Associate Professor Lucian ȚÂȚU, PhD (corresponding author)
E-mail: lucian.tatu@fin.ase.ro
Bucharest University of Economic Studies, Romania

Professor Andreea Maria STOIAN, PhD
E-mail: andreea.stoian@fin.ase.ro
Bucharest University of Economic Studies, Romania

Associate Professor Nicoleta VINTILĂ, PhD
E-mail: nicoleta.vintila@fin.ase.ro
Bucharest University of Economic Studies, Romania

Lecturer Paula LAZĂR, PhD
E-mail: paula.lazar@fin.ase.ro
Bucharest University of Economic Studies, Romania

Associate Professor Emilian Constantin MIRICESCU, PhD
E-mail: emilian.miricescu@fin.ase.ro
Bucharest University of Economic Studies, Romania

THE HIDDEN EFFECTS OF THE FLAT TAX RATE IN CENTRAL AND EASTERN EUROPEAN COUNTRIES

Abstract. *The aim of this paper is to examine the effects of the flat tax rate for the personal income in four Central and Eastern European countries, which introduced this rate schedule in order to simplify the former tax system and to avoid the distortions caused by the progressive tax rates structure. Using a simulated micro dataset for 500 individuals and taking into consideration the regulations enforced in 2021, we found evidence of tax inequity, progressivity, and regressivity, and of small-scaled redistributive effects. These 'hidden' effects can also affect the well-functioning of the income tax as an automatic stabiliser.*

Keywords*: Flat Tax Rate, Tax Equity, Progressivity, Redistributive Effects, Personal Income Tax, Income Inequality*

JEL Classification: H2, H24, H3

1. Introduction

Being aware of the impact of taxes on the economic behaviour, of how taxes can distort corporate decision-making, of the decrease in the post-tax revenues workers receive, and of the shrinkage of capital returns, governments struggle to find

DOI: 10.24818/18423264/57.3.23.03

ways and means to raise taxes in a fair manner and to minimise the deadweight loss. The economic theory on social preferences has suggested that people exhibit an inequity aversion in the sense that they are much more interested in their own payoffs in relation to others' payoffs (Fehr and Schmidt, 1999). Alm et al. (2012) have shown a pronounced sense of justice that citizens have when it comes to taxes: distributive justice related to horizontal and vertical tax equity; procedural justice regarding the fairness of procedures for making tax decisions; redistributive justice concerning the fairness of the form and severity of the punishment imposed. Plotnick (1981) suggested that, in general, tax legislation generates inequity among people. Unfair tax systems can cause dissatisfaction among taxpayers, and this can lead to tax avoidance or tax evasion that affects not only government's ability to raise revenues, but also economic stabilisation and income redistribution (Dean et al., 1980).

The principle of tax equity was first introduced by Adam Smith in 1776 and since then this postulate has evoked significant controversy among scholars and politicians alike. Discussions on tax equity are expressed in terms of horizontal and/or vertical equity, but the main critiques which have been brought draw attention to the lack of a normative content of both concepts and to the difficulties in measuring and applying them. Although significant efforts have been made to shed light on the unresolved issues surrounding these two notions, the properties and the normative content of this principle have not been fully clarified.

To accomplish tax equity and ensure the fairness of the tax system, the governments have favoured the progressive tax rates as opposed to flat or regressive rates schedules (Ifanti, 2008). Hall and Rabushka (2007) stated that the need for progressivity in tax rates structure in the United States was determined by the Great Depression and the events that followed (e.g., Korean War) that led to a significant increase in the government size and to the belief that fiscal policy could be a tool for redistributing income. As a result, the vertical equity norm associated with the ability to pay principle and to graduated tax rates emerged. For the European states, the introduction of the progressive tax rates has been explained as an effect of the left-wing ideology on the democratic parties in power since the second half of the 19th century (Basham and Mitchell, 2008).

When it comes to the personal income tax (PIT, hereafter), many of today's governments have chosen the progressive tax rates to better ensure tax equity among citizens and for redistributive purposes to smooth the after-tax income. Morini and Pellegrino (2016) showed that the PIT system in one country determines a particular tax revenue level and a given redistributive effect and influences economic efficiency through work incentives and better tax compliance. They also suggested that a more tax equity-oriented reform is possible in order to maximise the redistributive effect of the tax system, but at the same time not affect taxpayers' position in relation to the actual tax system.

Significant efforts have been made across the European Union (EU) countries to reform the PIT to cut tax wedges, particularly for low-income employees and to stimulate the employability of low-skilled workers (EU, 2018) because low tax wedges on labour are considered one of the main determinants of higher

employment (Grdović and Tomić, 2010). Decreasing tax rates and flattening the tax rate's structure were considered means to achieve this purpose, Estonia being the first European country that introduced the flat tax rate structure in 1994. Several other Central and Eastern European countries (CEEC) followed. Mitchell (2005) and Basham and Mitchell (2008) listed different reasons behind this decision: it ensures a greater equity treating individuals equally, it minimises the disincentives to work, earn, and save, it contributes to a faster economic growth, it is simple and effective, and it reduces tax evasion. Also, by employing a flat rate for all categories of incomes earned by individuals, the tax arbitrage can be offset.

The tax rate is not the only factor that determines the size of the income tax due. The taxpayers benefit from tax incentives, which are usually designed with the intended purpose of encouraging changes in taxpayers' behaviour (Bikas et al., 2014). Introducing a PIT flat rate with few deductions may create some advantages, e.g., decrease administrative costs of compliance. But one of the effects of the tax incentives is that they can turn the flat tax rate into a progressive tax rate. On one hand, this feature can be viewed as an advantage of the flat tax rate, i.e., it is able to achieve progressivity while eliminating the distortions of high and increasing marginal tax rates (Emes, et al., 2001). On the other hand, Caminada and Goudswaard (2001) and Paulus and Peichl (2008) demonstrated that a flat tax system is useful for very high, as well as very low-income earners, while individuals from middle-income groups lose, because the tax incentives granted to them are not significant.

Thus, the aim of our paper is to shed more light on the 'hidden' effects of the PIT regulations in four CEEC, namely Bulgaria, Estonia, Hungary, and Romania that still enforced the flat tax rate in 2021. We conduct our investigation threefold. First, we examine if PIT regulations fulfil the tax equity in its traditional view. Second, we investigate whether the PIT frameworks promote or inhibit progressivity. Third, we analyse the redistributive effects of the PIT regulations. The paper is organised as follows: Section 2 describes the methodology and dataset used. Section 3 reports and discusses the results. Section 4 draws the concluding remarks of the study, emphasising the resulting policy implications and formulating policy recommendations.

2. Methodological approach

2.1. Dataset[♣]

We use a generated dataset for each country under investigation. There are several reasons for this approach. The dataset is not affected by tax avoidance or any other assimilated practices. Several studies showed the prevalence of envelope wages in former communist countries that represents an illegitimate wage arrangement used by formal employers aimed to help them avoid paying full social

[♣] The dataset and the results in detail are available upon request. Please, contact the corresponding author.

contributions and tax liabilities (Sedleniesk, 2003; Williams, 2009; Meriküll and Staehr, 2010). We have the possibility to generate income that exhibits a symmetrical distribution, and we can better analyse and emphasise more clearly the effects of PIT regulations on salary income without the dataset being affected by certain salary settlements established between employers and employees. The dataset is built on the assumption that individuals in each sub-group are differentiates only by the value of the salary income and the number of dependent children.

Our dataset consists of a total number of 500 distinct individuals ($i = \overline{1,500}$) who earn income from salary. The average annual gross salary is the variable used to quantify the income. Research on market income at European level (European Commission, 2016) revealed that earnings from wages and salaries are the main source of market income of households in all countries in EU accounting for two-thirds or much more of such income. For CEEC, the share of wage and salary income in households' total income is greater than two thirds. We grouped the 500 individuals into five distinct subgroups, **G1** to **G5**, of 100 individuals each earning salary income proportional to the average annual salary (AS) in each country: **G1**-[1/2, 2/3xAS]; **G2**-[2/3xAS, AS]; **G3**-[AS, 4/3xAS]; **G4**–[4/3xAS, 5/3xAS]; **G5**–[5/3xAS, 2xAS].

The following equations give the increase in the salary income in **G1**: $s_{G_1} = (\frac{2}{3}\ x\ AS\text{-}1/2\ x\ AS)/99]$. It represents the difference between the highest salary income of the 100th individual in the sub-group and the lowest gross income of the 1st individual in the group divided by the number of the remaining individuals, 99. The first individual in **G1** ($S_{G_1}^1$) has a salary income of ½ of AS, The remaining 99 individuals (*k*) in **G1** will earn a salary income distributed after the following equation:$S_{G_1}^k = S_{G_1}^1 + k\ x\ s_{G_1}, k = \overline{2,99}$. The increase in the salary in sub-groups **G2** to **G5** is given by: $s_{\overline{G_2,G_5}} = [(\frac{1}{3}\ x\ AS)/100]$. It represents the difference between the highest salary of the 100th individual in sub-group **G2** to **G5** and the highest salary of the 100th individual in the previous sub-group **G1** to **G4** divided by the total number of individuals in each sub-group, 100. The first individual in sub-group **G2** has a salary income of $S_{G_2}^1 = S_{G_1}^{100} + s_{\overline{G_2,G_5}}$. The general equation that shows the increase in the salary income for the individuals (*k*) in sub-groups **G2** to **G5** (*j*) is:$S_{G_j}^k = S_{G_1}^{100} + k \cdot s_{\overline{G_2,G_5}}, k = \overline{1,400}; j = \overline{2,5}$. We note that the rate of growth of the salary income is small and allows us to examine the effects of PIT regulations to small increases in the salary income.

Because the values in our database are generated using the above-mentioned formulas, the values associated with the salary incomes in each sub-group have a symmetric uniform distribution as tested through the skewness of the data series.

Furthermore, considering that the household composition in the European Union (2022) reveal that the typical European household has 2.2 members and an average of 2 children, we also consider for each sub-group the following situations. From **S0** to **S2**, as follows: **S0** - employee without dependent children; **S1** - employee having one dependent child; **S2** – employee with two dependent children. In order

to have an identical approach for all countries and ensure comparability of results, we have chosen to consider only the tax allowance in accordance with the number of dependent children given that this tax allowance is the most common in the analysed countries. Other types of tax allowances, such as family allowances are not applicable as a rule in the analysed country group.

Using the dataset described above and the PIT regulations for each country analysed we computed for everyone in the sub-groups the pre-tax salary income, the associated due tax, and the post-tax salary income. The pre-tax salary income is calculated as the difference between the gross salary income and the associated social contributions. We use the pre-tax salary to ensure comparability among countries and focus on the impact of taxation upon the income without social contributions due by the employee, since tax equity relates to taxes and not contributions. Then we preceded to the determination of the tax on salary income based on the regulations applicable in each analysed country. The post-tax income is determined by subtracting the tax due on salary income from the pre-tax salary income.

2.2. Methodology

In order to detect the 'hidden' effects of PIT regulations for the selected countries, we investigate if the PIT regulations: (i) provide tax equity among individuals; (ii) lead to progressivity, even though a flat tax rate is applied (Bulgaria and Romania have a 10% flat tax rate, Hungary has a 15% flat tax rate and Estonia has a 20% flat tax rate); (iii) have redistributive effects. All the tests are conducted both at general level – for entire data set – and at sub-group level – to verify what changes occur when an individual moves to the next sub-group due to a salary increase. For these purposes, we use different methods that are detailed in the following sub-sections.

2.2.1. Tax equity

To test the tax equity of the PIT regulations, we recall Adam Smith's original statement that the contribution of everyone to the formation of the government revenues should be 'proportional' to their abilities. We name this view as the traditional approach to tax equity. The first hypothesis, H_1, we test is the following: $H_1: X_i > X_j \Rightarrow T_i > T_j$, where: X_i, X_j is the pre-tax salary income of individuals *i* and *j*; T_i, T_j is the tax liability of individuals *i* and *j*. By this hypothesis, we examine whether two distinct individuals who earn dissimilar incomes from the same source, pay different taxes, and whether the taxes are proportional to the income they get.

We also test this hypothesis for each sub-group. For this purpose, we calculate the median of the pre-tax salary income ($\widetilde{X_{G_k}}$), of the tax due ($\widetilde{T_{G_k}}$) and of the post-tax salary income ($\widetilde{X_{G_k} - T_{G_k}}$) for each sub-group $\mathbf{G_k}$, where $k = \overline{1,5}$ and for each of the corresponding situation described by **S0** to **S2**. We use the median to avoid the potential asymmetries generated by the PIT regulations in the distribution of the pre- or post-tax salary income or of the taxes due. The hypothesis, $\widetilde{H_1}$, for the

sub-groups can be written as: $\widetilde{H_1}$: $\widetilde{X_{G_m}} > \widetilde{X_{G_n}} \Rightarrow \widetilde{T_{G_m}} > \widetilde{T_{G_n}}$, where: $\widetilde{X_{G_m}}, \widetilde{X_{G_n}}$ is the median of pre-tax salary income in sub-groups *n* and *m*, respectively; $\widetilde{T_{G_m}}, \widetilde{T_{G_n}}$ is the median of tax due in sub-groups *n* and *m*. Through this hypothesis, we test whether the tax due increases proportionally for an individual how migrates to another sub-group as a result of a salary increase. In Kakwani and Lambert's (1998) view, the verification of these two hypotheses is associated with weak progressivity.

In order to examine whether PIT regulations generate tax inequity among individuals in the same group, we verified whether the distribution of taxes due and of post-tax salary income is symmetric. Thus, we calculate the skewness of taxes distribution ($\gamma_{T_{G_k}}$) and of the post-tax salary income distribution ($\gamma_{(X-T)_{G_k}}$) in each sub-group.

The second hypothesis, H_2, we test, is described by: H_2: $\gamma_{X_{G_k}} = 0 \Rightarrow \gamma_{T_{G_k}} = 0 \Rightarrow \gamma_{(X-T)_{G_k}} = 0$, where: $\gamma_{X_{G_k}}$ is the skewness of the pre-tax salary income distribution. If the PIT regulations do not generate any change in the post-tax salary income of individuals in the same sub-group, then we can state that the PIT regulations ensure tax equity.

2.2.2. Tax progressivity

To our knowledge, the progressivity of the tax system implies taxing the citizens' incomes with increasing rates as the income increases. In the case of the flat tax rate, the progressivity is generated by the tax incentives granted to taxpayers: personal deductions (for Bulgaria, Estonia, Hungary, and Romania) or family allowances. In general, deductions are granted to low-income individuals. As a result, the effective tax rates on individuals' income increase and well-paid individuals will end up paying higher taxes as they no longer benefit from these deductions. In this regard, we test hypothesis, H_3: H_3: $X_i > X_j \; and \; T_i > T_j \Rightarrow \frac{T_i}{X_i} \cdot 100 > \frac{T_j}{X_j} \cdot 100$, where: X_i, X_j is the pre-tax salary income of individuals *i* and *j*; T_i, T_j is the tax liability of individuals *i* and *j*; $\frac{T_i}{X_i} \cdot 100, \frac{T_j}{X_j} \cdot 100$ is the effective tax rate of individuals *i* and *j*. This hypothesis checks whether the effective tax rate for high-income individuals is greater than for low-income individuals.

We also test this hypothesis, $\widetilde{H_3}$, for each sub-group: $\widetilde{H_3}$: $\widetilde{X_{G_m}} > \widetilde{X_{G_n}} \; and \; \widetilde{T_{G_m}} > \widetilde{T_{G_n}} \Rightarrow \frac{\widetilde{T_{G_m}}}{\widetilde{X_{G_m}}} \cdot 100 > \frac{\widetilde{T_{G_n}}}{\widetilde{T_{G_n}}} \cdot 100$, where: $\widetilde{X_{G_m}}, \widetilde{X_{G_n}}$ is the median of pre-tax salary income in sub-groups *n* and *m*; $\widetilde{T_{G_m}}, \widetilde{T_{G_n}}$ is the median of tax due in sub-groups *n* and *m*; $\frac{\widetilde{T_{G_m}}}{\widetilde{X_{G_m}}} \cdot 100, \frac{\widetilde{T_{G_n}}}{\widetilde{X_{G_n}}} \cdot 100$ is the effective tax rate for sub-groups *n* and *m* calculated as a ratio between the median of tax due in sub-groups *n* and *m* and the median of the pre-tax salary income in sub-groups *n* and *m*, respectively. By this hypothesis, we examine whether the effective tax rate increases if individuals move from one group to another because of the increase in the salary income.

In order to analyse how much progressivity the PIT regulations generate, we calculate the marginal tax rate (*MTR*): $MTR = \frac{T_j - T_i}{X_j - X_i} \cdot 100$, where: X_i, X_j is the pre-tax salary income of individuals *i* and *j* and $Xj > Xi$; T_i, T_j is the tax liability of individuals *i* and *j* and $T_j > T_i$. Calculating the *MTR*, we will find out what is the additional tax paid by one individual who earns a higher salary income than another.

We also calculate the marginal tax rate for each sub-group ($\widetilde{MTR}$): $\widetilde{MTR} = \frac{\widetilde{T_{G_m}} - \widetilde{T_{G_n}}}{\widetilde{X_{G_m}} - \widetilde{X_{G_n}}} \cdot 100$, where: $\widetilde{T_{G_m}}, \widetilde{T_{G_n}}$ is the median of tax due in sub-groups *n* and *m*, $\widetilde{T_{G_m}} > \widetilde{T_{G_n}}$; $\widetilde{X_{G_m}}, \widetilde{X_{G_n}}$ is the median of pre-tax salary income in sub-groups *n* and *m*, $\widetilde{X_{G_m}} > \widetilde{X_{G_n}}$. By this, we want to examine the additional tax paid by an individual who migrates from one sub-group to another because of the increase in the salary income.

2.2.3. Redistributive effects

To study the redistributive effects generated by PIT regulations, we calculate the Gini coefficient of the pre-tax and post-tax salary income for each sub-group of individuals. It is generally accepted that the Gini coefficient represents the most widely used measure of income inequality. The Gini coefficient takes values between 0 and 1 and, a null value expresses perfect equality of income distribution, whilst a Gini coefficient of 1 shows maximal inequality of income distribution. As for the income to be equally distributed among individuals, the Gini coefficients should be closer to zero.

If the PIT regulations affect individuals' salary income distribution, then the *post-tax Gini* coefficient will be different from the *pre-tax Gini* coefficient. If the PIT regulations improve the equality of individuals' salary income distribution, then *post-Gini* will be smaller than *pre-tax Gini*. In the case that both Gini coefficients are equal, then the PIT regulations do not contribute to the redistribution of salary income. If *pre-tax Gini* is smaller than *post-tax Gini*, then the PIT leads to unequal redistribution of income. Therefore, we tested a threefold hypothesis (H_4):

$H_4 =$

$$\begin{cases} \text{if pre-tax Gini}_{G_m} > \text{post-tax Gini}_{G_m}, \text{ increased equality of salary income distribution,} \\ \text{if pre-tax Gini}_{G_m} < \text{post-tax Gini}_{G_m}, \text{ increased inequality of salary income distribution,} \\ \text{if pre-tax Gini}_{G_m} = \text{post-tax Gini}_{G_m}, \text{ no redistributive effects.} \end{cases}$$

where: G_m the sub-group, $\overline{m = 1,5}$.

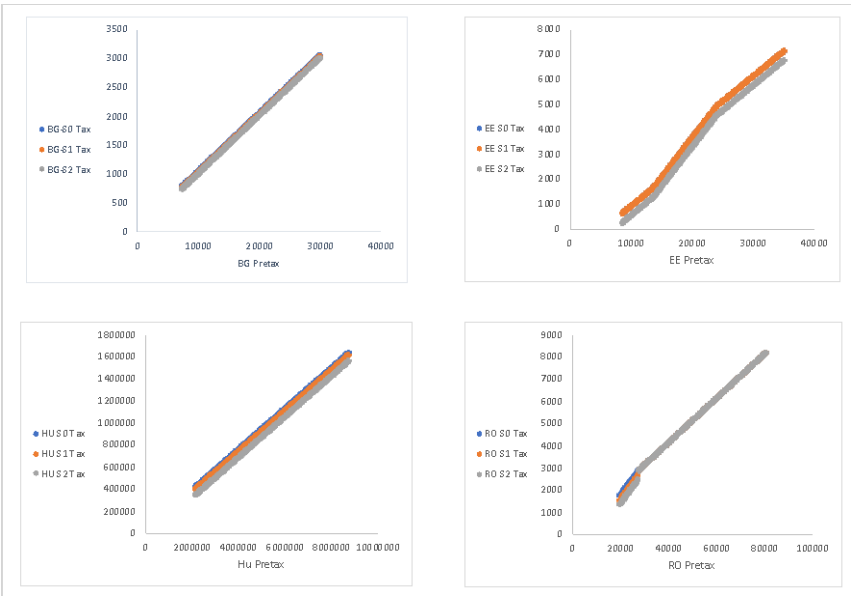
In order to analyse the magnitude of the redistributive effects, we calculate the percentage change of the Gini coefficient:

$$\Delta\%Gini = \frac{post - tax\ Gini_{G_m} - pre - tax\ Gini_{G_m}}{pre - tax\ Gini_{G_m}} \cdot 100$$

3. Results and discussions

3.1. Tax equity

To examine whether PIT regulations provide tax equity among individuals, we first check the fulfilment of the hypothesis, H_1. This hypothesis states that two distinct individuals earning different salary incomes, will pay taxes that are proportional to their income.



Source: Authors' computations

Figure 1. Pre-tax salary income vs. tax due

We can observe an almost perfect correlation between the pre-tax salary income and the tax liability in all countries. As salary income increases, the tax also increases. However, we notice some particularities. For example, in the case of Bulgaria and Romania, there is no significant difference between taxes due by individuals regardless of the number of dependent children. We found the same evidence for Estonia for individuals without dependent children or with one dependent child. This implies that, for these particular cases, individuals benefit from very low tax deductions (even regressive amounts as the income increases, as in Romania's case), even if the number of dependent children is high, which does not significantly differentiate the tax burden.

In order to verify the first hypothesis of tax equity at sub-groups level, we calculated the median of the pre-tax salary income and of tax liability. The computations confirm at the sub-group level the results of the hypothesis tested at the individual level. For all countries, increasing pre-tax salary income also raises the tax due across every case from S0 to S2.

Calculating the skewness of the distribution of the pre-tax salary income, tax due and post-tax salary income and verifying hypothesis, H_2, we could examine how tax equity is achieved within each sub-group of individuals for situations S0 to S2.

Table 1. The Skewness statistic

Bulgaria				Estonia				Hungary				Romania			
Statistics S0	Pretax	Tax	Post tax	Statistics S0	Pretax	Tax	Post tax	Statistics S0	Pretax	Tax	Post tax	Statistics S0	Pretax	Tax	Post tax
Skew G1	0,00	0,00	0,00	Skew G1	0,00	0,00	0,00	Skew G1	0,00	0,00	0,00	Skew G1	0,00	0,01	0,00
Skew G2	0,00	0,00	0,00	Skew G2	0,00	0,21	-0,09	Skew G2	0,00	0,00	0,00	Skew G2	0,00	-0,03	0,00
Skew G3	0,00	0,00	0,00	Skew G3	0,00	0,00	0,00	Skew G3	0,00	0,00	0,00	Skew G3	0,00	0,00	0,00
Skew G4	0,00	0,00	0,00	Skew G4	0,00	-0,07	0,02	Skew G4	0,00	0,00	0,00	Skew G4	0,00	0,00	0,00
Skew G5	0,00	0,00	0,00	Skew G5	0,00	0,00	0,00	Skew G5	0,00	0,00	0,00	Skew G5	0,00	0,00	0,00
Statistics S1	Pretax	Tax	Post tax	Statistics S1	Pretax	Tax	Post tax	Statistics S1	Pretax	Tax	Post tax	Statistics S1	Pretax	Tax	Post tax
Skew G1	0,00	0,00	0,00	Skew G1	0,00	0,00	0,00	Skew G1	0,00	0,00	0,00	Skew G1	0,00	0,01	0,00
Skew G2	0,00	0,00	0,00	Skew G2	0,00	0,21	-0,09	Skew G2	0,00	0,00	0,00	Skew G2	0,00	-0,25	0,02
Skew G3	0,00	0,00	0,00	Skew G3	0,00	0,00	0,00	Skew G3	0,00	0,00	0,00	Skew G3	0,00	0,00	0,00
Skew G4	0,00	0,00	0,00	Skew G4	0,00	-0,07	0,02	Skew G4	0,00	0,00	0,00	Skew G4	0,00	0,00	0,00
Skew G5	0,00	0,00	0,00	Skew G5	0,00	0,00	0,00	Skew G5	0,00	0,00	0,00	Skew G5	0,00	0,00	0,00
Statistics S2	Pretax	Tax	Post tax	Statistics S2	Pretax	Tax	Post tax	Statistics S2	Pretax	Tax	Post tax	Statistics S2	Pretax	Tax	Post tax
Skew G1	0,00	0,00	0,00	Skew G1	0,00	0,00	0,00	Skew G1	0,00	0,00	0,00	Skew G1	0,00	0,01	0,00
Skew G2	0,00	0,00	0,00	Skew G2	0,00	0,21	-0,09	Skew G2	0,00	0,00	0,00	Skew G2	0,00	-0,51	0,04
Skew G3	0,00	0,00	0,00	Skew G3	0,00	0,00	0,00	Skew G3	0,00	0,00	0,00	Skew G3	0,00	0,00	0,00
Skew G4	0,00	0,00	0,00	Skew G4	0,00	-0,07	0,02	Skew G4	0,00	0,00	0,00	Skew G4	0,00	0,00	0,00
Skew G5	0,00	0,00	0,00	Skew G5	0,00	0,00	0,00	Skew G5	0,00	0,00	0,00	Skew G5	0,00	0,00	0,00

Source: Authors' computations

As we can see from Table 1, for Bulgaria and Hungary, we did not find any evidence to show the change in the asymmetry of tax distribution, which is zero for all sub-groups of individuals regardless of the number of dependent children. This indicates proof of tax equity, the PIT regulations being fair for all the population but also for sub-groups. Similar evidence was found for Romania's case, except for G2. For this sub-group of individuals, the skewness is negative and increases depending on the number of children. We note, nonetheless, that the asymmetry is quite small. A left-tailed distribution means that the mass of the data is concentrated on the right toward higher values. This implies that only a few individuals in this sub-group benefit from tax deductions that reduce their due taxes, while for most of individuals, these deductions do not apply, and they must pay higher taxes. For Estonia, we found evidence of a positive asymmetry of tax distribution in the case of individuals in G2 and a negative asymmetry in G4. A right-tailed distribution indicates that the mass of the distribution is concentrated on the left, which suggests that most individuals in that sub-group benefit from tax deductions, and, therefore, for them the tax is lower than the tax that those who do not benefit from these deductions have to pay.

Continuing to test hypothesis H_2 and analysing the asymmetry in the post-tax salary income distribution, we noticed that the shape of the distribution has changed for cases where distribution of taxes was positively or negatively skewed. When the distribution of taxes is right-tailed, the distribution of post-tax salary income is left-tailed. When distribution of taxes is left-skewed, the distribution of post-tax salary income is right-tailed. These results show that the different tax treatments to which individuals are subjected are also reflected in the distribution of their post-tax income. In the cases when individuals benefit from the same tax

treatment and the tax due is zero, the shape of post-tax salary income distribution is similar with that of the pre-tax salary income distribution.

Based on these results, hypothesis H_2 can be re-written as follows: $H_2: \gamma_{X_{G_k}} = 0, \gamma_{T_{G_k}} \neq 0, \gamma_{(X-T)_{G_k}} \neq 0,$

for sub-groups and number of dependent children discussed above.

Thus, we can state that the tax equity hypothesis is not always confirmed for all sub-groups and situations because for individuals in the same sub-group we found evidence of different tax treatments.

3.2. Tax progressivity

To examine the progressivity of the PIT regulations, we first check whether hypothesis *H3* holds. We compute the effective tax rates for each individual and illustrate the relationship between the pre-tax salary income and the effective tax rates. Although in these countries a flat tax rate is applied, we can observe somewhat pronounced progressivity caused by the tax incentives that individuals benefit from. In the case of Bulgaria, we found that for individuals without children, the effective tax rate equals the statutory tax rate of 10%, and it is flat, irrespective of the size of the salary income. For individuals with the same number of dependent children, the effective tax rates vary very little, and they are close to the statutory tax rate. The effective tax rates slightly differ depending on the number of dependent children, but they range from 9% to 10% and converge towards the statutory tax rate.

We highlight a peculiar situation for the case of Hungary. The effective tax rates are higher than the statutory tax rate in case of all individuals because the taxable base for PIT in Hungary is directly the gross salary income (social contributions are not subtracted from the gross income in order to determine the due tax, as the legislation stipulated in the other three countries analysed). The effective tax rates decrease only as a consequence of using tax deductions, which are granted only to the categories of employees having dependent children.

In Estonia, the effective tax rates are below the statutory tax rate and they vary on range depending on the size of the salary income and on the number of dependent children as follows: S0 and S1:[8.11%, 20%] and S2: [4.45%, 18.85%]; We also notice that the range of variation increases and that the effective tax rates decrease with the increase in the number of dependent children. Individuals without children and individuals with one dependent child perceive the same tax burden because, in Estonia, the deduction for the first child is nil; hence no tax incentives to dilute the effects of taxation upon the income for the latter group. For the case of Hungary, we found evidence of progressivity only for the individuals with one dependent child and two dependent children for whom the effective tax rates vary between 17.69% and 18.18%, and, respectively, between 15.54% and 17.51%.

In Romania, we highlight a different kind of combination between flatness and progressivity, the effective tax rate varying as follows for: S0:[8.23%, 10%]; S1:[7.28%, 10%] and S2: [6.33%, 10%] and flattens and it flattens at 10% for $i = \overline{110,500}$ in all the sub-groups. The reason for this situation is the way the deduction

is computed and received, i.e., the deduction is applied regressively according to the income's level and the number of dependents. Thus, the higher the income and the number of dependents, the lower the deduction received with a cap on the income's level at 3,600 lei/month – meaning, individuals obtaining incomes above that level are not entitled to receive a personal deduction no matter the number of dependents.

Thus, we can state that hypothesis *H3* is not fully verified for all individuals in all sub-groups and situations depending on the number of children.

Testing hypothesis $\widetilde{H_3}$ for sub-groups, we come to similar findings as to those of the hypothesis *H3* for individuals, which proves the robustness of our tests. Figure 3 plots the effective tax rates at the sub-group level. One can observe that the progressivity becomes more pronounced, and the variation of the effective tax rates increases with the increase in the number of dependent children. Of all the analysed countries, Bulgaria is the only country that is closest to the true flat tax rate. The effective tax rates do not diverge so far from the statutory tax rate of 10% and its variation is very small within the sub-groups or between the situations of the number of dependent children. Romania has a combination of progressivity for G1 and G2 that flattens at 10% for G3, G4, and G5. Hungary has a flat effective tax rate of 18.40% for S0, and for S1 and S2 the effective tax rates are decreasing in accordance with the number of dependents.

With regard to the marginal tax rates, we observe for Bulgaria and Estonia a flat MTR of 10% and, respectively, of 20% that equals the statutory tax rates in these countries. In Hungary the MTR is flat at 18.40%; thus for individuals without dependent children the marginal tax rate is equal to the effective tax rate and above the statutory tax rate of just 15%. But for individuals in S1 and S2, those who have dependent persons, the marginal tax rate is higher than both effective tax rate and statutory tax rate. For Romania we noticed a bizarre situation, as the results reveal a combination of flatness (MTR of 10%), progressivity (from 10% to 23.31% or 36.35%) and regressivity (from 23.31% or from 36.35% to 10%) in MTRs levels. What is remarkable in the case of Romania is that when an individual is no longer entitled to tax deduction because the gross income's level tops the limit established by the legislation (3,600 lei/month, in our dataset i=108), the marginal tax rate catapults from 10% to 23.31% for an individual with no dependent children, to 165,29% for an individual with a single dependent child and to a whopping 307.26% for an individual with 2 dependent children.

Regressive marginal tax rates indicate that individuals who earn lower salary income will have to pay higher taxes for the same increase in the salary than individuals who earn higher salary income. The tax increases faster for individuals with low salary income than for individuals with higher salary income, even if the former benefit from tax deductions. The explanation is given by the regressive tax deductions granted for Romanian employees. By increasing the salary income, the increase in tax has two components: the increase in income plus the decrease of tax deduction, both multiplied with the statutory tax rate. The higher the tax deduction (for employees having more dependent children), the higher the effect (there is a

higher decrease in the amount of tax deduction received). The effect disappears when tax deductions are not granted anymore.

Calculating the $\widetilde{MTR}$s for sub-groups, we obtain similar results as for individuals and find the same combination of flat, progressive, and regressive $\widetilde{MTR}$s. The $\widetilde{MTR}$ is flat regardless of number of dependent children for the cases of Bulgaria, Estonia and Hungary. For Romania, we highlight progressive $\widetilde{MTR}$s for individual in G2 and regressive $\widetilde{MTR}$s in G3, that flatten for individuals in G4 and G5, all regardless of the number of dependent children. These results suggest that if one individual migrates from G2 to G3 for one monetary unit increase in his salary income, he will pay a smaller tax.

Thus, we can conclude that PIT regulations in CEEC generate not only progressivity in taxation as expected as an effect of tax deductions, but also regressive effects, due to the fact that some countries set the tax deductions as regressive amounts as income increases (Romania).

3.3. Redistributive effects

We examine the redistributive effects by calculating the Gini index of the pre-tax and of the post-tax salary income and by testing if hypothesis *H4* holds. Furthermore, we have determined the percentage change of the Gini coefficients to emphasise the magnitude of the redistribution. The Gini index measures the extent to which the distribution of income (or, in some cases, consumption expenditure) among individuals or households within an economy deviates from a perfectly equal distribution. A Lorenz curve plots the cumulative percentages of total income received against the cumulative number of recipients, starting with the poorest individual. The Gini index measures the area between the Lorenz curve and a hypothetical line of absolute equality, expressed as a percentage of the maximum area under the line.

Table 2 reports the Gini coefficients for each sub-group and the number of dependent children, and for the entire population (ALL). We computed the Gini coefficient of the gross salary income to show that social security contributions do not affect its distribution. Moreover, PIT regulations have no redistributive effects on post-tax salary income.

In general, we can see that the PIT regulations in CEEC do not have large redistributive effects. If we compare the percentage change in Gini coefficients for all sub-groups and situations depending on the number of dependent children, the results show the largest redistributive effects in Estonia, Hungary, Romania, and Bulgaria. We can also observe a variety of ways in which salary income is redistributed as an effect of PIT regulations.

In Estonia, the redistribution effects become larger with the increase in the number of dependent children. The largest redistribution takes place for G1, G2, and G3, regardless of the number of dependent children. Furthermore, for G2 and G3, the percentage change in Gini exceeds the percentage change for the entire population. In Hungary's case, the results indicate no redistributive effects for S0

i.e., the percentage change of Gini's index is zero. In the cases where the results show the existence of redistributive effects, their magnitude decreases with the increase in individuals' salary income suggesting that the redistribution is more pronounced for low-income individuals than with for those with high income. For Romania, we discovered a reduced redistribution of the salary income that increases and becomes more pronounced with the number of dependent children, and that takes place following a different pattern. The redistributive effects are larger for G1 and G2, while for the rest of individuals in high-income sub-groups, the redistributive effects are zero because they no longer benefit from tax deductions, and additionally the effective tax rate and the marginal tax rate are flat and equal to the statutory tax rate. The results indicate the smallest redistributive effects in the case of Bulgaria and there is no important difference in the percentage change of Gini coefficients among sub-groups and situations depending on the number of children.

Table 2. The Gini coefficient and its evolution

Country /Sub-groups		Bulgaña				Estonia				Hungary				Romania			
		gross	pre-tax	post-tax	%Δ	gross	pre-tax	post-tax	%Δ	gross	pre-tax	post-tax	%Δ	gross	pre-tax	post-tax	%Δ
S0	G1	6,81	6,81	6,81	0,00%	6,81	6,81	6,20	-8,96%	6,81	6,81	6,81	0,00%	6,81	6,81	6,52	-4,26%
	G2	8,65	8,65	8,65	0,00%	8,65	8,65	7,48	-13,53%	8,65	8,65	8,65	0,00%	8,65	8,65	8,65	0,00%
	G3	6,75	6,75	6,75	0,00%	6,75	6,75	5,97	-11,56%	6,75	6,75	6,75	0,00%	6,75	6,75	6,75	0,00%
	G4	5,70	5,70	5,70	0,00%	5,70	5,70	5,68	-0,35%	5,70	5,70	5,70	0,00%	5,70	5,70	5,70	0,00%
	G5	5,03	5,03	5,03	0,00%	5,03	5,03	5,03	0,00%	5,03	5,03	5,03	0,00%	5,03	5,03	5,03	0,00%
	ALL	22,65	22,65	22,65	0,00%	22,65	22,65	20,32	-10,29%	22,65	22,65	22,65	0,00%	22,65	22,65	22,55	-0,44%
S1	G1	6,81	6,81	6,80	-0,15%	6,81	6,81	6,20	-8,96%	6,81	6,81	6,77	-0,59%	6,81	6,81	6,48	-4,85%
	G2	8,65	8,65	8,64	-0,12%	8,65	8,65	7,48	-13,53%	8,65	8,65	8,61	-0,46%	8,65	8,65	8,60	-0,58%
	G3	6,75	6,75	6,75	0,00%	6,75	6,75	5,97	-11,56%	6,75	6,75	6,73	-0,30%	6,75	6,75	6,75	0,00%
	G4	5,70	5,70	5,70	0,00%	5,70	5,70	5,68	-0,35%	5,70	5,70	5,69	-0,18%	5,70	5,70	5,70	0,00%
	G5	5,03	5,03	5,02	-0,20%	5,03	5,03	5,03	0,00%	5,03	5,03	5,02	-0,20%	5,03	5,03	5,03	0,00%
	ALL	22,65	22,65	22,62	-0,13%	22,65	22,65	20,32	-10,29%	22,65	22,65	22,56	-0,40%	22,65	22,65	22,45	-0,88%
S2	G1	6,81	6,81	6,79	-0,29%	6,81	6,81	6,04	-11,31%	6,81	6,81	6,65	-2,35%	6,81	6,81	6,44	-5,43%
	G2	8,65	8,65	8,63	-0,23%	8,65	8,65	7,32	-15,38%	8,65	8,65	8,50	-1,73%	8,65	8,65	8,56	-1,04%
	G3	6,75	6,75	6,74	-0,15%	6,75	6,75	5,88	-12,89%	6,75	6,75	6,67	-1,19%	6,75	6,75	6,75	0,00%
	G4	5,70	5,70	5,69	-0,18%	5,70	5,70	5,61	-1,58%	5,70	5,70	5,65	-0,88%	5,70	5,70	5,70	0,00%
	G5	5,03	5,03	5,02	-0,20%	5,03	5,03	4,98	-0,99%	5,03	5,03	4,99	-0,80%	5,03	5,03	5,03	0,00%
	ALL	22,65	22,65	22,60	-0,22%	22,65	22,65	19,90	-12,14%	22,65	22,65	22,28	-1,63%	22,65	22,65	22,35	-1,32%

Source: Authors' computations

Thus, we can state that hypothesis *H4* is not verified for all cases. The percentage change in the Gini coefficients shows that the redistributive effects are not sizeable in their magnitude and that they expand with the increase in the number of dependent children and with the size of the salary income. In general, the redistributive effects are larger for low-income than for high-income individuals.

4. Conclusions

Taxes are the most important means of financing government activities in all countries. Although it is well known their distortionary effect, governments must find ways to minimise them and make taxation friendlier. One way to fulfil this goal is to ensure that taxation is equitable and citizens' tax liability correspond to their ability to pay. This can be achieved by applying a flat or a progressive tax rate structure. Governments who chose the flat tax rate structure for the PIT aimed at simplifying the tax system and minimising distortions generated by progressivity. However, 'hidden' progressive, unfair, and redistributive effects can occur because of tax deductions, tax credits, and other tax benefits. The four countries in Central and Eastern Europe that employ the flat tax rate were a relevant case study.

To underline these effects of the flat tax rate, we used a generated dataset of a uniform and symmetrically distributed gross salary income for 500 individuals whom we grouped in five sub-groups from low- to high-income individuals. We took into consideration five distinct situations based on the number of dependent children as to show that these effects are generated by the tax deductions in force in 2021. We tested several hypotheses to examine tax equity, progressivity, and redistributive effects of these regulations under a flat tax rate system.

We found that the tax equity hypotheses were not fully verified. We identified cases of individuals with similar number of dependent children whose salary income slightly varied and were subjected to different tax treatment. The progressivity hypotheses were also not fully verified. We found evidence of a flat tax rate or of mixed progressive and flat tax rate structures. The results also showed the existence of decreasing marginal tax rates. In what regards the redistributive effects, these are small scaled, and their size depends on the 'hidden' progressivity generated by the PIT regulations.

Our study also revealed several policy implications. It is widely recognised that taxes on income can have higher output gap elasticities than taxes on consumption, especially when progressive rate structures are applied (Baunsgaard and Symansky, 2009; Jianu et al., 2021), which make them a better automatic stabiliser capable of converting periods of likely recession into periods of normal growth (Cohen and Follette, 2000). The evidence we found has shown situations where tax equity is not fulfilled, and this should be a warning signal for policy makers. Considering citizens' great sense of justice, if tax treatment differs to individuals in similar situations whose salary income does not vary greatly, this can generate dissatisfaction among taxpayers. Furthermore, there is evidence, that in developing European countries (Jianu et al., 2021) the relationship between income inequality and economic growth proved to be negative and moreover we need to underline the tax evasion phenomenon associated with income inequality (Fülöp et al., 2022) that will enhance the "hidden" negative effects of the flat rate system. Consequently, they can find ways to avoid paying the taxes, or they can decide to substitute work with leisure. Thus, the function of PIT as an automatic stabiliser can be adversely affected. This is also true when the tax rates are modified

correspondingly to tax deductions. Effective tax rates which are higher than the statutory tax rates, zero tax rates, or decreasing marginal tax rates can diminish the stabilising effects.

The PIT can contribute to the decrease in the inequality of income distribution among individuals or households by promoting progressive taxation through tax rate's structure or through tax deductions or tax credits when applying a flat tax rate as in the case of CEEC. According to the European Commission (2022) on income inequality, Bulgaria had the highest Gini coefficient as related to the EU average (35% face to 30.1%) and Estonia and Romania were above the average as well. Therefore, CEEC governments should pay more attention to the problem of income redistribution, and PIT regulations can be a very important and useful tool in smoothing inequality of income distribution. If governments are not willing to change the flat tax rate and introduce a progressive tax rate structure, they could use the tax deductions, tax allowances, tax exemptions, or tax credits as means to achieve a stronger progressivity that can lead to more pronounced redistributive effects in order to smooth income inequality.

REFERENCES

[1] **Alm, J., Kirchler, E., Muehlbacher, S. (2012),** ***Combining Psychology and Economics in the Analysis of Compliance: From Enforcement to Cooperation.*** *Economic Analysis & Policy*, 42(2), 133-151;

[2] **Basham, P., Mitchell, D. (2008),** ***Lessons from Abroad – Flat Tax in Practice*** *in eds: Jason Clemens,* ***The Impact and Cost of Taxation in Canada. The Case for Flat Tax Reform.*** The Fraser Institute, 2008, 103-144;

[3] **Baunsgaard, T., Symansky, S.A. (2009),** ***Automatic Fiscal Stabilizers: How Can They Be Enhanced Without Increasing the Size of Government?*** *IMF Staff Position Note,* SPN/09/23;

[4] **Bikas, E. et al. (2014),** ***Evaluation of social, economic and fiscal impact on incentives of personal income taxation in Lithuania***. *Journal of Security and Sustainability Issues*, 4(1), 79-95;

[5] **Caminada, K., Goudswaard, K. (2001),** ***Does a flat rate individual income tax reduce tax progressivity? A simulation for the Netherlands***. *Public Finance and Management*, 1(4), 471-499;

[6] **Cohen, D., Follette, G. (2000),** ***The Automatic Fiscal Stabilizers: Quietly Doing Their Thing***. *FRBNY Economic Policy Review*, April 2000**;**

[7] **Dean, P., Keenan, T., Kenney, F. (1980),** ***Taxpayers' attitude to income tax evasion: An empirical study***. *British Tax Review*, 1, 28-44;

[8] **Emes, J., Clemens, J., Basham, P., Samida, D. (2001),** ***Flat Tax. Principles and Issues.*** *Fraser Institute Critical Issue Bulletin*, Fraser Institute;

[9] **European Commission (2022),** ***Household composition statistics***, Available at: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Household_composition_statistics
[10] **European Commission (2022),** ***Living conditions in Europe – Income distribution and income inequality*** Available at https://ec.europa.eu/eurostat/statisticsexplained/index.php?title=Living_conditions_in_Europe__income_distribution_and_income_inequality&oldid=528159#Income_inequality
[11] **Fehr, E., Schmidt, K.M. (1999),** ***A Theory of Fairness, Competition and Cooperation.*** *The Quarterly Journal of Economics*, August, 817-868;
[12] **Fülöp, M.T., Raita, G., Breaz, T.O. (2022),** ***The role of management and accounting in combating tax evasion in an emergent country.*** *Economic Computation and Economic Cybernetics Studies and Research*, 4(56), 273-289;
[13] **Grdović G.A., Tomić, I. (2010),** ***How hard does the tax bite hurt? Croatian versus European worker.*** *Financial Theory and Practice*, 34(2), 109-142;
[14] **Hall, R.E., Rabushka, A. (2007),** ***The Flat Tax, Second Edition.*** *Hoover Institution Press*, ISBN: 978-0-8179-9311-5;
[15] **Ifanti, A. (2008),** ***Tax Equity.*** *Buffalo Law Review*, 55, 1191-1260;
[16] **Jianu, I., Dinu, M., Huru, D., Bodislav, A. (2021),** ***Examining the Relationship between Income Inequality and Growth from the Perspective of EU Member States' Stage of Development.*** *Sustainability*, 13, 5204;
[17] **Kakwani, N., Lambert, P.J. (1998),** ***On measuring inequity in taxation: a new approac*****h.** *European Journal of Political Economy*, 14, 369-380;
[18] **Meriküll, J., Staehr, K. (2010),** ***Unreported Employment and Envelope Wages in Mid-Transition: Comparing Developments and Causes in the Baltic Countries***. *Comparative Economic Studies*, 52(4), 637-670;
[19] **Mitchell, D. (2005),** ***A Brief Guide to the Flat Tax.*** *Backgrounder*, 1866, The Heritage Foundation, 1-7;
[20] **Morini, M., Pellegrino, S. (2016),** ***Personal Income Tax Reforms: A Genetic Algorithm Approach***. *European Journal of Operational Research*, 264(3), 994-1004, https://doi.org/10.1016/j.ejor.2016.07.059;
[21] **Paulus, A., Peichl, A. (2008),** ***Effects of flat tax reforms in Western Europe on income distribution and work incentives***. *FiFo-CPE Discussion Paper No. 08-4*, http://dx.doi.org/10.2139/ssrn.1106173;
[22] **Plotnick, R. (1981),** ***A Measure of Horizontal Inequit*****y**. *The Review of Economics and Statistics*, 63(2), 283-288;
[23] **Sedleniesk, K. (2003*), Cash in an Envelope: Corruption and Tax Avoidance as an Economic Strategy in Contemporary Riga, in K. Arnstberg and T. Boren (eds),*** *Everyday Economy in Russia, Poland and Latvia*, Stockholm: Almqvist and Wiksell International;
[24] **Smith, A. (1776),** ***An Inquiry into the Nature and Causes of the Wealth of Nations.*** Oxford University Press, 1976;
[25] **Williams, C. (2009),** ***The prevalence of envelope wages in the Baltic Sea region.*** *Baltic Journal of Management*, 4(3), 288-300.