu/eurostat). Doerrenberg & Peichl [18] note that blending data from different sources in income inequality analysis may be doubtful as different data sources measure income inequality highly inconsistently. GINI estimates in this paper are based on the EU-SILC (Statistics on Income and Living Conditions) data. In addition, it is worth noting that data on income inequality have been considered in the past as doubtful [30] since they are based on household surveys.

We chose a sampling period between 2005 and 2018 due to data availability. In fact, most of the variables have data available from 2000 – however, we chose 2005 as a starting point since 2002, 2003 and 2004 Gini coefficients are not available for more than half of the EU members. In addition, using 2005 as a starting point ensures relative research homogeneity since it covers only the period after big EU enlargement in 2004 when ten countries became the EU members.

Covering 28 EU members across the period of fourteen years, the initial sample consists of 392 observations. However, Gini coefficient is not available for eight observations, so the econometric analysis is conducted using an unbalanced panel of 384 observations.

The regression method has been inevitably used in analyzing the impact of taxes on income inequality. Like many authors [32], we use panel regression analysis, but also upgrade it, using a quantile regression analysis. In line with defined variables, it is possible to formulate the basic regression equation for the country i in the year t as follows:

$$GINI_{i,t} = \beta_0 + \beta_1 TAX_{i,t} + \beta_2 GDP_{i,t} + \beta_3 UNEMPL_{i,t} + \beta_4 AGE_{i,t} + \beta_5 EDUC_{i,t} + \varepsilon_{i,t} \quad (1)$$

The regression analysis begins with Ordinary Least Squares (OLS) estimates, though there are also Random Effects (RE) and Fixed Effects (FE) model estimations. Breusch-Pagan LM test and Hausman test were used to determine the most appropriate regression model, choosing between OLS and RE estimation, and RE and FE estimation, respectively. Multicollinearity doubts are eliminated using the analysis of Pearson's correlation matrix and variance inflation factors.

In order to examine the possible different impact of taxes on income inequality on different parts of income inequality distribution, we also employ a quantile

Table 1: Definition of variables

Label	Description	Eurostat data code
GINI	Gini coefficient of equivalised disposable income – EU-SILC survey	ilc_di12
TAX	Total receipts from taxes and social contributions (including imputed social contributions) after deduction of amounts assessed but unlikely to be collected, as a percent of gross domestic product	gov_10a_taxag
GDP	Natural logarithm of purchasing power adjusted gross domestic product per capita	sdg_10_10
UNEMPL	Number of unemployed persons as a percentage of the labor force	tipsun20
AGE	Median age of population	demo_pjanind
EDUC	Percent of population aged 15-64 with less than primary, primary and lower secondary education	edat_lfse_03

regression. Quantile regression, originally proposed by Koenker & Bassett [28], enables the estimation of impact of independent variables on dependent variable at different levels of the dependent variable distribution. Besides providing different estimators for each quantile, an additional advantage of quantile regression is a less sensitivity to outliers. Bang et al. [9] summarize that quantile regression has become a common method in income distribution analysis. However, to our knowledge, this is the first research to study the impact of taxes on income inequality using quantile regression. To obtain as detailed as possible results, in the paper are used ten quantiles or deciles.

Research results

Descriptive statistics

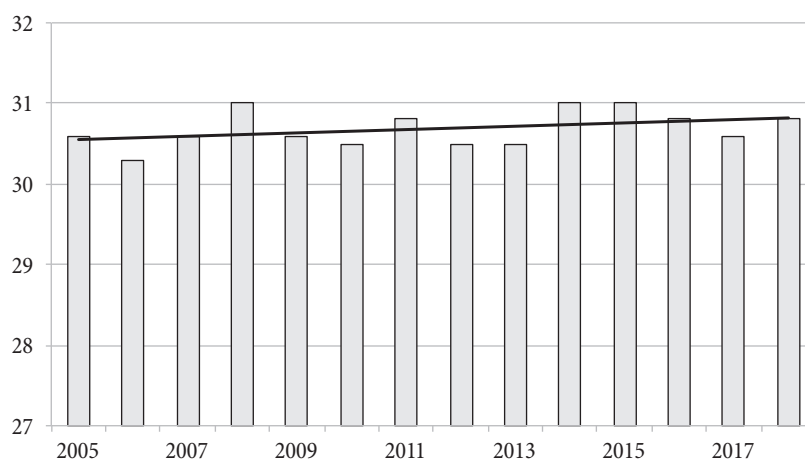
Table 2 shows descriptive statistics for each employed variable. In the observed period, the lowest value of Gini

coefficient is reported in Slovakia in 2018, while the highest value is reported in Bulgaria in 2017. It is interesting to point out that ten observations with the lowest Gini coefficient regard Denmark, Sweden, Slovakia and Slovenia. On the other hand, ten observations with the highest Gini coefficient regard Latvia, Lithuania, Bulgaria, Romania and Portugal.

If Gini coefficients in 2005 and 2018 are compared, it may be observed that 13 EU members increased, while 12 countries reduced Gini coefficient. For three countries (Bulgaria, Croatia and Romania), the Gini coefficient for 2005 is not available. In this regard, Luxembourg had the largest increase (from 26.5 to 33.2), while Poland had the largest decrease (from 35.6 to 27.8) of Gini coefficient.

As the Gini coefficient is the main variable of interest, we tracked the trend of this variable. Figure 1 presents the dynamics of Gini coefficient in the EU-28 with the linear trendline. It could be noticed that income inequality during the observed period was relatively stable, though with slight growing linear trend.

Figure 1: The dynamics of Gini coefficient in the EU-28



Note: Based on the Eurostat (online data code: ilc_di12); the period 2005-2009 refers to the EU-27 due to data unavailability for Croatia

Table 2: Descriptive statistics (2005-2018)

	GINI	TAX	GDP	UNEMPL	AGE	EDUC
Mean	29.8979	36.4939%	10.0815	8.7974%	40.5712	28.2355%
Minimum	20.9000	23.0000%	8.9746	2.2000%	33.3000	11.7000%
25 th percentile	26.6000	32.1000%	9.8456	5.9000%	39.3750	20.0000%
Median	29.7000	36.0500%	10.0900	7.7000%	40.7000	25.4000%
75 th percentile	33.1250	41.0500%	10.3328	10.1250%	42.1000	31.9500%
Maximum	40.2000	49.9000%	11.2810	27.5000%	46.3000	72.7000%
Standard deviation	3.9128	5.8689%	0.3906	4.3233%	2.3467	12.2363%
Observations	384	392	392	392	392	392

The highest level of taxes and contributions (as a percent of gross domestic product) is reported in Denmark in 2014, while the lowest level is reported in the Republic of Ireland in 2018. In addition, ten observations with the highest level of taxes and contributions regard Belgium, Denmark and France, while ten observations with the lowest level of taxes and contributions regard Bulgaria, the Republic of Ireland and Romania.

In the levels of taxes and contributions in 2005 and 2018 are compared, we may conclude that 20 EU countries increased (most in Greece, from 33.5% to 41.5%), while remaining eight EU members reduced it (most in the Republic of Ireland, from 31.4% to 23%).

Among control variables, the highest value of gross domestic product per capita is reported in Luxembourg in 2018, while the lowest value is reported in Romania in 2005. Greece had the highest unemployment rate in the sample, in 2013, while Czech Republic reported the lowest unemployment rate in the sample, in 2018. The oldest population is reported in Italy in 2018, while the youngest population is reported in the Republic of Ireland in 2007. The highest level of education indicator is reported in Portugal in 2005, while the lowest value is reported in Lithuania in 2018.

Univariate analysis

Table 3 presents the correlation matrix with Pearson’s correlation coefficients *r* reported. We do not expect multicollinearity problems as there is no highly strong correlation (for instance, higher than 0.7) between independent variables.

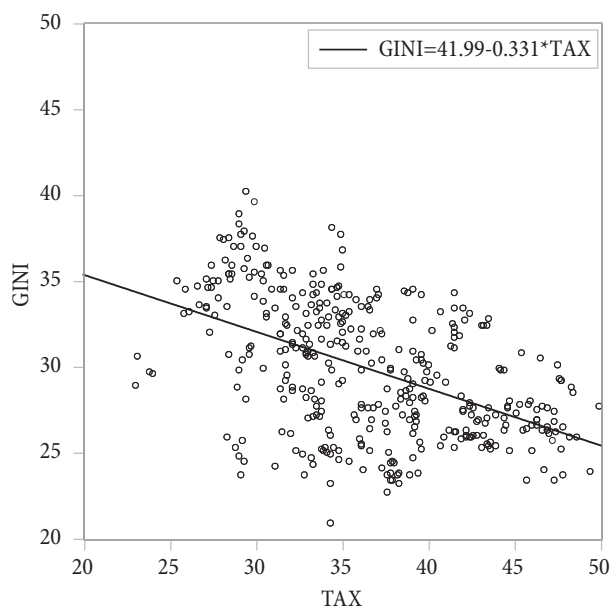
The main variable of interest, GINI, appears to have the strongest correlation with TAX. In fact, GINI is the only variable that is correlated at statistically significant levels

with each variable employed in the research model. On the other hand, the strongest correlation among independent variables appears between TAX and GDP.

Regression analysis

Figure 2 shows a simple scatter diagram with simple regression between taxes and Gini coefficient. Declining regression line implies that increasing TAX for 1% results in statistically significant decrease in Gini coefficient for 0.331.

Figure 2: TAX-GINI scatter diagram (2005-2018)



However, the relation between taxes and income inequality should be controlled for the impact of specified control variables and include random or fixed effects. Therefore, Table 4 presents the linear regression estimates with OLS, RE and FE models reported. In each regression model, variance inflation factor for each employed variable is lower than ten, confirming the inexistence of multicollinearity problems.

Table 3: Pearson’s correlation matrix (2005-2018)

n = 384	GINI	TAX	GDP	UNEMPL	AGE	EDUC
GINI	1.0000					
TAX	***-0.4987	1.0000				
GDP	***-0.4085	***0.5002	1.0000			
UNEMPL	***0.3459	***-0.1622	***-0.3276	1.0000		
AGE	**0.1002	***0.3337	-0.0292	0.0474	1.0000	
EDUC	***0.2118	0.0786	0.0689	***0.1320	-0.0245	1.0000

Note: statistically significant at the level of 10% (*), 5% (**) and 1% (***)

Breusch-Pagan LM test showed that RE regression model outperformed OLS model. On the other hand, Hausman test suggests that FE regression estimates should have priority over RE estimates. However, the impact of taxes on income inequality is relatively consistent throughout the presented regression models.

Table 4: Linear regression estimates (2005-2018)

	Expected sign	Dependent variable: GINI		
		OLS	RE	FE
Intercept		***29.7370 (4.3446)	***75.8258 (6.9319)	***68.8237 (4.5536)
TAX	-	***-0.3576 (-10.4068)	***-0.1479 (-3.2589)	*-0.0948 (-1.6603)
GDP	+	-0.8582 (-1.5505)	***-3.1040 (-3.1248)	-1.8096 (-1.2527)
UNEMPL	+	***0.2041 (4.9636)	0.0512 (1.5932)	*0.0662 (1.8249)
AGE	-	***0.4502 (5.2306)	***-0.3446 (-2.6665)	***-0.5429 (-3.6196)
EDUC	+	***0.0750 (5.6666)	***0.0984 (3.5437)	***0.0921 (2.6629)
Year dummies		Yes	Yes	Yes
Adjusted R ²		0.4353	0.1169	0.8892
F-value		***17.4024	***3.8171	***69.3122
Period		2005-2018	2005-2018	2005-2018
Observations		384	384	384

Note: beta coefficients in front of parentheses, t-values in parentheses; statistically significant at the level of 10% (*), 5% (**) and 1% (***).

In line with theoretical predictions, the presented regression outputs indicate that the impact of taxes on income inequality is negative and statistically significant. Therefore, *the first research hypothesis cannot be rejected*. However, this impact is relatively weak as an increase in tax burden for 1% reduces income inequality for only 0.3576% (OLS model), 0.1479% (RE model) or 0.0948% (FE model).

Therefore, research results indicate that the redistributive function of taxes in the EU-28 is far from perfect. As pointed out in D'Agostino et al. [15], some macroeconomic or sociological factors (such as high corruption or low quality of institutional setting) may explain low redistributive power of taxes. On the other hand, national tax authorities may decide to increase tax burden (through increase of statutory tax rates or elimination of tax exemptions and tax credits) or progressivity of taxes.

However, we argue that increasing the tax burden or progressivity of taxes are not the key measures to

enhance the redistributive function of taxes. In fact, the redistributive effects of increased tax burden would be (at least partially) offset by increasing tax avoidance – by the richest individuals and companies, in particular. Therefore, the first task for governments should be to combat tax avoidance and, then, to redesign the current national tax systems.

Although it is hard to quantify accurately, national tax authorities within the EU probably have billions of euros in lost tax revenue each year due to tax avoidance. Due to integration of national markets and globalization of economies, cross-border tax avoidance is available more than ever before. The richest individuals in a society may move their money abroad (usually in some high-secrecy and low-tax jurisdictions), while the richest companies incorporate subsidiaries in tax havens and account the largest portion of their profits in such jurisdictions. As per rule, cross-border tax avoidance requires some investments in tax planning and, as a result, only the richest layers of society can afford such tax avoidance mechanisms. Therefore, if statutory tax rates or progressivity of taxes are increased, the richest layers of society would be increasingly motivated to invest in tax planning and move their wealth abroad.

Considering that tax avoidance is a cross-border phenomenon, national tax authorities are not able to combat it by themselves. On the other hand, the full cooperation between national tax authorities becomes an imperative. Some of the efforts in the EU have been conducted (for instance, Anti Tax Avoidance Package, Base Erosion and Profit Shifting, or Code of Conduct in Business Taxation), though they have not been fully effective yet.

Governing bodies of the EU should recognize that modern tax havens are not placed only in exotic Caribbean islands, but also on the EU territory. In addition, they should recognize that conduit countries (serving as a route to the traditional tax havens) make almost similar damage to income inequality as the traditional tax havens. The EU should also revise their criteria for blacklisting countries that have tax haven features. A list of tax havens by the EU is published and updated, but the blacklisting criteria are not applied to the EU members. Non-government organization Oxfam

[33] argues that as many as five EU countries (Cyprus, Luxembourg, Malta, the Netherlands and the Republic of Ireland) should be considered tax havens if the EU blacklisting criteria is applied to them.

Eliminating the role of conduit countries within the EU would heavily hit traditional tax havens since the companies would be demotivated to shift profits to low-tax jurisdictions as they would have to pay withholding tax on such transfers. This would surely result in higher corporate tax revenues for the European national tax authorities. In addition, higher corporate tax revenues would enable governments to reduce indirect tax burden in the EU countries and to rely on indirect taxes to a lesser extent. Since indirect taxes are usually regressive (most heavily impact the lower-income layers of society), it is rational to assume that lower relying on indirect taxes would reduce the regressivity of national tax systems and make the society more egalitarian.

Regarding control variables, the impact of unemployment and education is in line with expected as higher employment and higher education attainment leads to a more egalitarian society. The impact of age of the population depends on the employed regression model. Contrary to the research predictions, the impact of gross domestic product per capita on income inequality is negative.

Table 5 presents the results of quantile regression with the impact of taxes on income inequality reported on each decile of the income inequality distribution. In this regard, the impact of taxes on income inequality is negative and statistically significant throughout the whole income inequality distribution.

Quantile regression estimates suggest that the redistributive function of taxes has a lowest magnitude on the first deciles, and the highest magnitude on the latter deciles of the income inequality distribution. For instance, on the first decile a one percent increase in tax burden reduces income inequality for only 0.1522%, while on the ninth decile a one percent increase in a tax burden reduces it for 0.3927%. Since the taxes have a different impact on income inequality at the different levels of the income distribution, *the second research hypothesis cannot be rejected.*

It may be concluded that taxes are the most efficient in redistributing income when income inequality is relatively high. Therefore, taxes may be a successful tool for income inequality reduction in early stages of income inequality reduction. On the other hand, as a society becomes more egalitarian, the redistributive power of taxes declines. The results also imply that governments of countries with low income inequality should not rely only on taxes to

Table 5: Quantile regression estimates (2005-2018)

Quantile	Dependent variable: GINI					
	C	TAX	GDP	UNEMPL	AGE	EDUC
Expected sign		-	+	+	-	+
0.1	**20.6261 (-2.0552)	** -0.1522 (-2.1075)	***3.1155 (4.7199)	***0.4036 (10.2180)	0.3506 (1.5347)	***0.0989 (7.0023)
0.2	-4.8672 (-0.3818)	*** -0.1936 (-3.0061)	*1.5880 (1.9096)	***0.3825 (10.2755)	*0.4089 (1.6817)	***0.0857 (4.5166)
0.3	26.4072 (1.6115)	*** -0.2659 (-4.7508)	-0.9665 (-0.9292)	***0.2183 (4.2396)	*0.3918 (1.8322)	***0.1046 (4.2165)
0.4	***33.4351 (3.7239)	*** -0.3079 (-8.1096)	*-1.2596 (-1.8367)	***0.1712 (3.9144)	***0.3851 (3.9958)	***0.0890 (4.4384)
0.5	***41.6862 (5.5508)	*** -0.3392 (-8.7424)	***-1.8240 (-2.7146)	***0.1676 (4.5920)	***0.3794 (5.1993)	***0.0738 (4.2570)
0.6	***42.1259 (5.5042)	*** -0.3492 (-8.8110)	** -1.7061 (2.4185)	***0.1535 (4.2738)	***0.3866 (5.5408)	***0.0692 (4.3133)
0.7	***48.5366 (6.4585)	*** -0.3587 (-8.9916)	***-2.0540 (-2.8548)	***0.1305 (3.3793)	***0.3414 (5.3127)	***0.0708 (4.1591)
0.8	***49.7526 (6.1206)	*** -0.3966 (-9.4892)	** -1.7139 (-2.3539)	***0.1207 (2.6579)	***0.2700 (3.2890)	***0.0777 (3.7426)
0.9	***53.7338 (4.8557)	*** -0.3927 (-8.0230)	** -1.6514 (-1.9771)	*0.1135 (1.7976)	0.1836 (1.3614)	***0.0813 (3.3144)

Note: beta coefficients in front of parentheses, t-values in parentheses; statistically significant at the level of 10% (*), 5% (**) and 1% (***); year dummies included.

further reduce income inequality, but to combine taxes with some other factors.

Taxes, unemployment and education are the variables that have statistically significant impact on income inequality on each decile of income inequality distribution. In this regard, the power of unemployment in increasing income inequality declines throughout the income inequality distribution.

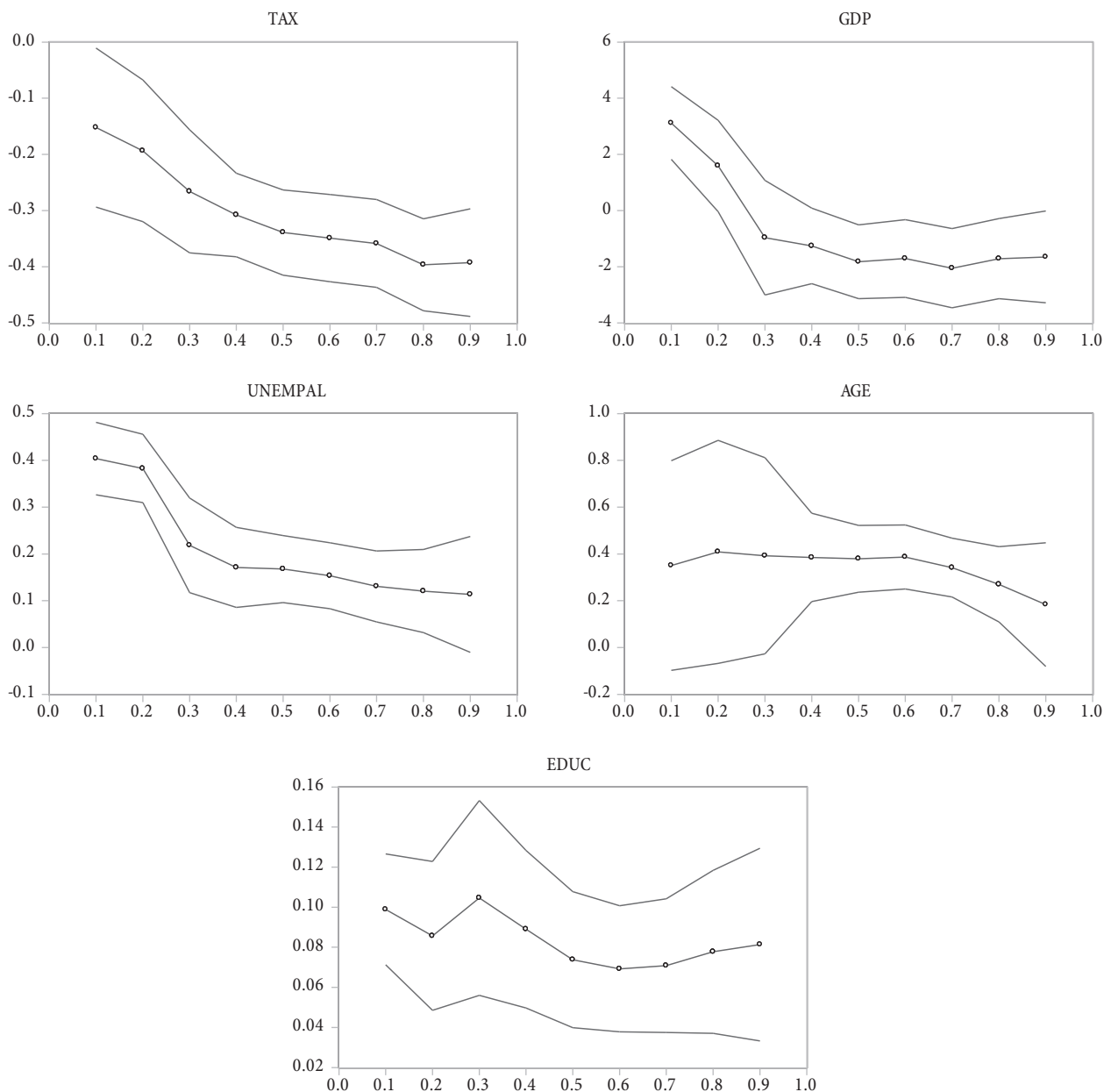
Figure 3 graphically presents the impact of employed independent variables on the income inequality on different parts of income inequality distribution. A 95% percent confidence intervals are also presented. Regarding the

impact of taxes, confidence intervals at each decile are placed below the null line.

Robustness analysis

We check the robustness of the research results by changing the sampling period and lagging independent variables. First, we extend a sampling period for five years to cover the period between 2000 and 2018. The added period between 2000 and 2004 may significantly impact research results since it captures the current EU members in the period before big enlargement in 2004. Therefore, a

Figure 3: Quantile regression estimates with 95% confidence intervals (2005-2018)



sample comprises an important portion of observations that were not part of the EU. Regression estimates are presented in Table 6.

The impact of taxes on income inequality in the period 2000-2018 was quite similar to the original

Table 6: Linear regression estimates (2000-2018)

	Expected sign	Dependent variable: GINI		
		OLS	RE	FE
Intercept		***26.0759 (4.4761)	***33.5276 (3.8616)	*20.0920 (1.8198)
TAX	-	***-0.3751 (-11.6375)	***-0.2331 (-4.8399)	** -0.1466 (-2.4410)
GDP	+	-0.4381 (-0.8983)	-0.4569 (-0.5564)	1.1275 (1.0419)
UNEMPL	+	***0.1810 (4.6304)	0.0163 (0.4845)	0.0361 (0.9932)
AGE	-	***0.4299 (5.3071)	0.1041 (0.8285)	-0.0391 (-0.2676)
EDUC	+	***0.0823 (6.9120)	***0.1017 (3.9539)	***0.1058 (3.3107)
Year dummies		Yes	Yes	Yes
Adjusted R ²		0.4322	0.1386	0.8339
F-value		***16.0588	***4.1841	***46.6763
Period		2000-2018	2000-2018	2000-2018
Observations		456	456	456

Note: beta coefficients in front of parentheses, t-values in parentheses; statistically significant at the level of 10% (*), 5% (**) and 1% (***).

linear regression estimates. However, such impact in robustness analysis period is slightly stronger than the impact in original estimates. This may be due to the fact that arithmetic mean of GINI in EU-28 was lower in the period 2000-2018 (29.71) than in period 2005-2018 (29.90), while the arithmetic mean of TAX was almost unchanged (36.41% in the period 2000-2018 and 36.49% in the period 2005-2018).

Table 7 presents results of quantile regression for the extended period (2000-2018), confirming that the redistributive power of taxes increases throughout the income inequality distribution. Therefore, research results of the paper are robust to change of the sampling period. Graphical presentation of quantile regression estimates with confidence intervals for the period 2000-2018 is given in Appendix A.

Second, a time lag phenomenon is well-known in macroeconomic research. In this regard, it is possible that taxes affect income inequality not only contemporaneously, but also with a time lag. In order to test the existence of such time lag, we lag the independent variables at the first lag. Table 8 presents linear regression output, estimating the impact of taxes on income inequality in the following year.

The presented results confirm the original research results regarding the impact of taxes on income inequality.

Table 7: Quantile regression estimates (2000-2018)

Quantile	Dependent variable: GINI					
	C	TAX	GDP	UNEMPL	AGE	EDUC
Expected sign		-	+	+	-	+
0.1	-13.8282 (-1.4790)	** -0.1096 (-2.1457)	***2.8373 (5.0738)	***0.3742 (8.0661)	0.2018 (1.0835)	***0.1066 (7.5982)
0.2	7.5589 (0.6083)	***-0.1718 (-3.0632)	1.0923 (1.3118)	***0.3488 (8.2008)	0.2091 (0.9637)	***0.1004 (4.6061)
0.3	***31.5618 (4.6359)	***-0.2582 (-3.9312)	*-0.9343 (-1.8501)	***0.2093 (3.8655)	0.2197 (1.3322)	***0.1160 (4.7016)
0.4	***31.3301 (5.6851)	***-0.3433 (-8.5558)	-0.7520 (-1.5938)	***0.1604 (3.7336)	***0.3224 (3.6341)	***0.0939 (4.9425)
0.5	***32.7709 (5.2892)	***-0.3841 (-10.4282)	*-0.9820 (-1.7234)	***0.1241 (3.0227)	***0.4094 (5.7767)	***0.0889 (5.2106)
0.6	***33.7181 (4.6657)	***-0.3926 (-10.8061)	-1.0073 (-1.4575)	***0.1597 (4.1296)	***0.4302 (6.4752)	***0.0893 (5.2320)
0.7	***46.0953 (5.4251)	***-0.3903 (-9.8029)	** -1.7742 (-2.1985)	**0.1097 (2.4840)	***0.3240 (4.6603)	***0.0837 (4.9475)
0.8	***49.6494 (5.5995)	***-0.4056 (-10.3815)	** -1.8013 (-2.2517)	**0.1105 (2.4638)	***0.2617 (3.2137)	***0.0881 (4.9116)
0.9	***51.0079 (3.6459)	***-0.4209 (-8.7605)	-1.5963 (-1.5496)	0.0830 (1.3226)	0.2155 (1.2796)	***0.0832 (4.4731)

Note: beta coefficients in front of parentheses, t-values in parentheses; statistically significant at the level of 10% (*), 5% (**) and 1% (***); year dummies included.

On the other hand, such impact is slightly stronger than the impact in original estimates. This may imply that taxes need some time, at least one year, to efficiently redistribute the income.

Table 8: Linear regression estimates with lagged independent variables (2005-2018)

	Expected sign	Dependent variable: GINI		
		OLS	RE	FE
Intercept		***28.5534 (4.2374)	***73.1213 (6.9580)	***69.9616 (4.9042)
TAX(-1)	-	***-0.3678 (-10.4598)	***-0.1850 (-4.0202)	** -0.1471 (-2.5624)
GDP(-1)	+	-0.7779 (-1.4161)	***-2.9083 (-3.0248)	-1.9771 (-1.4413)
UNEMPL(-1)	+	***0.1851 (4.4882)	0.0422 (1.3601)	0.0535 (1.5395)
AGE(-1)	-	***0.4676 (5.3894)	** -0.3012 (-2.2578)	***-0.4947 (-3.1775)
EDUC(-1)	+	***0.0757 (5.9444)	***0.1002 (3.7472)	***0.0988 (0.9678)
Year dummies		Yes	Yes	Yes
Adjusted R ²		0.4363	0.1232	0.8896
F-value		***17.4658	***3.9885	***69.5867
Period		2005-2018	2005-2018	2005-2018
Observations		384	384	384

Note: beta coefficients in front of parentheses, t-values in parentheses; statistically significant at the level of 10% (*), 5% (**) and 1% (***)

Table 9 presents the results of quantile regression with lagged independent variables. Lagging independent variables does not change the research results significantly as taxes have a different power in reducing next year's income inequality throughout the income inequality distribution. Therefore, research results of the paper are robust to lagging independent variables. The graphical presentation of quantile regression estimates with lagged independent variables and confidence intervals is given in Appendix B. The research results are also quite unchanged if second or third lag of independent variables are employed. However, these results are not tabulated due to reasons of space.

Conclusion

Income inequality is an ever-present attractive and controversial issue. We have tested the redistributive function of taxes, i.e. the power of taxes to reduce income inequality in the EU. In this regard, we have observed the period between 2005 and 2018 across the 28 EU countries.

During the observed period, income inequality in the EU was relatively stable, though with slight growing trend. However, dynamics of income inequality between the EU members considerably differs as some countries (such as

Table 9: Quantile regression estimates with lagged independent variables (2005-2018)

Quantile	Dependent variable: GINI					
	C	TAX(-1)	GDP(-1)	UNEMPL(-1)	AGE(-1)	EDUC(-1)
Expected sign		-	+	+	-	+
0.1	*-18.9993 (-1.9490)	** -0.1337 (-2.0959)	***2.9145 (4.1111)	***0.3934 (10.2177)	0.3479 (1.3674)	***0.0934 (7.0949)
0.2	-0.8742 (-0.0672)	***-0.1839 (-2.9562)	*1.5102 (1.6539)	***0.3742 (9.3844)	0.3176 (1.3265)	***0.0888 (3.7716)
0.3	**28.7226 (2.0475)	***-0.2587 (-3.9461)	-0.7369 (-0.7190)	***0.2078 (3.5465)	0.2654 (1.5542)	***0.1085 (4.3966)
0.4	***35.2659 (3.9746)	***-0.3266 (-8.0980)	** -1.4244 (-1.9903)	***0.1629 (4.1095)	***0.3838 (4.1038)	***0.0814 (4.3526)
0.5	***39.7566 (5.2544)	***-0.3545 (-9.2822)	** -1.5800 (-2.4514)	***0.1319 (3.4037)	***0.3773 (4.8972)	***0.0857 (4.7980)
0.6	***44.3188 (6.4307)	***-0.3749 (-10.0456)	***-1.8023 (-2.7673)	***0.1413 (3.9380)	***0.3675 (5.1515)	***0.0744 (4.3269)
0.7	***47.1948 (7.1840)	***-0.3860 (-10.1078)	***-1.7238 (-2.7627)	**0.0985 (2.5197)	***0.3195 (4.6708)	***0.0789 (4.4704)
0.8	***50.1487 (7.5396)	***-0.4161 (-11.5478)	***-1.7661 (-2.8540)	*0.0806 (1.9087)	***0.2728 (3.7372)	***0.0956 (4.9646)
0.9	***61.9822 (6.8506)	***-0.4046 (-9.6015)	***-2.3926 (-3.4254)	0.0194 (0.4280)	0.1645 (1.4743)	***0.0906 (4.0989)

Note: beta coefficients in front of parentheses, t-values in parentheses; statistically significant at the level of 10% (*), 5% (**) and 1% (***); year dummies included.

Poland) significantly reduced the income inequality, while others (such as Luxembourg) significantly increased it.

A linear regression analysis showed that taxes have a statistically significant negative impact on income inequality. This finding is in line with some prior research on the redistributive function of taxes in the EU [6], [23], [26]. However, this impact is relatively weak. We argue that combating cross-border tax avoidance may be a key to enhance the redistributive power of taxes instead of increasing statutory tax rates or progressivity of taxes. If cross-border tax avoidance is mitigated, the EU governments would collect more tax revenue from the richest layers under the same tax system and, therefore, more resources would be distributed to the lower layers of society. This logic may serve as a path for a more egalitarian society. In addition, this is in line with the arguments of Alstadsaeter et al. [2], [3] about the importance of mitigating cross-border tax avoidance for improving equality in the societies. We believe that this finding may be helpful for governing bodies in the EU as cross-border tax avoidance may be mitigated only with joint efforts of each EU country.

A quantile regression estimates showed that the impact of taxes on income inequality is not same on the different deciles of income inequality distribution. This finding is in line with prior research [6], [26] on the different redistributive power of taxes across the EU countries. Taxes are most effective in reducing income inequality in the most unequal countries and *vice versa*. We believe that this finding may be helpful for national governments of the EU countries. In particular, governments of the most egalitarian countries should recognize that further reduction of income inequality requires the implementation of other instruments, not only the taxes. Additional statistical analysis was conducted using different sampling period and lagging independent variables. We have found that original research results are robust to such modifications.

The presented findings should be considered in the light of certain limitations. The research employed only Gini coefficient as the only income inequality measure available in the Eurostat database. In addition, research captures limited period due to data unavailability. Research also does not go beyond country-level data.

After the sampling period, the EU countries have experienced some important challenges, such as Brexit or Covid-19 virus crisis. However, the impact of these events on income inequality and redistributive function of taxes in the EU is left for future research.

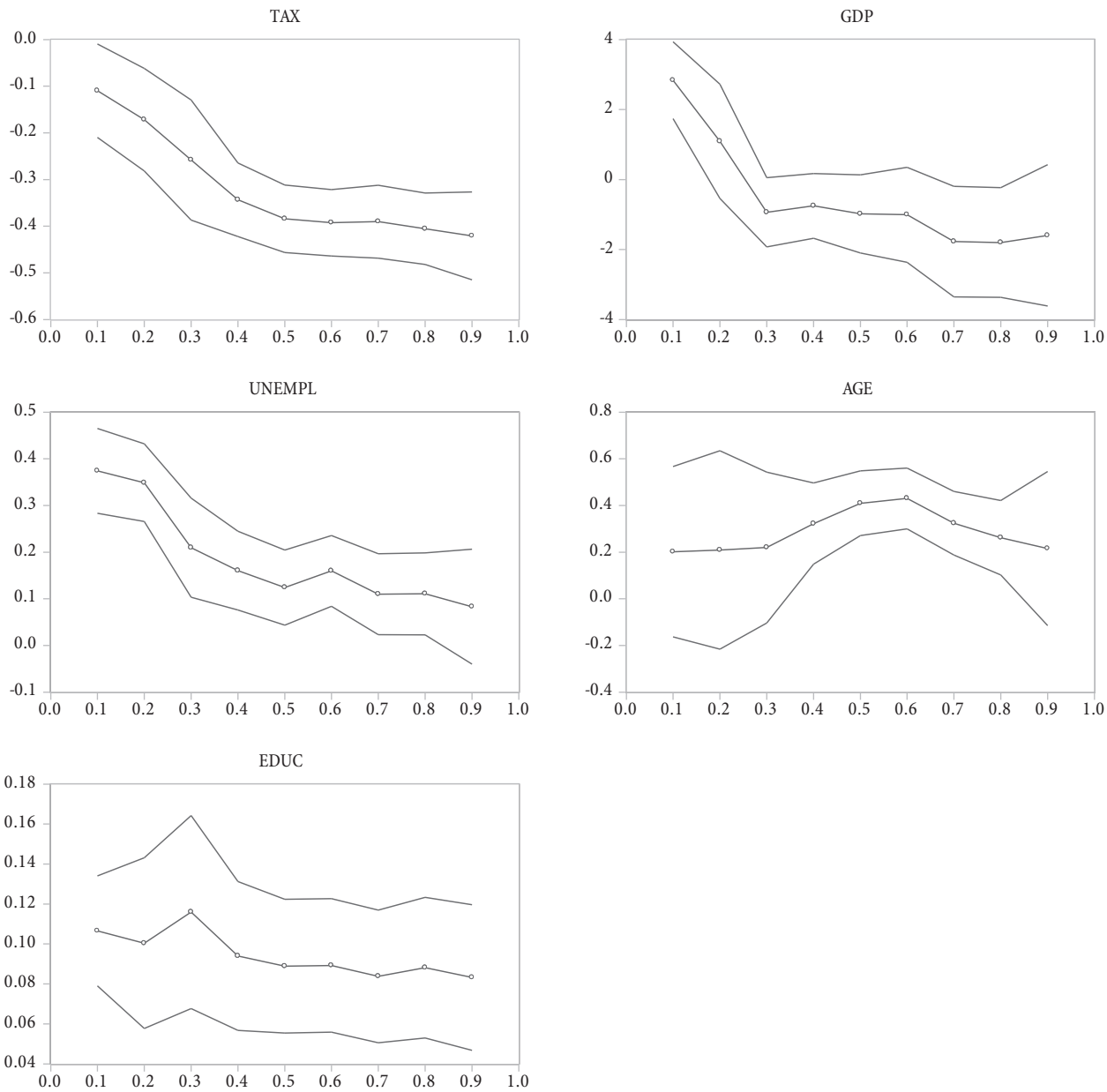
References

1. Abounoori, E., & McCloughan, P. (2003). A Simple Way to Calculate the Gini Coefficient for Grouped as well as Ungrouped Data. *Applied Economics Letters*, 10(8), 505-509.
2. Alstadsaeter, A., Johannesen, N., & Zucman, G. (2018). Who Owns the Wealth in Tax Havens? Macro Evidence and Implications for Global Inequality. *Journal of Public Economics*, 162(1), 89-100.
3. Alstadsaeter, A., Johannesen, N., & Zucman, G. (2019). Tax Evasion and Inequality. *American Economic Review*, 109(6), 2073-2103.
4. Anand, S., & Segal, P. (2008). What Do We Know about Global Income Inequality? *Journal of Economic Literature*, 46(1), 57-94.
5. Avram, S. (2018). Who Benefits from the 'Hidden Welfare State'? The Distributional Effects of Personal Income Tax Expenditure in Six Countries. *Journal of European Social Policy*, 28(3), 271-293.
6. Avram, S., Levy, H., & Sutherland, H. (2014). Income Redistribution in the European Union. *IZA Journal of European Labor Studies*, 3(1), 1-29.
7. Atkinson, A. (2003). Income Inequality in OECD Countries: Data and Explanations. *CESifo Economic Studies*, 49(4), 479-513.
8. Atkinson, A., Piketty, T., & Saez, E. (2011). Top Incomes in the Long Run of History. *Journal of Economic Literature*, 49(1), 3-71.
9. Bang, J., Mitra, A., & Wunnava, P. (2016). Do Remittances Improve Income Inequality? An Instrumental Variable Quantile Analysis of the Kenyan Case. *Economic Modelling*, 58(1), 394-402.
10. Barrera, R., & Bustamante, J. (2018). The Rotten Apple: Tax Avoidance in Ireland. *The International Trade Journal*, 32(1), 150-161.
11. Beblo, M., & Knaus, T. (2001). Measuring Income Inequality in Euroland. *The Review of Income and Wealth*, 47(3), 301-333.
12. Burman, L. (2013). Taxes and Inequality. *Tax Law Review*, 66(4), 563-592.
13. Castells-Quintana, D., Ramos, R., & Royuela, V. (2015). Income Inequality in European Regions: Recent Trends and Determinants. *Review of Regional Research*, 35(2), 123-146.
14. Čok, M., Urban, I., & Verbič, M. (2013). Income Redistribution through Taxes and Social Benefits: The Case of Slovenia and Croatia. *Panoeconomicus*, 60(5), 667-686.
15. D'Agostino, G., Pieroni, L., & Scarlato, M. (2020). Social Transfers and Income Inequality in OECD Countries. *Structural Change and Economic Dynamics*, 52(1), 313-327.
16. de Mello, L., & Tiongson, E. (2006). Income Inequality and Redistributive Government Spending. *Public Finance Review*, 34(3), 282-305.
17. Deininger, K., & Squire, L. (1996). A New Data Set Measuring Income Inequality. *The World Bank Economic Review*, 10(3), 565-591.

18. Doerrenberg, P., & Peichl, A. (2014). The Impact of Redistributive Policies on Inequality in OECD Countries. *Applied Economics*, 46(17), 2066-2086.
19. Duncan, D., & Peter, K. (2016). Unequal Inequalities: Do Progressive Taxes Reduce Income Inequality? *International Tax and Public Finance*, 23(4), 762-783.
20. Ferrarini, T., & Nelson, K. (2003). Taxation of Social Insurance and Redistribution: A Comparative Analysis of Ten Welfare States. *Journal of European Social Policy*, 13(1), 21-33.
21. Filauro, S., & Parolin, Z. (2019). Unequal Unions? A Comparative Decomposition of Income Inequality in the European Union and United States. *Journal of European Social Policy*, 29(4), 545-563.
22. Frank, M. (2009). Inequality and Growth in the United States: Evidence from a New State-Level Panel of Income Inequality Measures. *Economic Inquiry*, 47(1), 55-68.
23. Fuest, C., Niehues, J., & Peichl, A. (2010). The Redistributive Effects of Tax Benefit Systems in the Enlarged EU. *Public Finance Review*, 38(4), 473-500.
24. Giammatteo, M. (2006). Inequality in Transition Countries: The Contributions of Markets and Government Taxes and Transfers. *LIS Working Paper*, No. 443, Luxemburg Income Study.
25. Hueseken, B., & Overesch, M. (2019). Tax Avoidance through Advance Tax Rulings – Evidence from the LuxLeaks Firms. *FinanzArchiv/Public Finance Analysis*, 75(4), 380-412.
26. Jara, H., & Tumino, A. (2013). Tax-Benefit Systems, Income Distribution and Work Incentives in the European Union. *International Journal of Microsimulation*, 6(1), 27-62.
27. Joumard, I., Pisu, M., Bloch, D. (2012). Tackling Income Inequality. *OECD Journal: Economic Studies*, 2012(1), 37-70.
28. Koenker, R., & Bassett, G. (1978). Regression Quantiles. *Econometrica*, 46(1), 33-50.
29. Mankiw, G., Weinzierl, M., & Yagan, D. (2009). Optimal Taxation in Theory and Practice. *Journal of Economic Perspectives*, 23(4), 147-174.
30. Milanovic, B. (2000). Determinants of Cross-Country Income Inequality: An Augmented Kuznets Hypothesis. In: V. Franicevic & M. Uvalic (Eds). *Equality, Participation, Transition*, pp. 48-79. London, UK: Palgrave MacMillan.
31. Nolan, B., Richiardi, M., & Valenzuela, L. (2019). The Drivers of Income Inequality in Rich Countries. *Journal of Economic Surveys*, 33(4), 1285-1324.
32. Obadić, A., Šimurina, N., & Sonora, R. (2014). The Effects of Tax Policy and Labour Market Institutions on Income Inequality. *Proceedings of Rijeka Faculty of Economics*, 32(1), 121-140.
33. Oxfam (2020). *Once Again, the EU Lets Tax Havens Off the Hook*. Retrieved from www.oxfam.org/en/press-releases/once-again-eu-lets-tax-havens-hook (May 1st, 2020).
34. Perugini, C., & Martino, G. (2008). Income Inequality within European Regions: Determinants and Effects on Growth. *The Review of Income and Wealth*, 54(3), 373-406.
35. Poterba, J. (2007). Income Inequality and Income Taxation. *Journal of Policy Modeling*, 29(4), 623-633.
36. Rodriguez-Pose, A., & Tselios, V. (2009). Education and Income Inequality in the Regions of the European Union. *Journal of Regional Science*, 49(3), 411-437.
37. Roine, J. (2006). The Political Economics of Not Paying Taxes. *Public Choice*, 126(1-2), 107-134.
38. Shevlin, T., Shivakumar, L., & Urcan, O. (2019). Macroeconomic Effects of Corporate Tax Policy. *Journal of Accounting and Economics*, 68(1), 1-22.
39. Shin, I. (2012). Income Inequality and Economic Growth. *Economic Modelling*, 29(5), 2049-2057.
40. Sikka, P. (2015). The Hand of Accounting and Accountancy Firms in Deepening Income and Wealth Inequalities and the Economic Crisis: Some Evidence. *Critical Perspectives on Accounting*, 30(1), 46-62.
41. Sylwester, K. (2002). Can Education Expenditures Reduce Income Inequality? *Economics of Education Review*, 21(1), 43-52.
42. Traub, S., & Yang, H. (2020). Tax Competition and the Distribution of Income. *The Scandinavian Journal of Economics*, 122(1), 109-131.
43. Tridico, P. (2018). The Determinants of Income Inequality in OECD Countries. *Cambridge Journal of Economics*, 42(4), 1009-1042.
44. Verbist, G., & Figari, F. (2014). The Redistributive Effect and Progressivity of Taxes Revisited: An International Comparison across the European Union. *FinanzArchiv / Public Finance Analysis*, 70(3), 405-429.
45. Vogiatzoglou, K. (2018). Differences in Inward FDI Performance between the Southern Eurozone and Eastern EU Members: A Panel-Data Analysis Over 2004-2016. *Economic Themes*, 56(4), 519-532.
46. Weyzig, F. (2013). Tax Treaty Shopping: Structural Determinants of Foreign Direct Investment Routed through the Netherlands. *International Tax and Public Finance*, 20(6), 910-937.
47. Wong, A., & Ribeiro, C. (2017). Income Inequality: Does It Matter? *Economic Horizons*, 19(2), 143-157.
48. Zee, H. (2004). Inequality and Optimal Redistributive Tax and Transfer Policies. *Public Finance Review*, 32(4), 359-381.

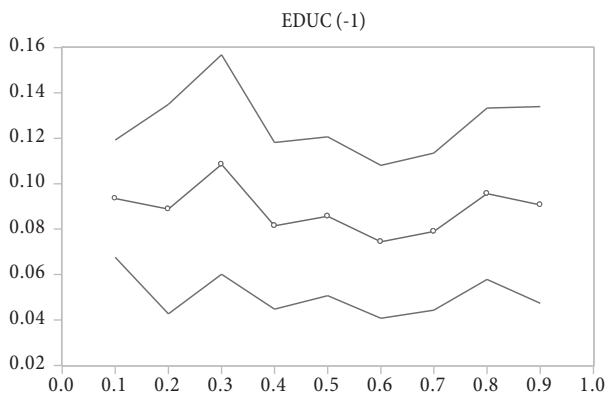
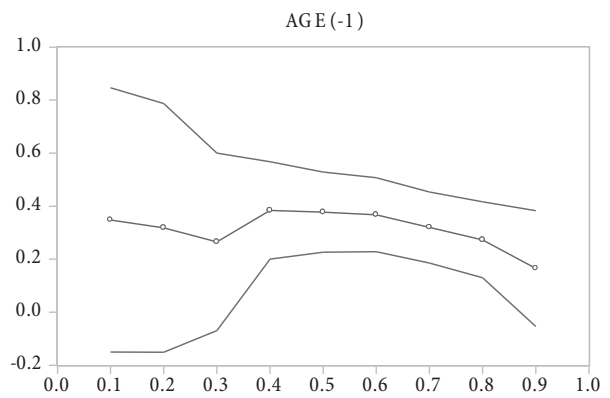
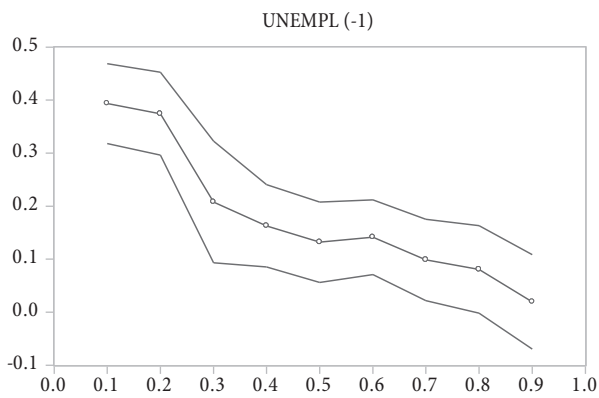
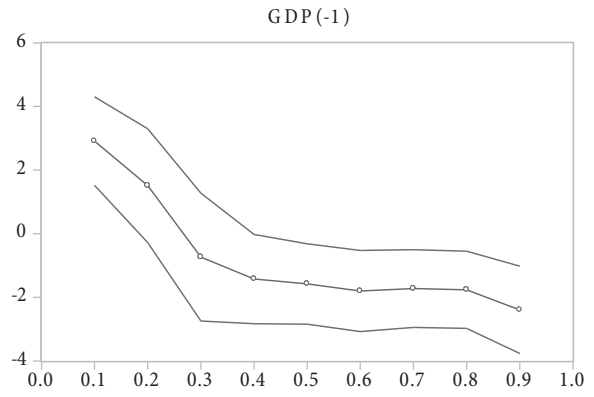
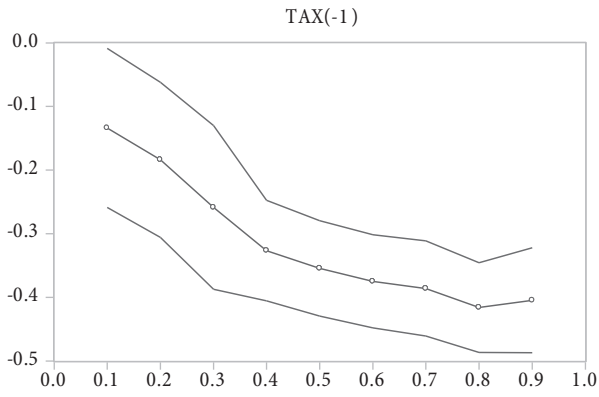
Appendix A

Quantile regression estimates with 95% confidence intervals (2000-2018)



Appendix B

Quantile regression estimates with lagged independent variables and 95% confidence intervals (2005-2018)





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