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The Impact of Capital Income Tax on Income Inequality

Empirical Evidence from the Eastern Bloc Countries

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Abstract. The capital income tax has been commonly proposed as a measure against economic inequality. This study analyzes data from eight countries in Central and Eastern Europe to assess impact of capital income taxation on inequality in young market economies of the area. First, a time-series cross-section dataset is employed in a macro-based econometric model. The Prais-Winsten procedure with panel-corrected standard errors is used to provide meaningful insights in spite of limited time and cross-section dimensions. The estimated results are subject to further investigation based on micro data from the Luxembourg Income Study. The conducted analyses include the Gini coefficient decomposition by income source and calculations of various inequality measures. The main findings suggest that in case of the studied countries, the impact of capital income taxation remains statistically insignificant. It seems that social expenditure and measures against labor income concentration in post-socialist economies continue to exhibit the most equalizing potential.

Keywords: capital income tax, income inequality, time-series cross-section data, Eastern Bloc

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1. Introduction

Rising inequality levels observed across many countries over the past decades pose an important question about potential causes and measures that can be undertaken to counteract income concentration. Those considerations become even more important in the light of recent empirical evidence that suggests negative impact of inequality on the aggregate output and economic growth (e.g. Brueckner and Lederman, 2015). Among many commonly cited factors, high concentration of capital has received particular attention due to Piketty (2014). According to his hypothesis, inequality continues to rise because, over the long run, the rate of return on capital exceeds the rate of economic growth. Consequently, taxes levied on wealth and capital income have appeared at the heart of a debate on potential policies aimed at fighting unequal income distribution.

However, the important questions arise: can capital income tax be treated as a universal measure against inequality? Can it be effective in countries where unimpeded accumulation of private capital is a relatively new phenomenon? Is the share of capital income in total income received by the rich large enough to make a difference in the young market economies? In the former Eastern Bloc countries, inequality levels were rising sharply during the early stages of transition process. Privatization, involving the transfer of wealth from state ownership into the private hands of a small group of people, dramatically increased the importance of capital income and skewed income distribution. However, labor income played even greater role in this regard. First, the scheme of wage setting was changed from centrally planned to decentralized. Second, radical structural and technological changes of the economy led to a shift in labor demand from manual workers and public sector to private sector and highly qualified personnel. It is therefore not unlikely that two decades later differences in wages are still the most important source of inequality. Consequently, other policies may prove to be better suited to prevent further income concentration. Moreover, in most Central and Eastern European countries capital income tax is proportional, which is likely to limit its potential if capital owners are present also in the lower income categories. This thesis aims at shedding more light at those matters.

To the best of the author's knowledge, empirical evidence regarding influence of capital income tax on inequality is scarce and almost exclusively focused on the United States. This limited geographic coverage results from the fact that relevant microdata, on which existing empirical researches are based, are usually unavailable for longer periods of time under which a change in taxation policy can occur. This paper aims to cover this gap by offering a different approach. Firstly, the relationship of interest is estimated within a macro-level econometric model using a time-series cross-section dataset. Subsequently, microdata available for some of the years within the studied period are analyzed in order to better understand the reasons behind the obtained estimates and assess their validity.

The remainder of the paper is organized as follows: Section 2 provides a review of literature on capital income tax as an anti-inequality policy and on potential inequality determinants; Section 3 describes the relevant background information for the set of analyzed countries; Section 4 introduces an econometric model, discusses estimation methods and presents the results; Section 5 contains microdata analysis: it documents distributional characteristics of total income and its respective sources, proceeds with the Gini coefficient decomposition, and provides an overview of alternative inequality measures; Section 6 discusses obtained results and formulates policy implications.

2. Literature Review

Although the empirical research concerned with the impact of capital income tax on income inequality seems to be at its early stages, some relevant microdata analyses can be referred to as a benchmark. The recent paper by Looney and Moore (2015) examines the post-tax distribution of net wealth in the U.S. from 1989 to 2013 by looking into data from the Fed's Survey of Consumer Finances. The authors describe the distribution of tax-deferred assets, provide estimates of the income tax liabilities and find that the effectiveness of the income tax system in diminishing wealth inequality has decreased. A reduction in the long-term capital gains rate is identified as a primary reason behind this finding. Also Stein (2014), in his similar work, concludes that the majority of benefits of lower tax rates on capital gains and dividends are captured by the top quintile of income distribution. Similarly, Piketty and Saez (2006) use a long series of U.S. personal income data to show that most of the changes

in income distribution can be assigned to changes in shares of income held by the top deciles. They also argue that modifications in marginal capital (and income) taxation for the top income earners are the underlying cause of the observed relationship.

Hungerford (2013) analyzes income inequality between 1996 and 2006. He decomposes Gini coefficient into different income sources, based on the data for the U.S. tax filers. The results suggest that changes in income from capital gains were the single largest driving force behind rising income inequality. Changes in wages, in turn, were found to have had little effect on the upward trend in overall income inequality. Similar approach is applied by Frassdorf, Grabka, and Schwarze (2008) for Great Britain, Germany, and the USA. The authors conclude that the contribution of capital income to total income inequality is substantial in all three countries.

As mentioned in the *Introduction*, this paper moves beyond the traditional approach of microdata analysis and thus the whole body of literature on macro-level inequality determinants becomes relevant. The economic theories on the income distribution provide a vast array of potential factors at play. However, there is little guidance on selection of appropriate explanatory variables and there is no single accepted empirical specification. Early literature on the macroeconomic determinants of inequality has suggested two main channels through which income distribution can be affected: real GDP growth (or the unemployment rate) and inflation (Marrero and Rodríguez, 2012). Early empirical studies suggest negative impact of the former on inequality (at least in developed countries) but evidence regarding the latter is inconclusive. This most probably stems from the fact that inflation can influence inequality in both directions: while inequality may decrease when input costs increase faster than profits (i.e. inflation comes from the supply side), it tends to rise in case of inflation resulting from tensions on the demand side.

As far as economic growth is concerned, a lot of attention was directed towards its implications for income distribution and related hypotheses evolved over time. Early contribution by Kuznets (1955) assumed inverted U-shaped relationship between income inequality and economic growth. An underlying notion was that of the industrialization process advancing at the expense of agricultural sector. In its initial stages, inequality should

rise as stakeholders of fast adapting enterprises capture most of the benefits of the structural shift, while income of the others is relatively decreasing. Subsequently, after reaching a certain level of economic development, inequality should fall in response to the welfare state policies and trickle-down effects. With the development of empirical researches, the Kuznets curve hypothesis was proved to not hold universally (e.g. Fields, 2001). It was suggested that aggregate growth can still potentially decrease inequality through reducing exclusion in the labor market; however, if it is driven by a technological change that is biased towards high-skilled workers (increasing their wages relatively more as compared to unskilled labor), this desired effect will be dampened (Ayala, Cantó, and Rodríguez, 2011). Furthermore, Bourguignon (2002) points towards reverse causality between economic growth and inequality. He also argues that, apart from direct channels, the former can influence income distribution indirectly, e.g. through institutions.

Another commonly cited set of factors that potentially affect income inequality levels includes globalization (understood as trade liberalization and financial integration), financial development, government size, and welfare state.

In general, trade openness is expected to influence income inequality negatively since it increases the merchandise trade, which in turn rises demand for the products of unskilled labor. However, along the lines of standard Heckscher-Ohlin theory, trade liberalization in countries relatively rich in capital can lead to an increase in demand for skilled labor instead, and decrease relative wages of unskilled workers. Thus, the direction of this relationship depends on a country's relative factor abundance and productivity. Harisson (2006) looks into general equilibrium effects and shows that globalization, defined as both openness to trade and international capital flows, has equalizing impact on income in the presence of proper governance and sound institutions. Jaumotte, Lall, and Papageorgiou (2008), based on the empirical cross-country comparisons, reach similar conclusions about trade openness but they find that FDI has the opposite impact on inequality, as it mostly takes place in relatively more skill- and technology-intensive sectors. Other authors, however, present different results, also with regard to trade liberalization (e.g. Cornia, 2003; Roine, Vlachos, and Waldenström, 2009).

Similarly, in case of financial development the empirical evidence is mixed. Standard theory typically predicts that financial development reduces income distribution by providing access to capital to previously credit-constrained individuals. Following this line of argument, financial development improves the allocation of resources and opens possibilities to engage in profitable projects for the individuals from lower income categories. Beck, Demirgüç-Kunt, and Levine (2007) use the panel GMM method to test this hypothesis and find that financial development is indeed pro-poor in nature. However, Claessens and Perotti (2005) provide references to both theory and empirical evidence that demonstrate the opposite relationship. They argue that income concentration affects division of political power, which in turn can lead to capture of financial regulations by the elites. Consequently, top income earners can block all those financial developments that disproportionately benefit the poor so as to retain their more favorable positions.

Finally, the impact of fiscal policies has also been broadly studied with regard to income distribution. Higher labor income taxes have an immediate negative effect on incentives to work and may thus limit gross inequality if: (i) this effect is relatively stronger among top income earners, (ii) in top deciles income from labor constitutes bigger share of total income received than in other income categories, or (iii) income tax is progressive. However, if individuals set some target disposable income levels, they may increase their labor supply instead of decreasing it. Moreover, top income earners may invest more in tax avoidance when tax rates goes up, since costs associated with these kind of actions become smaller as weighted again possible gains. In fact, Duncan and Peter (2008) demonstrate—on both theoretical and empirical grounds—that increased tax progressivity may lead to higher income concentration in countries with weak law. However, the authors also show that the same policy change in countries with more developed democratic institutions has relatively strong equalizing impact on reported gross and net income. Furthermore, Voinea and Mihaescu (2009) analyze the influence of the flat tax reform implemented in Romania in 2005. They suggest restoration of progressivity as a measure counteracting income concentration. At the same time they advise against rises in the flat tax rate or VAT, as they would achieve the opposite of the desired effect. Similar conclusions about pro-poor character of progressive tax system have also been drawn by other researchers (e.g. Roine, Vlachos, and Waldenström, 2009). All the aforementioned theoretical considerations

regarding progression apply to capital income tax as well, but it is difficult to determine *a priori* whether adjustments to changes in tax policies follow the same pattern as in case of labor income.

3. Background

The analyses carried out in this thesis are focused on the set of eight Eastern Bloc countries: Bulgaria, Croatia, Czech Republic, Hungary, Poland, Romania, Slovak Republic, and Slovenia. Before the market transition, these socialist economies were characterized by relatively low level of income inequality (Flemming and Micklewright, 1999). The transformation process, however, brought about profound structural changes that in most cases led to significant increase in income concentration. Nowadays, the analyzed countries on average do not differ considerably from other members of the European Union in terms of total income inequality (Tóth and Medgyesi, 2011). Some of them, like Czech Republic and Slovenia, considerably lower the average observed in the EU, while others, especially Bulgaria and Romania, are among the most unequal member states. Nevertheless, almost all of them experienced an upward trend in income concentration over years 2000–2013, which are of primary interest in this paper. The periods of inequality growth, however, were usually separated by years of relative stability, or even decline, and varied in intensity across countries.

This almost universal increase in income inequality can be potentially explained, at least to some extent, by commonly implemented changes in fiscal policy. Slovakia, Romania, Bulgaria, Czech Republic, and Hungary all introduced the flat tax system at some point within the studied period. New personal income tax (PIT) rates ranged from merely 10% in Bulgaria to 19% in Slovakia. In Slovenia, even though a progressive tax system was maintained, the number of brackets was decreased along with the top marginal tax rate. Similarly, PIT tax rates in Poland have been diminishing since 1995. Moreover, in 2004, a flat 19% tax rate was introduced for persons conducting non-agricultural business. In fact, the taxpayers were offered a choice between a standard progressive system and a new flat tax rate. Many high-income earners benefited from this opportunity and registered businesses so as to reduce tax liabilities. It is also important to note that this reform was proposed and implemented by a post-Communist left-wing party. In general, in all analyzed countries tax

progressivity and tax burden in top income categories have been decreasing over time, independently of the ruling party's ideological position and in spite of the rising income concentration. In other words, income taxes have not been considered as a redistributive mechanism and they have not appeared in the public debate in this context. Instead, they were perceived as a tool aimed at stimulating economic growth through enhancing the attractiveness of conducting business and creating new workplaces. Hence, changes in income inequality should not be looked upon as a motivation behind the introduced tax reforms in the set of studied countries. Furthermore, according to Gini Country Report for Poland (2013), rising income concentration did not lead voters to shift to the left, as could be expected. The same is also true for other countries of the region. All of that suggests that the two-way relationship between inequality and redistribution-oriented changes in tax policy is not likely to be present in the former Eastern Bloc countries. Instead, it seems that decreasing tax progressivity affects income inequality but is not introduced in response to changes observed in the latter.

Regarding tax levied on capital income, several countries underwent important policy changes. In Poland, capital income tax (encompassing revenue from bonds, mutual fund shares, interest from bank deposits, and equity sells) was introduced for the first time in 2004. Slovenia, in turn, implemented a dual income system in 2005, under which 'active' income (i.e. from labor) is taxed at progressive rates, while 'passive' income (received from capital) is subject to a flat rate. In Hungary capital income tax rates were lowered along with the introduction of a flat tax system. Finally, Bulgaria decided to impose a tax on interest from bank deposits, which until 2013 was exempt from taxation. In the light of those recently implemented reforms, it seems that a natural step forward in understanding rising income inequalities would involve an attempt at assessing the effectiveness of capital income tax in preventing further income concentration. An evaluation of its relative importance in this regard, compared to tax levied on labor income, would enable formulation of relevant anti-inequality policies.

4. Macro-level Empirical Analysis

The aim of this section is to estimate the impact of capital income tax on total income inequality in Central and Eastern European countries that belonged to the Eastern Bloc. To this purpose the Gini coefficient, which is the only inequality measure available for the whole studied period, is regressed on capital income tax and its other potential determinants. The set of countries used in the analysis consists of Bulgaria, Croatia, Czech Republic, Hungary, Poland, Romania, Slovak Republic, and Slovenia. Due to the fact that observations for the main variable of interest – capital income tax – are not available prior to 2000 (2002 in case of Croatia) and after 2012, the analysis is restricted to this period.

4.1. Model and the data

The estimated model takes the following shape:

$$Gini_net_{i,t} = \beta_0 + \delta cinctGDP_{i,t} + \beta_1 Z_{i,t} + \varepsilon_{i,t}, \quad (1)$$

where $Gini_net_{i,t}$ is the Gini index for income after taxes and transfers in country i and year t , $cinctGDP_{i,t}$ is the share of capital income tax in the GDP of country i , $Z_{i,t}$ is a vector of control variables, and $\varepsilon_{i,t}$ stands for the error term.

Before proceeding with the detailed model description it is important to look into the potential threats to internal validity and assess the extent to which estimated relationship could be interpreted as causal. On one hand, rising income concentration can shift voters' ideological position to the left. Consequently, with increasing power of the left-wing parties, reforms including a rise of capital income tax rates, tax progressivity, or social expenditures could be implemented. With this kind of simultaneity, where not only tax rates affect income inequality but also changes in inequality levels trigger fiscal system reforms, the obtained results would be biased. However, as described in the *Background* section, this problem is not likely to be present in case of the former Eastern Bloc countries. Despite the advancing income concentration, PIT progressivity has been reduced over time, independently of ideological position held by the dominant party. There is also no evidence of median voter's

shift to the left caused by rising income inequality. Those facts suggest that the obtained results should not be severely biased, but—as usually in case of macro-based models dealing with political economy—endogeneity cannot be totally ruled out. The use of instrumental variables is often suggested as a fix to this potential issue. However, finding a good instrument for taxes or social expenditure constitutes itself another problem, solution to which is yet to be found. Since weak instruments can introduce even more bias (e.g. Baum, 2006) this approach is rarely used in inequality models. Hence, it is a common practice to include variables such as income tax progressivity, taxes/GDP, top marginal tax rates or government expenditure directly in the models of inequality determinants (e.g. Roine, Vlachos, and Waldenström, 2009, Atkinson and Leigh, 2008, Lee, Kim, and Cin, 2013, Marrero and Rodriguez, 2012, Mehrara and Mohammadian, 2015). Additionally, given that in the set of studied countries income inequality does not seem to influence welfare state or fiscal system to the large extent, the inference is based on the estimates obtained from the equation 1.

Values of inequality measure—the Gini index—come from the Standardized World Income Inequality Database (SWIID) constructed by Solt (2009). According to the author this database not only ensures maximum comparability across countries but also has coverage by far exceeding those of alternate datasets. Therefore, it is particularly suitable for cross-national comparisons. However, the Gini index is far from being an ideal measure of inequality. It assigns more weight to the middle of income distribution, which means that it may not fully capture information about the top and bottom income categories. This issue is further examined in the section *Micro Data Analysis*. The Gini index can vary from 0 to 100, where higher values mean more inequality.

The main variable of interest—capital income tax—is obtained from Eurostat’s database. It includes taxes collected from income generated by physical capital (rental income) as well as financial investment and saving. The latter encompasses interest from bank accounts, bonds, dividends, profits from security sells, voluntary individual pensions, and the like. Moreover, taxes on corporate profits are also understood as a component of capital income tax. Gravelle and Hungerford (2011) show that most or all of the burden of the corporate

income tax falls on capital income (dividends and capital gains) and it can be perceived in terms of higher effective tax rates imposed on financial capital owners.

The vector Z_t contains the following control variables: real growth rate of GDP per capita, inflation, measure of financial development, progressivity of personal income tax and social expenditure expressed as percentage of GDP. The first two of them enter majority of traditional inequality models and are incorporated in the baseline specification. The relevant data come from the World Bank. Inflation is captured by the annual percentage change in Consumer Price Index. In the robustness check, this measure is replaced with the annual growth rate of GDP deflator so as to account for price changes in the economy as a whole.

Several measures of financial development are used in the analysis. That includes: deposits at private commercial and savings banks, market capitalization (calculated by multiplying the share price by the number of shares outstanding for listed domestic companies), and domestic credit provided by financial sector. Finally, the first two categories are added up together so as to obtain yet another measure. All of those measures are expressed as a percentage share of GDP. They were obtained from the World Bank, International Monetary Fund (IMF), and International Financial Statistics (IFS). Motivation behind inclusion of financial development into the model was twofold. First, it is often cited in the literature as inequality determinant as it influences access to capital for credit constrained individuals. Second, it serves as a proxy for (financial) capital accumulated in the economy, which helps to single out the effect of capital income tax on inequality. By construction, capital income tax increases when the amount of capital relative to GDP rises (assuming unchanged rate of return on capital). With the share of financial capital in GDP present in the model, an increase in capital income tax can be associated with rising capital income tax rates. Additionally, as an attempt to control for potential changes in rate of return on capital, the real interest rate is added in the robustness check. It is not a perfect measure as it can be fully representative only for bank deposits. However, according to Global Wealth Report published by Allianz (2014), bank deposits are by far the most common investment choice in Europe. The values for the real interest rates were obtained from the World Bank, European Central Bank, the National Bank of Slovakia, and the National Bank of Poland.

The next control variable, progressivity of personal income tax, aims at capturing tax reforms implemented in the analyzed countries. Slovak Republic, Romania, Czech Republic, Bulgaria, and Hungary all introduced flat tax systems at some point within the studied period. Poland, while maintaining a progressive tax system, decreased the top marginal tax rates. These changes could affect inequality levels to large extent, given that labor income is believed to be the prime driver of inequality in this part of Europe. The measure of tax progressivity was obtained following the approach suggested by Duncan and Peter (2012). First, for each year and country 100 units of pre-tax income were created, ranging from 4 to 400% of a given year's GDP per capita. Next, tax schedule information was applied (including tax rates and basic personal allowances) to calculate income liability and average tax rate for each unit. The progressivity measure was obtained by regressing those average tax rates on gross income—it is the estimated parameter of the income variable, which measures the percentage point change in the tax rate resulting from a one-percentage point change in gross income. The information on tax schedules comes from multiple sources: databases of the IMF and OECD, OECD Economic Surveys, books by McGee (2008), Belev (2003), Edwards and Mitchell (2008), and tax reports published by Deloitte, KPMG, and Ernst and Young.

The last control variable included in the baseline specification is the ratio of social expenditure to GDP. It measures the amount of government spending aimed largely at improving the situation of the less affluent households. The increase in the capital income tax rate can lead to additional public funds which may in turn be relegated to social transfers. However, supplementary government revenue arising from changes in tax policy might also be directed to other purposes that do not affect inequality levels. In order to isolate the effect of capital income tax on income inequality, it is necessary to take the magnitude of social expenditure into account. This allows for capturing the effects of the tax independently of the underlying social policy and its potential influence on inequality. Social expenditures are defined as social benefits (transfers) paid by government and intended to relieve the recipients from financial burden of numerous hardships or needs (related to e.g. disability, old-age, unemployment). They also include transfers in kind (non-cash transfers). Eurostat provides the relevant data.

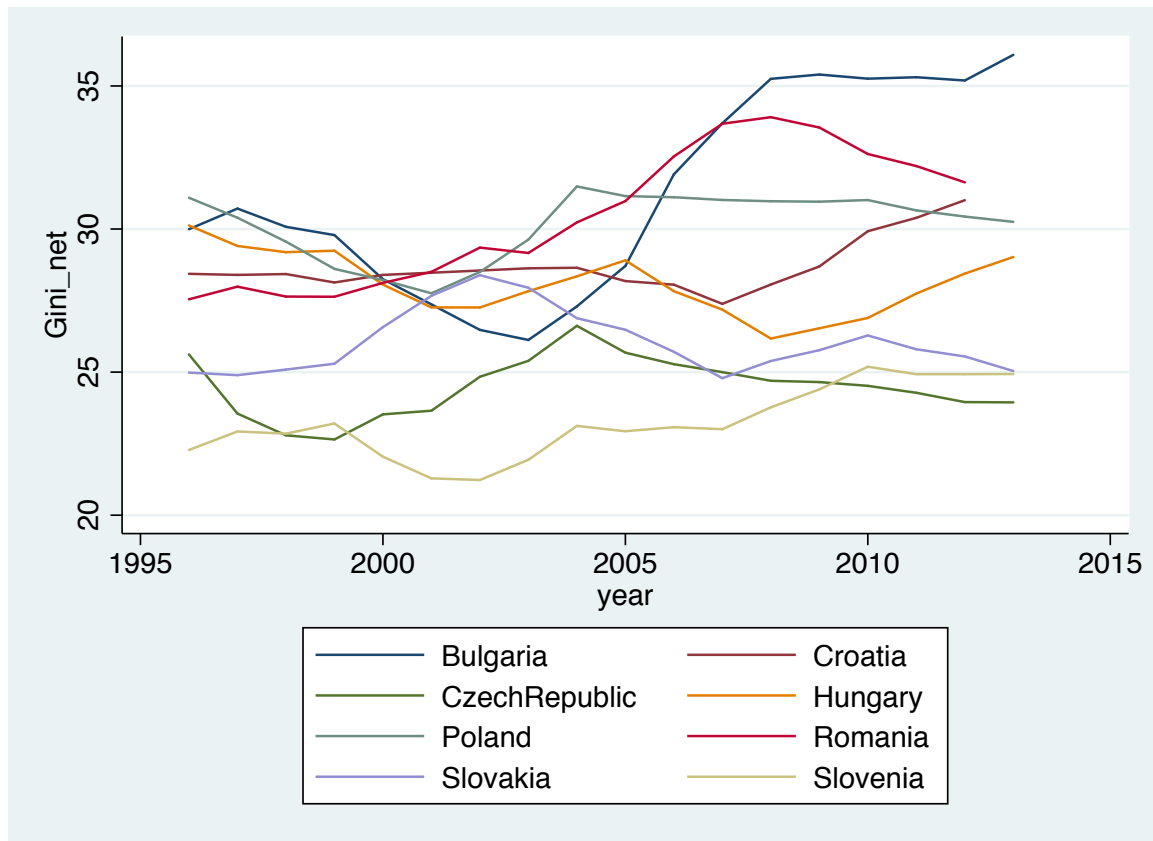
In order to test the stability of the estimated capital income tax parameter the following variables are added to the baseline specification:

- trade openness, foreign direct investment, remittances, funds received from the European Union,
- unemployment rate, real minimum wage at purchasing power parity,
- dummy variable for financial crisis.

Motivation for the first group of additional explanatory variables comes from Figure 1 which shows values of the Gini coefficient in the set of studied countries. In four countries—Slovenia, Czech Republic, Poland, and Hungary—income inequality was rising for some time before 2004 (2005 in case of Hungary) but after this year it stabilized or started declining. 2004 was also a year in which all aforementioned countries joined the European Union. Furthermore, the same pattern is observed in Romania and Bulgaria in year 2007, which also happens to be the year of their EU accession. This may suggest that some changes associated with joining the European Union affected income inequality levels. First, reduction in barriers to trade and movement of financial capital could have its role in the observed correlation. To control for that, trade openness is considered and it is measured by the percentage share of exports and imports in GDP. To account for changes in financial integration net inflows of foreign direct investment relative to GDP are used.

Another potential cause of decreased inequality following year 2004 could be related to the opening of borders and labor markets within the EU for its new members. In many countries increased work-related emigration was observed and it could have affected inequality levels mainly through two channels: increase in remittances and decrease in unemployment rates. However, the direction of impact associated with the first one of them is unclear. On one hand, unskilled workers constituted important share of all emigrants and families receiving remittances from this group usually belonged to lower income categories. On the other hand, in some countries the phenomena of brain-drain became commonly known, as highly educated individuals and professionals from more favorable economic backgrounds were over-represented among emigrants (Okólski and Topinska, 2012). It is therefore difficult to predict how remittances influence inequality levels but, since it is possible that they had equalizing effect on income distribution, they are included in the robustness check as the percentage share of GDP.

Figure 1. The Gini coefficient



Source: Author's compilation based on SWIID

Finally, funds received from the European Union relative to GDP are taken into account as part of them, e.g. Cohesion Fund, was directed towards decreasing economic and social disparities and promoting inclusive growth. Since completing the projects financed by those funds usually takes considerable amounts of time and their impact on income inequality is not likely to be instantaneous, lagged values are used. The relevant data are obtained from Eurostat. The World Bank is the source of all other data used to capture changes following accession to the European Union.

There is one more pattern followed by several countries that can be seen in Figure 1. After the year 2007, income inequality increases ending the period of decline or stability. It concerns Slovenia, Slovak Republic, Slovakia, and—with one year lag—Hungary. As in most Central and Eastern European countries years 2008–2010 were marked by the financial crisis, those two events can be related. Most studies find that financial crises and subsequent policy measures aiming at counteracting their consequences do indeed result in more income

inequality. For example, fiscal consolidation and stabilization policies can affect income distribution both directly and indirectly, through the cuts in social spending and increase in the unemployment rate (Bohoslavsky, 2016). Therefore, dummy variable for the crisis is included in the robustness check and it is lagged to allow for time needed for adjustments and policies implementations.

Finally, given that the labor income is commonly considered as the main driver of inequality in the analyzed region of Europe, two of its potential determinants are incorporated in the extended specifications: unemployment rate and real minimum wage at purchasing power parity. Drop in the latter can lead to decrease in the share of total income earned by the bottom income categories as it should primarily affect the wages of low income earners. The rise in the former can have similar effect by increasing the number of individuals with very low income. Moreover, it might further rise income concentration by lowering relative wages of all workers in the sector that is characterized by excess labor. Data on unemployment rates are obtained from the World Bank. Values for real minimum wages come from the databases of Eurostat and OECD; data for Croatia are not available.

Table 1 defines all variables that are included in the model and appear in the result tables. Summary statistics and correlations of employed variables are reported in the Appendix.

There was a potential issue that deserved some attention before proceeding with the model estimation. The variables measuring financial development, which serves as a proxy for financial capital accumulation, indirectly capture the private saving rate. As changes in capital income tax rates alter the after-tax rate of return on capital, the saving rate can be affected as well. On one hand, decreasing rate of return can decrease households' willingness to save, since future consumption becomes more expensive in terms of current consumption (the substitution effect). At the same time, however, the decreased return forces households to save more, as far as they want to maintain some target affluence level (the income effect). If the latter effect dominates, the negative impact on capital income can be partially or fully mitigated. If, on the contrary, households respond on average by lowering their saving rates, this negative effect is reinforced. In both cases, the influence that capital income tax has on inequality cannot be properly isolated from that exerted by capital accumulation. In other

words, variable capturing financial development may not be effectively held constant while interpreting relationship of the main interest. This potential causality running from capital income tax to saving rate has received much attention in the debate regarding capital income taxation. As it is also well founded in the theory, it is further investigated in the Appendix. To that purpose, the model in which saving rate is regressed on capital income tax rate is constructed. Estimated coefficients suggest, however, that correlation between the two is not statistically significant and should not affect the inequality model. Model description and the results obtained are included in the Appendix.

Table 1. Definitions of variables

rel_gGDPpc	real growth rate of GDP per capita
inflation	% change in Consumer Price Index
findev	(bank deposits + market capitalization) / GDP
ir_real	real interest rate
prog	personal income tax progressivity
cinctGDP	capital income tax / GDP
socialexpGDP	social expenditure / GDP
trade_open	(imports + exports) / GDP
GDPdeflator	% change in GDP deflator
market_cap	market capitalization
FDIGDP	FDI / GDP
creditGDP	credit / GDP
Lcrisis	lagged crisis dummy
remitGDP	remittances / GDP
rmin_wagePPP	real minimum wage at PPP
LgGDP	lagged real per capita GDP growth
LEU_funds	lagged funds received from the EU
depoGDP	bank deposits / GDP
unemploy	unemployment rate

4.2. Estimation method

In the analyzed dataset, cross-section dimension is dominated by time dimension but both N and T are relatively small ($N=8$, $T=13$). This is a typical example of Time-Series Cross-Section (TSCS) design, commonly used in comparative political economy. Its unusual size and relation between dimensions cause majority of traditional panel data methods to be unsuitable. For that reason, pooled models estimated by Ordinary Least Square (OLS) procedure are sometimes chosen by political economy researchers as a lesser evil. However, this approach is related to numerous problems and obtained estimates are likely to be biased, inefficient and/or inconsistent. This is caused by the fact that TSCS designs often violate the standard OLS assumptions about the error process. Errors tend to be both contemporaneously correlated (across units within years), and serially correlated (within units across time). Additionally, they tend to be heteroscedastic—error variance is typically dependent on the countries and varies across them. Apart from complications resulting from violation of the Gauss-Markov assumptions, other problems exist. It is not likely that all countries obey exactly the same specification with common parameter values. Rather, some degree of heterogeneity across units is present. If there are country-specific characteristics correlated with both the dependent variable and explanatory variables, they will bias the estimates, if not controlled for in the model.

One approach allowing for elimination of time-invariant country-specific characteristics and the related complications involves fixed effects (FE) models. However, Beck and Katz (Beck, 2001, Beck and Katz, 2007) make a convincing argument against the use of FE models in case of TSCS datasets. They argue that fixed effects will soak up the most of explanatory power when variables change slowly, which is usually the case in models dealing with policies and their potential consequences. Estimates obtained for such variables will be therefore statistically insignificant and of limited magnitude. For that reason, fixed effects are not controlled for in many political economy researches (Beck, 2001). Moreover, cluster-robust variance estimation often paired with FE models is asymptotically consistent as the number of independent clusters increases. While it allows for intragroup correlation of errors, it should not be applied when cross-section dimension is short (Pustejovsky and Tipton, 2016). However, Garrett and Mitchell (2001) warn that omission of fixed effects

might be a mistake if inclusion of the country dummies has a considerable impact on the direction, magnitude, and statistical significance of the estimated coefficients.

Random effects (RE) are often considered a good alternative for fixed effects models in the context of TSCS data analysis. They do not control out the relevant information as FE do and still allow for some heterogeneity across countries. However, they assume that unobserved country-specific characteristics are normally distributed random variables and are not correlated with regressors. If this assumption does not hold, omitted variable bias will be present. There is also a question of the methods used in order to estimate RE models. Beck and Katz (1995, 2007) show that commonly used Parks-Kmenta extension of Feasible Generalized Least Squares (FGLS) procedure has very poor properties for short time dimensions of typical TSCS datasets. It allows for serial correlation but the assumption is that autocorrelation coefficient differs between units and is estimated separately for each of them. This, according to the authors, can do a considerable harm in TSCS designs. They also demonstrate in the Monte Carlo experiment that the alternative Maximum Likelihood Estimator (MLE) performs well in the finite samples and it is also preferred to the standard pooled OLS (Beck and Katz, 2007). However, MLE is based on the assumption of normality and lack of correlation in error component.

Beck and Katz made yet another contribution in the subject of TSCS estimation methods. They proposed the panel-corrected standard errors (PCSE) which, applied to the OLS or Prais-Winsten (PW) procedure, allow for taking into account the properties of typical TSCS error process. Consequently, cross-correlation, heteroscedasticity (and/or autocorrelation in case of PW) can be corrected for. The Prais-Winsten estimator is a special case of FGLS, but unlike Parks-Kmenta method, it assumes a common autoregressive process in error component across all units. Simulations carried out by Beck and Katz (1995) indicate that PCSEs are very accurate even in small samples ($T=10$) and that they definitely outperform their OLS counterparts when Gauss-Markov assumptions are violated. The main drawback of this method, however, is that—unlike FE—it does not address the problem of time-invariant unobserved characteristics that may be correlated with covariates.

There are two remaining issues regarding estimation method and the underlying model. First, it has been argued that instead of correcting for autocorrelation in the error terms, it is better to directly model the dynamics by including lagged dependent variable (LDV). However, OLS estimators become inconsistent in the presence of both LDV and serial correlation in the errors (Maddala, 1998). Other, more advanced panel methods, such as the first difference generalized method of moments (FD-GMM), are not applicable to the TSCS datasets, as they require large samples and the asymptotes lie in the cross-section dimension. Moreover, Achen (2001) shows, that while the incorporation of an autoregressive term often improves the fit to a great extent, the coefficients of many of the remaining covariates becomes artificially small, statistically insignificant, and can even take on the wrong sign. In contrast, lagged dependent variable acquires a large and significant coefficient. This is particularly likely to happen within the TSCS setup, where time-series are often trending and characterized by high autocorrelation.

Finally, the issue of reverse causality can be present in the models, which leads to bias in the obtained estimates. The use of instrumental variables (IV) could be considered as a potential solution. However, in the presence of weak instruments the precision of IV estimates drops dramatically compared to the OLS and there may be no improvement over the latter. Apart from that, most of justification for the use of IV is based on asymptotics and finite-sample properties of this method may be very poor (Baum, 2006). Since the model estimated in this section uses growth rate of GDP per capita as a regressor, the reverse causality may constitute a problem. Such a bilateral relationship has been demonstrated in numerous empirical analyses (e.g. Brueckner and Lederman, 2015). To address it, the common approach of replacing this covariate with its lagged values is applied in the robustness check. It is certainly not a perfect solution but can give some insight into the stability of the estimated parameters.

In order to choose the best model and estimator, eight-fold cross-validation was conducted. The procedure was as follows. First, the data were split into 8 partitions. Then, the baseline model was fitted for each partition using the remaining 7 groups and the estimated parameters were used to predict $Gini_net_{i,t}$ in the unused group. Subsequently, root-mean-

square error (RMSE) was calculated for each partition so as to evaluate the model's ability to fit out-of-sample data.

The following methods/models were subject to cross-validation:

- Prais-Winsten procedure with PCSEs (based on the visual inspection of residuals from the basic specification estimated via standard pooled OLS regression, the standard errors are corrected for autocorrelation, cross-correlation, as well as for heteroscedasticity),
- Random Effects model estimated by the small-sample Swamy-Arora estimator (RE SA),
- Random Effects model estimated by the maximum-likelihood estimator (MLE),
- Fixed Effects model (FE).

The RMSEs are reported in Table 2.

Table 2. Root-mean-square errors by estimation method

	PCSE	RE SA	MLE	FE
est1	2.824	2.917	2.783	2.906
est2	2.199	2.788	2.978	2.254
est3	2.804	2.476	2.910	3.550
est4	2.449	3.103	2.987	2.169
est5	2.657	2.718	2.674	3.138
est6	1.898	2.577	3.551	3.493
est7	1.670	2.502	2.423	3.266
est8	1.803	2.523	1.691	2.407
average	2.288	2.700	2.750	2.898

On average, PCSE exhibits the best performance and FE the poorest. Therefore, Prais-Winsten procedure with panel-corrected standard errors is used to estimate the described model.

4.3. Results

Table 3 presents the estimation results. In the baseline specification, obtained coefficients are statistically significant in case of only two variables: personal income tax progressivity

and social expenditure. The direction of the estimated impacts is in line with expectations: both increased tax progressivity and rise in public spending directed towards social purposes have, on average, an equalizing impact on income distribution. The coefficient of capital income tax is positive but statistically insignificant even at the 0.1 level. This holds in all tested specifications—even though the estimated capital income tax parameter is characterized by considerable variability (it ranges from 0.06 in the baseline specification to 0.18 in the specification 5), it is always positive and insignificant. The impact of social expenditure and personal income tax progressivity is much more stable across specifications.

Some of the variables used in the robustness check proved to have significant impact on income inequality. On average, an increase in trade openness reduces income concentration, similarly to an increase in real minimum wage. On the contrary, rising unemployment rates are associated with more inequality. The effects of minimum wage and unemployment are perfectly in line with expectations and their significance is not surprising, given that in the set of studied countries labor income is considered to be the main driver of income inequality.

Finally, it is worth noting that the choice of a variable describing financial development considerably affects an estimate obtained for that variable. The only statistically significant parameter is observed in case of the credit/GDP ratio. While the impact of bank deposits—even though insignificant—is similar in magnitude, the estimates of market capitalization and the *findev* variable are considerably smaller. Nevertheless, the estimates of other covariates do not seem to be largely affected by the choice of the financial development measure. Overall, it can be concluded that financial development potentially increases income inequality.

Table 3. Estimation results

VARIABLES	(1) Gini_net	(2) Gini_net	(3) Gini_net	(4) Gini_net
rel_gGDPpc	-0.0187 (0.0274)	0.0119 (0.0284)	-0.0231 (0.0289)	-0.00533 (0.0307)
inflation	-0.0469 (0.0349)	-0.0429 (0.0340)		-0.0422 (0.0323)
findev	0.00144 (0.00275)	0.00251 (0.00224)		
prog	-0.160*** (0.0531)	-0.189*** (0.0547)	-0.164*** (0.0554)	-0.173*** (0.0511)
cinctGDP	0.0557 (0.195)	0.0646 (0.210)	0.0730 (0.194)	0.125 (0.193)
socialexpGDP	-0.365** (0.152)	-0.327** (0.137)	-0.386** (0.155)	-0.520*** (0.150)
trade_open		-0.0222*** (0.00726)		
GDPdeflator			-0.0381 (0.0356)	
market_cap			0.00148 (0.00286)	
FDIGDP			0.00118 (0.0114)	
creditGDP				0.0211** (0.0106)
Lcrisis				0.410 (0.298)
Constant	34.59*** (2.977)	36.36*** (2.989)	34.86*** (2.949)	35.65*** (2.771)
Observations	102	102	102	102
R-squared	0.538	0.607	0.530	0.576
Number of cntry	8	8	8	8

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Continuation of Table 3.

VARIABLES	(5) Gini_net	(6) Gini_net	(7) Gini_net	(8) Gini_net
rel_gGDPpc	-0.0129 (0.0261)	-0.0223 (0.0283)	0.00327 (0.0300)	
inflation	-0.0452 (0.0340)	-0.0381 (0.0372)	-0.0511* (0.0310)	-0.0426 (0.0326)
findev	0.00172 (0.00273)			
prog	-0.157*** (0.0531)	-0.176*** (0.0540)	-0.150*** (0.0578)	-0.152*** (0.0546)
cinctGDP	0.0762 (0.196)	0.0666 (0.190)	0.177 (0.201)	0.105 (0.204)
socialexpGDP	-0.366** (0.157)	-0.489*** (0.154)	-0.408*** (0.150)	-0.356** (0.139)
ir_real	0.0323 (0.0406)			
depoGDP		0.0206 (0.0316)		0.0207 (0.0309)
unemploy		0.176*** (0.0615)		
creditGDP			0.0268** (0.0113)	
rmin_wagePPP			-0.00582*** (0.00200)	
LgGDP				-0.0324 (0.0247)
remitGDP				-0.00405 (0.189)
LEU_funds				0.0223 (0.218)
Constant	34.28*** (2.969)	33.83*** (3.138)	35.56*** (2.625)	33.34*** (2.834)
Observations	102	102	91	102
R-squared	0.558	0.610	0.642	0.552
Number of cntry	8	8	7	8

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

As mentioned in the previous section, the time-series cross-section datasets are problematic in many respects when it comes to estimation method and the underlying model. The main drawback of the chosen approach is that it does not allow for correlation between unobserved country-specific characteristics and independent variables. To check whether exclusion of fixed effects could have biased the results, the baseline specification is estimated within the FE framework. Other methods discussed previously are employed as well. Table 4 contains the results.

Table 4. Estimation results of the baseline specification by the estimation method

VARIABLES	(RE SA) Gini_net	(MLE) Gini_net	(FE) Gini_net
rel_gGDPpc	-0.00440 (0.0564)	0.0113 (0.0532)	0.0274 (0.0548)
inflation	-0.0524 (0.0355)	-0.0507 (0.0331)	-0.0488 (0.0344)
creditGDP	0.0477*** (0.0111)	0.0505*** (0.0106)	0.0533*** (0.0111)
prog	-0.231*** (0.0636)	-0.215*** (0.0620)	-0.202*** (0.0663)
cinctGDP	0.322 (0.259)	0.355 (0.263)	0.408 (0.295)
socialexpGDP	-0.437*** (0.137)	-0.335** (0.146)	-0.227 (0.152)
Constant	32.57*** (2.798)	30.52*** (3.083)	28.31*** (3.136)
Observations	102	102	102
Number of centry	8	8	8
Number of groups			
R-squared (within)	0.467		0.481
(overall)	0.469		0.240

In general, estimates of social expenditure and personal income progressivity are similar in magnitude, as compared to those obtained through PW PCSE (although slightly larger in case of progressivity). However, in the fixed effects model the former becomes insignificant. Apart from that, the impact of the credit/GDP ratio is now almost two times bigger,

independently of the method applied. Similarly, the estimated parameter of capital income tax increases considerably but it remains statistically insignificant. It is important to note that all three methods yield rather similar results. All of them also differ from the Prais-Winsten procedure with PCSEs in the way that the error process is treated. Here, autocorrelation and cross-correlation are not assumed as they either cannot be readily accounted for or the underlying dataset characteristics exclude such a possibility.

Even though the point estimates obtained in this section cannot be relied on due to difficulties and high uncertainty related to TSCS designs, the analysis carried out do provide some insight into the direction and significance of the studied relationships. It can be concluded that increased personal income tax progressivity and social spending reduce income inequality levels. Also factors affecting labor market (unemployment rate and real minimum wage) play important role in this regard. Capital income tax, in turn, does not influence income distribution in a statistically significant way. It seems to have a disequalizing effect, as the coefficients are consistently positive, although the standard errors are relatively large. In all cases, the coefficients average around positive values of moderate magnitude, yet the standard errors are spread quite widely.

5. Micro Data Analysis

Following an attempt to establish a relationship between income inequality and capital income tax, complementary micro data were used to supplement the model. This section serves as an overview of the nature and general characteristics of income inequality in the studied countries. The focus is placed on how the total income inequality is affected by the distribution of the main income sources, with a special emphasis on income from capital. The data used in the analysis come from the Luxembourg Income Study (LIS), which is a non-profit organization that provides access to the largest available cross-national database of income microdata. All of the data were collected in household surveys by the participating countries' national statistical offices or independent agencies. Even though the differences in survey design across countries exist (regarding for example questionnaires, collection and processing techniques, or variable definitions), LIS harmonizes the microdata. This enables cross-country comparisons. However, while a common foundation for variable definitions

and household characteristics has been set, complete cross-national comparability is not possible. Moreover, LIS offers limited numbers of observation periods per country within a relatively short timeframe, which precludes inferences about long-term trends and relationships in income inequality. Nevertheless, it serves as a tool for assessing validity of the estimation conducted in the previous section.

5.1. Income distribution by income source and income category

LIS provides datasets for five out of eight analyzed countries, i.e. Czech Republic (CZ), Poland (PL), Slovak Republic (SK), Slovenia (SI), and Hungary (HU). While for the first four countries subsequent waves of surveys in the analyzed period overlapped (all conducted in 2004, 2007, and 2010), the schedule for Hungary was somewhat different (2005, 2007, 2009, 2012). Additionally, in contrast to the remaining countries, Slovenia and Hungary reported all current income components net of taxes and social contributions. Since there is no record of taxes in the provided datasets and countries using gross values include only total taxes with no distinction by different sources of income, the total disposable income remains the only comparable category across all states.

Tables 5 and 6 present the share of total national income, as well as labor and capital income, held respectively by the top and the bottom decile. Labor income is defined here as monetary payments and value of non-monetary goods and services from paid employment plus profits/losses and value of goods for personal consumption from self-employment. Capital income consists of monetary payments from property and capital. Interest received from bank accounts, bonds, and the like, along with dividends, royalties, voluntary individual pensions, and rental income generated by non-financial assets fall into this category. However, capital gains (i.e. profit/losses resulting from security sells) are not reported in LIS datasets for the countries of interest and cannot be included in the analysis. Finally, total income combines the two previous income sources with monetary payments and value of non-monetary goods and services received from social or private transfers. It does not encompass, however, social transfers in kind, such as universal health insurance and education benefits.

Before calculating the relevant statistics, top and bottom coding was applied to LIS datasets. All income values less than zero or exceeding more than ten times the median were set as equal to the corresponding threshold. The motivation behind this approach was twofold. Firstly, inequality measures calculated in the next subsections are sensitive to the extreme values and some of them are not defined for negative values of income. Secondly, and most importantly, different countries may originally have different top and bottom codings and eliminating extreme observations increases comparability among them.

Next modification introduced to the original datasets involved the use of the equivalence scale. As the unit of aggregation adapted in surveys is the household, it was necessary in order to arrive at individual equivalent income. Obviously, it is not proper to directly compare income of households characterized by different size and composition. Therefore, total household income was divided by the square root of household size. This equivalence scale was discussed for example by Gottschalk and Smeeding (1997) and it constitutes a compromise between assigning all individuals their household income and expressing this income in per capita terms. Finally, to obtain the results that are representative for national populations (not just samples drawn for surveys) and to ensure cross-sectional comparability, all values were adjusted using normalized weights.

Table 5. Share of national income held by the top decile, by income source

	2004			2007			2010					
	Total	Capital	Labor	Total	Capital	Labor	Total	Capital	Labor			
CZ	24.1	56.9	30.4	23	61.4	28.8	23	49.1	29.3			
PL	25	53.5	33.5	25	67.9	33.1	24.8	56.2	32.6			
SK	23.6	33.3	29.2	22	30.2	26.6	22.1	29.5	27.4			
SI*	19.3	38.8	23.6	18.9	32.6	24.3	19.8	42	24.4			
	2005			2007			2009			2012		
	T	C	L	T	C	L	T	C	L	T	C	L
HU*	24.2	76	33.8	23.1	36.6	34	22.6	68.9	35.7	22.2	53.4	33.9

Source: Author's calculations based on LIS database

Note: *net values as opposed to income before taxes and social contributions

From Table 5 it follows that, among the top 10% in almost all countries, capital income is far more concentrated than the labor income. Only in Slovak Republic capital income concentration just slightly exceeds that of labor income and it exhibits the lowest levels

compared to other countries (even to after-tax shares reported by Slovenia and Hungary). Moreover, a gradual decrease can be noted, which cannot be stated about any other country. Similarly, there is no clear pattern to be observed over time in case of total income concentration, except for Hungary, where it is decreasing. In general, the shares of total income held by the top decile change rather slowly from wave to wave, while capital income concentration is characterized by the highest variability in all countries, and especially in Hungary.

Table 6 complements the picture of income concentration by providing the same information as in Table 5, but this time for the bottom decile.

Table 6. Share of national income held by the bottom decile, by income source

	2004			2007			2010					
	Total	Capital	Labor	Total	Capital	Labor	Total	Capital	Labor			
CZ	3.6	0.6	0.7	3.8	0.6	0.6	3.7	1.3	0.9			
PL	2.8	2.3	2.0	3.0	1.6	1.8	3.1	0.7	1.7			
SK	3.2	2.2	0.9	3.7	2.05	0.9	3.5	3.8	1.2			
SI*	4	3.1	1.6	3.9	0.9	1.4	3.2	2	1.3			
	2005			2007			2009			2012		
	T	C	L	T	C	L	T	C	L	T	C	L
HU*	3.5	1.6	1.5	3.4	9.0	1.3	3.2	0	1.1	2.9	0.5	0.9

Source: Author's calculations based on LIS database

Note: *net values as opposed to income before taxes and social contributions

It is clear that, in general, the poorest 10% are no more destitute of capital income than they are of labor income. In fact, in Slovak Republic and in years 2004 and 2010 in Slovenia they control bigger share of capital than of labor income. The same is true for Poland in 2004, but in the following waves the capital income share held by the bottom decile decreases and in 2010 it is more than two times smaller than that of labor income. In Czech Republic, both shares are similar, except for 2010 when capital income exceeds labor income share. In Hungary, reported values again change a lot and capital income dominates labor income share only in the first two waves, but afterwards the relationship reverses. Overall, it can be concluded that capital income does not concentrate in the top decile at the expense of the bottom one. As far as other tendencies are concerned, both in Slovenia and Hungary, from wave to wave, the poorest 10% control less and less of total and labor income. The opposite

is true for total income share held by this group in Poland, even though the shares of both capital and labor income drop over time.

Finally, to get an idea of the relative importance of capital and labor income for different income deciles it is worth referring to Table 7. It presents shares of capital and labor income in total personal income in selected income categories.

Table 7. Share of capital and labor income in total personal income, by income category

		2004		2007		2010			
		Capital	Labor	Capital	Labor	Capital	Labor		
CZ	Bottom 10	0.2	13.9	0.2	11.3	0.3	17.5		
	Bottom 50	0.4	34.2	0.3	35.9	0.4	34.3		
	Bottom 80	0.4	52.5	0.4	53.8	0.5	51.7		
	Top 10	2.2	93	2	92.9	1.7	91		
PL	Bottom 10	0.3	40.7	0.2	35.9	0.1	33.8		
	Bottom 50	0.1	43.7	0.1	43.6	0.1	42.6		
	Bottom 80	0.2	46.6	0.1	48.9	0.2	49.6		
	Top 10	0.6	74.4	0.8	80.8	0.7	83		
SK	Bottom 10	0.2	20.5	0.3	19.3	0.3	25.5		
	Bottom 50	0.2	38.7	0.3	44.2	0.2	40.2		
	Bottom 80	0.2	55.6	0.3	59.3	0.3	55.3		
	Top 10	0.3	92.6	0.4	92.8	0.4	91.3		
SI*	Bottom 10	0.39	25.7	0.1	23.2	0.47	26.5		
	Bottom 50	0.21	48.7	0.25	45.2	0.32	45.2		
	Bottom 80	0.29	56.1	0.32	54.2	0.33	54.8		
	Top 10	0.86	81	0.8	85	1.31	83.3		
		2005		2007		2009		2012	
		C	L	C	L	C	L	C	L
HU*	Bottom 10	1.7	22	0.9	16	0	15	0.1	15.4
	Bottom 50	0.7	28.2	0.4	20.9	0.1	20.4	0.1	20.9
	Bottom 80	0.7	37.4	0.3	29.6	0.1	26.5	0.2	29.4
	Top 10	6.9	73.6	0.5	63.2	0.8	60.7	1	62

Source: Author's calculations based on LIS database

Note: *net values as opposed to income before taxes and social contributions

What can be noticed first is that in all countries and all income categories, income received from labor is much larger than that from capital. In general, when compared across income categories, capital income constitutes the greatest share of total income in the top deciles (with Hungary in 2007 being the only exception). The same can be stated about labor income, in case of which the relative importance increases along with income category. However, capital income does not exhibit the latter pattern. In some years in Poland,

Slovenia, and Hungary capital income shares in total income are higher in the bottom 10% than in the bottom 50% and 80% (or even the top 10% in 2007 in Hungary). Even though the last two countries report shares of after-tax income, comparability is preserved to some degree, given that capital income tax rates are generally flat. As far as five and eight bottom deciles are concerned, the differences among them with regard to capital income shares are relatively small, while the distance between those two categories and the top 10% is usually much bigger (except for Slovak Republic characterized by the lowest capital income shares in the richest 10%, as compared to other countries). In general, capital income share in the top decile is the highest in Czech Republic but it decreases over waves, while the opposite tendency is seen in the bottom 10%.

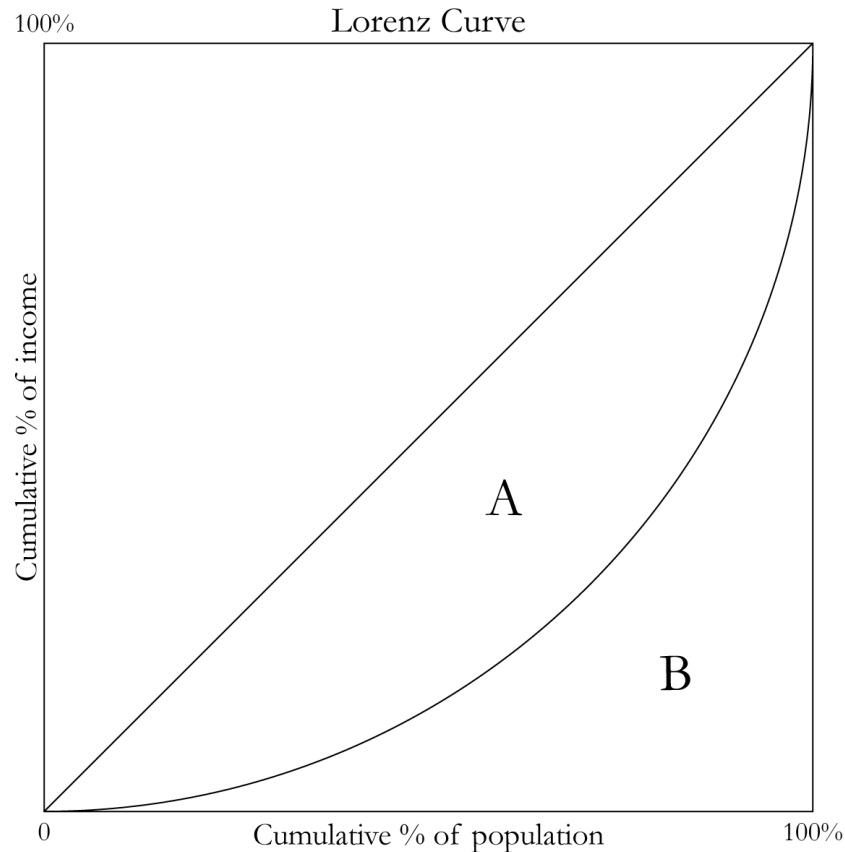
As a concluding remark it should be stressed again that LIS datasets do not capture any long-term trends due to limited number of observation periods. Moreover, year 2010 was marked by the financial crisis that started in the fall of 2008 in Central and Eastern Europe, which further diminishes the probability of distinguishing any clear tendencies. Also, distributional characteristics previously described could potentially be altered by inclusion of capital gains income into the analysis. It is possible that profits from security sells constitute a non-negligible share in capital income. If they are more common in higher income categories, the overall picture is not accurate. However, even though some caution is required, two main conclusions can be drawn. First, relatively high share of capital income is controlled by the top decile and it exceeds the corresponding share for labor income. Second, capital income can be relatively more important for the bottom 10% than for the lower- and higher-middle income categories, although it does not hold universally across all years and countries. Nevertheless, it is not the case that higher capital income concentration in the top decile (as compared to labor income) occurs at the expense of the poorest 10%.

5.2. The Gini coefficient decomposition by income source

Next step naturally following from the basic analysis carried out in the previous section involves an attempt at estimating the contribution of different income sources to total income inequality. Numerous inequality decomposition methods that serve the purpose exist and in order to employ them it is necessary to calculate first a single inequality measure

that takes into account total income distribution. The Gini coefficient is the most commonly used example of such a measure.

Figure 2. Lorenz Curve



The Gini coefficient is based on the Lorenz curve, a cumulative frequency curve that compares the distribution of a given variable with the uniform distribution. Figure 2 shows how it can be presented graphically. In order to construct the Lorenz curve, the cumulative percentage of individuals (sorted from poor to rich) should be graphed on the horizontal axis against the share of resources they collectively possess. The diagonal line represents perfect equality. The Gini coefficient is then defined as the ratio of the area between this 45-degree line and the Lorenz curve over the total area under the line of equality: $A / (A + B)$, where A and B are marked on the graph. If A equals 0, so does the Gini coefficient, which means absolute equality. When, in turn, B equals 0, the Gini coefficient amounts to 1, reflecting the situation where the whole income is held by one individual.

Alternatively, the Gini coefficient can be considered as half of the relative mean absolute difference. In other words, it is half of the average absolute difference between all possible pairs of incomes in the population expressed as a proportion of total income (Justino, Litchfield and Whitehead, 2003):

$$G = \frac{\sum_{i=1}^n \sum_{j=1}^n |y_i - y_j|}{2n\bar{y}(n-1)}, \quad (2)$$

where y_i is the income of person i , $\bar{y}$ is the arithmetic mean of income, and n stands for the total population.

As mentioned before, numerous methods of decomposing the Gini coefficient have been developed. All of them aim at estimating the relative influence of income components on total inequality, however, they do it applying different decomposition rules and most often yield different results. Jurkatis and Strehl (2013) describe related misinterpretation issues. They argue that marginal effects of income sources on total inequality should be seen as the only meaningful way to assess the relationships in question.

Following the recommendation of Jurkatis and Strehl, decomposition framework described by Stark, Taylor, and Yitzhaki (1986) is used, which allows for easy computation of marginal effects. According to the authors, the influence of any income component on total income inequality depends on three features:

- the importance of the income source with respect to total income
- how equally the income source is distributed as measured by the Gini coefficient
- how the source is correlated with the distribution of total income

Furthermore, the Gini coefficient, G , is fully decomposable and can be represented as follows (Lerman and Yitzhaki, 1985):

$$G = \sum_{k=1}^K S_k G_k R_k, \quad (3)$$

where S_k is the share of source k in total income, G_k is the Gini index of a income source k , and R_k is the Gini correlation of income from source k with the distribution of total income.

Finally, the marginal effect, i.e. the percentage change in total inequality resulting from a 1% change in income from source k , equals the initial relative contribution of income source k to the overall Gini coefficient minus the share of the income source in total income:

$$\frac{S_k G_k R_k}{G} - S_k \quad (4)$$

Table 8 contains the results of inequality decomposition conducted for Czech Republic, Poland, Slovak Republic, Slovenia, and Hungary. In all countries total inequality was calculated with regard to disposable income. However, Czech Republic, Poland, and Slovak Republic reported only gross values for respective income sources, so in their case taxes were included as additional income component generating negative income. Remaining income sources include labor, capital, pension, transfer, and other sources not captured by those main categories. Pension income includes pensions and monetary transfers from public programs made to elderly and handicapped individuals, as well as survivors (widows, orphans). Transfer income covers social security transfers other than pensions and private transfers. Taxes encompass income taxes and social security contributions. Capital and labor income is defined as previously.

Table 8. The Gini coefficient decomposition by income source

Country	Income source	2004		2007		2010	
		Share in total income	%	Share in total income	%	Share in total income	%
			Change in Gini from 1% increase in the source		Change in Gini from 1% increase in the source		Change in Gini from 1% increase in the source
CZ	Labor	80.63	0.7371	78.94	0.8115	75.66	0.7102
	Capital	1.10	0.0189	0.93	0.0175	0.86	0.0125
	Pension	29.73	-0.4631	30.63	-0.5462	30.98	-0.4981
	Transfer	5.00	-0.0803	4.94	-0.0438	4.18	-0.0333
	Tax	-18.80	-0.2139	-17.55	-0.2288	-14.17	-0.1741
	Other	2.34	0.0011	2.11	-0.0101	2.48	-0.0173
SK	Labor	84.07	0.5615	84.15	0.6142	77.55	0.4941
	Capital	0.28	-0.0001	0.33	0.0021	0.34	0.0018
	Pension	27.06	-0.3508	26.86	-0.423	28.43	-0.3918
	Transfer	5.77	-0.0767	3.52	-0.0429	3.61	-0.0453
	Tax	-17.67	-0.1442	-15.34	-0.1452	-10.58	-0.0563
	Other	0.49	0.0103	0.48	-0.0051	0.64	-0.0025
PL	Labor	62.51	0.2314	65.1	0.2574	66.11	0.277
	Capital	0.35	0.0037	0.43	0.0059	0.39	0.0044
	Pension	36.55	-0.161	32.45	-0.2201	30.89	-0.241
	Transfer	3.82	-0.0637	3.09	-0.0501	2.38	-0.0433
	Tax	-7.79	-0.0036	-5.72	0.007	-3.88	0.0087
	Other	4.56	-0.0069	4.64	-0.0001	4.11	-0.0058
SI*	Labor	66.18	0.3052	66.09	0.3758	66.92	0.3123
	Capital	0.43	0.0044	0.5	0.0052	0.64	0.0075
	Pension	28.2	-0.2302	26.74	-0.2922	25.89	-0.2444
	Transfer	4.82	-0.0741	6.18	-0.0845	6	-0.0717
	Other	0.38	-0.0053	0.49	-0.0043	0.56	-0.0038
HU*		2005	2007	2009	2012		
	Labor	50.55	0.3369	38.82	0.3244	41.74	0.3495
	Capital	2.5	0.044	0.33	0.0048	0.28	-0.0002
	Pension	37.84	-0.3291	46.8	-0.3167	41.47	-0.3747
	Transfer	8.33	-0.0667	4.55	-0.0687	5.5	-0.0487
	Other	0.77	0.0148	9.5	0.0563	11.01	0.0741
						15.19	0.0533

Source: Author's calculations based on LIS database

Note: *calculations based on net values

All marginal effects are statistically significant at the 0.01 level

Even though all marginal effects presented in Table 8 are statistically significant, influence of 1% change in capital income on the overall inequality is in most cases very weak, usually not much different from zero (ranging from -0.0002 to 0.044 across waves and countries). This is not particularly surprising, given relatively small shares of capital income in total income and distributional characteristics described in the previous section. In general, capital income has a disequalizing impact on total income, with the greatest magnitude observed in Czech Republic (but decreasing over waves) and the smallest in Slovak Republic. In fact, in 2004 in Slovakia the impact of capital income on inequality was estimated to be negative but very close to zero (similarly to Hungary in 2009). It is also worth noting that labor has by far the most disequalizing influence on total income, especially in Slovak Republic. Pensions, on the contrary, contribute the most to counteracting income inequality. Overall, these findings support results obtained from the inequality model estimated in the previous section, where measures affecting labor income distribution and social expenditure appeared to have the largest equalizing potential. Capital income tax had no significant influence on inequality, which is also in line with limited contribution of income from capital to the overall inequality.

5.3. Alternative measures of inequality

Although the Gini coefficient is the most widely used measure of inequality it has not been free from critique. First of all, two identical Gini coefficients can represent Lorenz curves of different shapes that intersect each other. Similarly, improvements in inequality as measured by the Gini can come from a more even distribution between top and bottom deciles, as well as between middle and bottom deciles (Deininger and Squire, 1996). In other words, the Gini index does not provide a unique mapping between changes in measured inequality and underlying income distribution. Moreover, as any other measure, it cannot capture all characteristics of the whole income distribution and the Lorenz curve does not fit its entire range in a satisfying degree. While the Gini coefficient attaches greater weight to individuals in the middle of the distribution, other measures place greater emphasis on its different parts. It is therefore worth checking whether application of alternative measures can lead to different assessments regarding the degree of inequality.

The following commonly used inequality measures have been calculated and reported in Tables 9 and 10:

1. Generalized Entropy measures, including the squared coefficient of variation, the Theil index, and the mean logarithmic deviation
2. Atkinson's inequality measures
3. Decile dispersion ratios

The General Entropy class of measures is defined by the following general formula:

$$GE(\alpha) = \frac{1}{\alpha(\alpha - 1)} \left[\frac{1}{N} \sum_{i=1}^N \left(\frac{y_i}{\bar{y}} \right)^\alpha - 1 \right], \quad (5)$$

where y_i is income of person i , $\bar{y}$ is the arithmetic mean of income, and N stands for the total population. The values of GE vary between zero and infinity, with higher values corresponding to higher levels of inequality. The parameter α represents the sensitivity to inequality at different parts of the distribution. Lower values of α mean that greater weight is placed on inequality in the lower tail (e.g. among the poor). $GE(0)$, also called the mean log deviation measure, is given by:

$$GE(0) = \frac{1}{N} \sum_{i=1}^N \ln \left(\frac{\bar{y}}{y_i} \right) \quad (6)$$

$GE(1)$, referred to as the Theil index, assigns larger weights to the middle of income distribution (similarly to the Gini coefficient) and is expressed as:

$$GE(1) = \frac{1}{N} \sum_{i=1}^N \frac{y_i}{\bar{y}} \ln \left(\frac{y_i}{\bar{y}} \right) \quad (7)$$

When $\alpha = 2$, the squared coefficient of variation is obtained and the emphasis shifts to the upper tail.

Atkinson has proposed another class of inequality measures with the general formula taking the following shape:

$$A_{\varepsilon} = 1 - \left[\frac{1}{N} \sum_{i=1}^N \left(\frac{y_i}{\bar{y}} \right)^{1-\varepsilon} \right]^{1/(1-\varepsilon)}, \quad (8)$$

where ε is a weighting parameter measuring aversion to inequality. Higher values of ε give relatively more importance to the distribution of low incomes. The Atkinson index takes on values between 0 and 1, with 0 and 1 corresponding respectively to complete equality and total inequality. It can be interpreted as the percentage of current income needed to achieve the current level of welfare if all incomes were equally distributed.

Table 9. Generalized Entropy and Atkinson's measures of disposable income inequality

		GE(0)	GE(1)	GE(2)	Gini	A(0.5)	A(1)
CZ	2004	0.125	0.134	0.182	0.272	0.062	0.117
	2007	0.116	0.120	0.153	0.261	0.057	0.109
	2010	0.118	0.123	0.155	0.265	0.058	0.111
PL	2004	0.165	0.170	0.226	0.308	0.079	0.152
	2007	0.164	0.172	0.234	0.307	0.079	0.151
	2010	0.165	0.173	0.236	0.310	0.080	0.152
SK	2004	0.132	0.139	0.189	0.277	0.065	0.123
	2007	0.120	0.122	0.157	0.263	0.058	0.113
	2010	0.133	0.131	0.175	0.270	0.063	0.125
SI	2004	0.118	0.108	0.117	0.255	0.054	0.111
	2007	0.113	0.105	0.112	0.252	0.053	0.107
	2010	0.158	0.132	0.140	0.279	0.068	0.146
HU	2005	0.151	0.162	0.225	0.295	0.075	0.140
	2007	0.143	0.148	0.202	0.282	0.069	0.133
	2009	0.131	0.132	0.161	0.273	0.063	0.123
	2012	0.153	0.146	0.180	0.289	0.071	0.142

Source: Author's calculations based on LIS database

Finally, decile dispersion ratios are reported. These are simply the ratios of income received by different deciles and are readily interpretable as they express the income of the top x^{th} % as a multiple of that in the bottom y^{th} %. However, decile dispersion ratios completely ignore information about income distribution, even in the deciles they take into account.

Table 10. Decile dispersion ratios for disposable income

		p90/p10	p90/p50	p10/p50
CZ	2004	3.175	1.876	0.591
	2007	3.058	1.815	0.594
	2010	3.116	1.824	0.585
PL	2004	3.836	1.955	0.510
	2007	3.708	1.962	0.529
	2010	3.853	1.998	0.519
SK	2004	3.247	1.826	0.562
	2007	3.103	1.791	0.577
	2010	3.282	1.840	0.561
SI	2004	3.354	1.710	0.510
	2007	3.424	1.700	0.496
	2010	3.698	1.754	0.474
HU	2005	3.333	1.899	0.570
	2007	3.244	1.810	0.558
	2009	3.279	1.826	0.557
	2012	3.677	1.897	0.516

Source: Author's calculations based on LIS database

In general, different inequality measures presented in Table 9 exhibit similar behavior and their values change in the same direction from wave to wave in most countries. Poland constitutes the only exception in this regard but it is also characterized by very small changes in inequality across time according to all indices. Hence, no considerable discrepancies are observed. Overall, the relative magnitude of changes in inequality differs between measures but those differences are moderate at most. Thus, many measures focusing on different sections of distribution seem to be almost parallel.

Furthermore, the following ranking of countries by decreasing income inequality can be constructed with the help of the Gini coefficient, Generalized Entropy, and Atkinson's measures:

Table 11. Income inequality ranking based on selected inequality measures

2004	2007	2010	
All Measures	All Measures	All Measures except for GE(2)	GE(2)
Poland	Poland	Poland	Poland
Slovak Republic	Hungary	Slovenia	Slovak Republic
Czech Republic	Slovak Republic	Slovak Republic	Czech Republic
Slovenia	Czech Republic	Czech Republic	Slovenia
	Slovenia		

Source: Author's compilation based on LIS database

In years 2004 and 2007, the choice of inequality measure was irrelevant for the countries' ordering in the inequality ranking – all formulas yielded exactly the same results. However, in 2010 the squared coefficient of variation puts Slovenia on the last place, while according to all the remaining measures it is the second most unequal country. The same conclusions as in case of *GE(2)* can be drawn when the ratio of the top decile to the median is assumed as the ordering criterion. This suggests that in case of Slovenia there was less inequality among high and middle-high income earners than in other income categories.

It is also worth noting that decile dispersion ratios in general do not exhibit the same desirable properties as other inequality measures. Changes in their values often do not follow the directions suggested by the remaining indices and they tend to produce different inequality rankings. However, as mentioned before, decile ratios are much simpler constructs, which ignore income distribution. Overall, Table 9 suggests that all income categories share similar inequality dynamics. Even though a single measure like the Gini coefficient is never perfect, it provides relevant information on the entire range of income distribution, at least in the set of studied countries. Nevertheless, caution is required in any analysis involving an inequality measure and, ideally, before formulating conclusions, different indices should be taken into account.

6. Discussion and Policy Implications

Based on the conducted empirical analysis, it can be concluded that the impact of capital income tax on income inequality is not statistically different from zero. LIS microdata provide additional support for this finding. Even though the levels of capital income concentration in the top decile are relatively high, the percentage share of this particular income source in total national income rarely exceeds 1%. Similarly, even in the top deciles, income from capital constitutes usually less than 2% of total income received. However, what might still be surprising, is that the coefficient of capital income tax estimated in the inequality regression is positive in all specifications. That would suggest that – if anything – an increase in capital income tax rate could potentially lead to higher inequality levels.

The fact that income from capital can account for larger share of total income in the lowest deciles than in the bottom 50% or even 80% could be perhaps related to that issue. Given that income from capital is taxed uniformly in the analyzed countries, the poorest are relatively more affected than the middle-income categories. However, this observation applies only to some countries and some years. The Gini coefficient decomposition indicates that capital income has a rather disequalizing effect on income distribution (although very small). Hungary in 2009 and Slovakia in 2004 are the only exceptions in this regard but estimated negative marginal effect is almost no different from zero. Moreover, in case of Hungary, it corresponds to net values.

In this context, it is also worth looking one more time into potential adjustments in the saving rate. Regressions estimated in the Appendix point toward lack of influence of changes in capital income tax rates on average propensity to save. However, it may well be the case that both top and bottom income categories adjust their savings, but they do it in the opposing directions. If individuals target some specific wealth levels, an increase in capital income tax will lead to a higher saving rate. However, only middle and top income categories might be able to decrease their consumption so as to save more. The bottom deciles, in turn, are likely to rely on the very basic consumption that cannot be scaled back. Consequently, their capital income can decrease resulting in lowered total income. As long as a corresponding decrease in the higher income categories does not occur or remains relatively

smaller (due to an increased saving rate), the overall income inequality rises. However, this potential saving adjustment mechanism has limited importance if the share of capital income in total income is small. It is thus not likely to play a leading role in the analyzed countries, where the level of capital accumulation is still relatively low.

Another issue that deserves more attention concerns the definition of the capital income tax. As mentioned earlier, it encompasses tax levied on corporate income. The underlying assumption is that the burden of this tax is borne by owners of capital (see Gravelle and Hungerford, 2011). If, however, it falls on labor instead, in the form of reduced wages, the implications for income inequality may be different. In the latter case, an increase in capital income tax rate would lead to decrease in wages and, if unskilled, low-paid workers were affected the most, income inequality levels would rise in response.

Finally, an increase in capital income tax rate can entail tax avoidance and tax evasion. It is most likely that only individuals with relatively high capital income would become involved in this kind of actions, as they are typically associated with additional costs and risks. Such methods can thus be considered profitable only above a certain threshold. If, due to such practices, mostly lower and middle income categories are burdened with capital income tax, income inequality should be expected to rise. However, tax evasion is not captured in the estimated model. The Gini index is calculated based primarily on household surveys and illegal or obfuscated income is unlikely to be reported by respondents. Similarly, a proxy for financial capital does not include 'hidden' income sources. Nevertheless, the possibility of tax evasion and its implications for inequality should be taken into consideration before an increase in any tax rate, especially if it is already relatively high.

From the analysis carried out it follows that a policy aimed at decreasing income inequality will not be successful if it is based solely on a rise in the capital income tax rate. If, however, additional funds flowing to the budget were spent on social purposes, the effectiveness of such a policy would be much higher, as social expenditures were found to have relatively large equalizing effect on the disposable income. Labor, on the other hand, seems to remain the prime source of inequality. Consequently, progressivity of tax levied on income from labor plays an important role in decreasing income concentration. Similarly, labor market

policies—such as changes in minimum wage—have some potential in this regard. However, it should be borne in mind that if set too high, a minimum wage can increase unemployment, dampening the desired effect. Finally, capital income tax, if introduced, should rather be progressive than proportional, given distributional characteristics of capital income. Especially if a more economically equal society is a priority of the implemented policies.

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Appendix

Table A1. Pairwise correlations of the key regressors

	rel_gG~c	inflation	findev	prog	cinctGDP	social~P	ir_real
rel_gGDPpc	1						
O	0.22	1					
findev	0.02	-0.25	1				
prog	0.12	0.14	0.09	1			
cinctGDP	0.26	-0.07	0.23	-0.08	1		
social~P	-0.42	-0.53	0.24	0.18	0.15	1	
ir_real	-0.22	0.07	-0.10	0.03	-0.21	0.01	1
unemploy	0.06	-0.15	0.21	0.13	0.26	0.17	0.26
rmin_wagePPP	-0.29	-0.32	0.13	0.46	-0.14	0.68	-0.18
remitGDP	0.13	-0.18	-0.02	0.04	-0.16	-0.20	0.00
EU_fundsGDP	-0.23	-0.17	-0.10	-0.57	-0.05	0.02	-0.12
trade_open	-0.12	-0.21	0.29	-0.12	-0.04	0.44	-0.36
FDIGDP	0.20	0.10	0.03	-0.04	0.05	-0.15	-0.18
	unemploy	rmi~ePPP	remitGDP	EU_fun~P	trade_~n	FDIGDP	
unemploy	1						
rmin_wagePPP	-0.28	1					
remitGDP	0.32	-0.30	1				
EU_fundsGDP	-0.07	-0.03	0.19	1			
trade_open	-0.14	0.32	-0.08	0.39	1		
FDIGDP	-0.08	-0.22	0.18	-0.07	0.11	1	

Table A2. Summary statistics of the key variables

Variable	Obs	Mean	Std. Dev.	Min	Max
Gini_net	110	27.95295	3.370812	21.22887	36.08631
cinctGDP	102	4.328431	1.212834	2.4	7.2
rel_gGDPpc	112	3.224567	3.652864	-8.626932	10.8021
inflation	112	5.218531	5.83093	0.1077088	45.66659
findev	108	75.38588	41.67438	18.24371	333.3378
creditGDP	112	53.84943	21.2425	1.67747	95.98027
prog	105	6.172948	3.65329	0	11.778
socialexpGDP	111	15.65495	2.704029	8.7	19.4
trade_open	112	109.1143	32.33118	58.07425	183.4276
FDIGDP	112	5.546494	7.722123	-16.09109	50.78472
remitGDP	112	1.732961	1.505065	0.0614079	8.166161
EU_fundsGDP	112	1.06218	1.005325	0.0325839	4.926863
unemploy	112	10.34196	4.317065	4.4	20.5
rmin_wagePPP	98	422.8847	172.3698	167.9102	880.279

Model of saving rate

In order to analyze the impact of capital income tax rate on saving rate the following equation is estimated:

$$saving_rate_{i,t} = \beta_0 + \delta impl_cinctr_{i,t} + \beta_1 Z_{i,t} + \varepsilon_{i,t} , \quad (9)$$

where $saving_rate_t$ is the aggregate household saving rate in year t and country i , $impl_cinctr_{i,t}$ is the implicit capital income tax rate, $Z_{i,t}$ is a vector of control variables, and $\varepsilon_{i,t}$ stands for the error term.

Saving rate is defined as gross household savings (adjusted for the change in net equity of households in pension funds reserves) divided by gross disposable income (including transfers in kind). To account for capital income tax, implicit tax rates are incorporated to the model. They are computed as the ratio of total tax revenue from capital income to a proxy of the potential tax base (the base is defined using the production and income accounts of the national accounts). This variable was chosen so as to avoid simultaneity, which would be present if the capital income tax to GDP ratio was used instead (as it was in the inequality model). In the latter case increase in saving rate would lead to enlargement of the tax base relative to GDP and, consequently, to rise in the capital income tax/GDP ratio. However, the change comes at the cost of reduced sample size. Calculation of the denominator of the alternative measure is possible only for five countries: Czech Republic, Hungary, Poland, Slovak Republic and Slovenia. Given that the sample size is already small, revenue from capital income tax relative to GDP is preferred in the inequality model.

The vector Z_t contains two control variables typically included in the saving rate models: real interest rate (ir_real) and the real growth rate of per capita disposable income (g_real_income). The impact of real interest rates on saving is ambiguous. As in case of capital income tax rates, the same two offsetting effects can appear: substitution effect in consumption smoothing household (rise in real interest rate leads to increased saving) and income effect when particular wealth levels are targeted. As far as the real growth rate of income is

concerned, the direction of the influence exerted on saving rate is also unclear. On one hand, with positive growth rate, younger generations may expect rises in their future income and decrease saving rate so as to smooth consumption over time. On the other hand, the income effect, aimed at ensuring a similar level of income after retirement, will have the opposite direction.

In the robustness check, the following variables are additionally included: income volatility (*vol_income*), old-age dependency ratio (*olddep_ratio*) and life expectancy at birth (*Elife_0*). The first of them is aimed at capturing uncertainty and it is expressed as the standard deviation of the real disposable income growth rate. In general, it would be expected that higher volatility leads to an increase in saving rate as individuals may want to hedge themselves against uncertain future and prepare for bad times. Old-age dependency ratio (the number of people older than 64 divided by the size of the working population) and life expectancy at birth are incorporated in the model to account for demographic changes. Rising life expectancy means that individuals may face a longer period of economic activity and they may consequently increase their saving rates with the aim of consumption smoothing. Finally, according to the life cycle hypothesis, people tend to save little when they are young, much when they enter working age and they tend to dissave when retired. With rising proportion of the last category, the aggregate saving rate is expected to decrease. However, as populations age rapidly, the pension systems come under a lot of pressure. Consequently, individuals might want to rely to the lesser extent on pensions and try to ensure themselves more independency by increasing saving rates while being economically active.

The data on the saving rate, disposable income and implicit capital income tax rates come from Eurostat. The values for the real interest rates were obtained from the World Bank, European Central Bank, the National Bank of Slovakia and the National Bank of Poland. The World Bank also served as a source for demographic variables.

Table A3 presents the results. To obtain the estimates, Prais-Winsten procedure with panel-corrected standard errors was applied. A short description of this method is included in subsection 4.2. – *Estimation Method*. It should be stressed that interpretation of the estimated coefficients requires caution. All the potential problems mentioned in the *Estimation Method*

subsection are applicable to those regressions, and even more so, given reduced cross-section dimension. Nevertheless, the main conclusion is that the impact of capital income tax rate on saving rate is not statistically significant. In all specifications, real interest rate is the only variable with a statistically significant coefficient and it affects the saving rate positively, which suggests that the income effect is dominant in this case.

Table A3. Estimation results

VARIABLES	(1) saving_rate	(2) saving_rate	(3) saving_rate	(4) saving_rate
g_real_income	-0.0206 (0.0341)	-0.0217 (0.0297)	-0.0208 (0.0300)	-0.0175 (0.0321)
impl_cinctr	0.0654 (0.145)	0.0968 (0.136)	0.0898 (0.135)	0.172 (0.146)
ir_real	0.344*** (0.116)	0.244** (0.124)	0.252** (0.124)	0.268** (0.124)
income_vol		0.0990 (0.0676)	0.105 (0.0681)	0.101 (0.0713)
Elife_0			0.157 (0.288)	
olddep_ratio				0.283 (0.205)
Constant	2.302 (2.484)	1.848 (2.366)	-9.937 (22.04)	-5.232 (5.384)
Observations	64	63	63	63
R-squared	0.320	0.293	0.298	0.310
Number of centry	5	5	5	5

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1