Title: Income Redistribution Through Tax and Social Benefits: The Case of Slovenia and Croatia

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The final version of this preprint (working paper) was published in an article entitled *Income Redistribution Through Taxes and Social Benefits: The Case of Slovenia and Croatia* in the journal *Panoeconomicus*.

DOI: http://dx.doi.org/10.2298/PAN1305667C

Suggested citation:

Čok Mitja, Urban Ivica, Verbič Miroslav: Income Redistribution Through Taxes and Social Benefits: The Case of Slovenia and Croatia. Panoeconomicus, 60(2013), 5, pp. 667-686.

Inštitut za ekonomska raziskovanja
Institute for Economic Research

INCOME REDISTRIBUTION THROUGH TAX AND SOCIAL BENEFITS: THE CASE OF SLOVENIA AND CROATIA

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WORKING PAPER No. 61, 2012

February 2012

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Printed by Institute for Economic Research – IER

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Published by Institute for Economic Research in February, 2012
Number of copies – 50 pieces

WORKING PAPER No. 61, 2012

Editor of the WP series: Boris Majcen

CIP – Kataložni zapis o publikaciji
Narodna in univerzitetna knjižnica, Ljubljana

330.526(497.4:497.5)

ČOK, Mitja
Income redistribution through tax and social benefits : the case of Slovenia and Croatia / Mitja Čok, Ivica Urban, Miroslav Verbič. – Ljubljana : Inštitut za ekonomska raziskovanja = Institute for Economic Research, 2012. – (Working paper / Inštitut za ekonomska raziskovanja, ISSN 1581-8063 ; no. 61, 2012)

ISBN 978-961-6543-95-8
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Abstract

The article analyses the redistributive effect attained by personal income tax, social security contributions and social benefits in Slovenia and Croatia. The redistributive effect is decomposed first to reveal progressivity and horizontal inequity effects, and further to show contributions of different tax and benefit instruments. Even though both countries started from the same socioeconomic background two decades ago, the current results reveal divergence that is a consequence of diverse development during this period. The results indicate that Croatia experienced significantly higher pre-fiscal income inequality and lower redistributive effect than Slovenia. Horizontal inequity effects, though, were higher in Slovenia than in Croatia. In both countries, the means-tested social benefits exerted an over-proportionate influence on vertical effects, suggesting a strong impact of the welfare state on income position of their residents, but also induced a large amount of horizontal inequity. In Slovenia, the non-means-tested benefits slightly increased income inequality.

Key words: redistributive effect, horizontal inequity, taxes and benefits, decomposition, Slovenia, Croatia.

JEL classification: D31, D33, H23, H24.

1 Introduction

Social security programs provide income assistance in the form of social benefits to individuals and their families in the case of unemployment, work injury, maternity, sickness, old age, or permanent earning inability. They are financed by social security contributions, as well as by other taxes. In this article, we focus our research on tax and benefit systems consisting of social benefits, social security contributions and personal income tax (PIT).

Given their size in modern states, tax and benefit systems have a significant influence on income distribution. Generally, tax and benefit systems reduce income differences between high-income and low-income households. Income inequality reduction caused by tax and benefit systems is called the redistributive effect, and it is equal to the difference between pre-tax-and-benefit (or pre-fiscal) income inequality and post-tax-and-benefit (or post-fiscal) income inequality.

A more detailed analysis of the redistributive process reveals its complexity. Usually, one distinguishes between vertical equity and horizontal inequity, perceiving them as two opposite "forces". Vertical equity is achieved through inequality reduction between richer and poorer units (households, individuals). Horizontal inequity, on the other hand, emerges due to inequality augmentation between equally well-off units. These notions are built into the framework of decomposing the redistributive effect into two main parts: the vertical effect, representing fulfilment of the vertical equity principle, and the horizontal effect, measuring the horizontal inequity.

Due to different designs, various tax and benefit instruments have different consequences for vertical equity and horizontal inequity of the overall tax and benefit systems. The means-tested social benefits are particularly designed to help the poorest individuals or households, while the non-means-tested social benefits are dispensed irrespectively of the recipient's personal or household income. One could expect that the contribution of means-tested social benefits to vertical equity is larger than the contribution of non-means-tested social benefits, while the latter will contribute relatively more to horizontal inequity.

While social security contributions are typically proportional to their tax base, PIT systems are usually designed to create larger relative burden on higher income earners. However, social security contributions may also achieve inequality reduction due to their usual payers – employed people – receiving on average higher incomes than non-active people that do not pay social security contributions. In the present article, we analyse redistributive effects of tax and benefit systems in Slovenia and Croatia, two neighbouring countries that share a similar socioeconomic background. Both countries achieved independency in 1991 after the breakdown of Yugoslavia, and started the transition towards market economy from the same tax and benefit system of ex-common state.

In Croatia, the overall income inequality increased between 1998 and 2002 due to increased inequality of wages, in spite of better-targeted social transfers that suppressed the overall inequality increase (*cf.* Nestić, 2005). This was confirmed by Bićanić *et al.* (2010), who examined wage inequality and wage differentials for the period from 1970 to 2008. They concluded that average wage differentials by education and vocational training increased through the mid-1990s and then stabilized. The stabilized income inequality in the period 2002–2004 is also evident from the World Bank reports (*cf.* World Bank, 2007). On the other hand, the overall inequality of pre-tax income in

Slovenia increased as well during the last two decades (Stanovnik and Verbič, 2005; Stanovnik and Čok, 2009), while the inequality of after-tax income remained fairly stable during 1991–2009 due to changes in the PIT system (Stanovnik and Verbič, 2012).

Developments in both countries during the last two decades were reflected in the level of pre- and post-fiscal income inequality. As the results of this article reveal, the inequality of pre-fiscal and post-fiscal income was higher in Croatia than in Slovenia. However, the aim of this article is neither to investigate the political and economic mechanisms that have caused an increase of inequality of pre-fiscal income during the last two decades nor to focus on the mechanisms that have created the current tax and benefit systems in both countries, but to apply recently developed methodology for the measurement of redistributive, vertical and horizontal effects, and to demonstrate their usefulness in cross-country comparisons of the role of fiscal systems in reducing income inequality.

To compare the performance of tax and benefit systems in Slovenia and Croatia, we employed the following decompositions of the redistributive effect. First, the Duclos *et al*. (2003) model decomposes the redistributive effect into vertical, classical horizontal inequity, and reranking effects. For certain combinations of parameters, the Duclos *et al*. (2003) model then becomes equivalent to the well-known Kakwani's (1984) decomposition of the redistributive effect, which contains only the vertical and reranking effects. Finally, all the effects obtained from the Kakwani's (1984) decomposition were further decomposed, following Urban (2012), to reveal contributions of individual tax and benefit instruments to the vertical, reranking and redistributive effects. To the best of our knowledge, this is the first application of the Duclos *et al*. (2003) and Urban's (2012) methodology in comparative analyses of tax and benefit systems. The results show significant differences between the two countries in almost every respect. Croatia had a higher level of post-fiscal income inequality than Slovenia, which was a consequence of higher inequality of pre-fiscal income, as well as of a less redistributive tax and benefit system.

The article proceeds as follows. In Section 2, we briefly provide the measurement models decomposing the redistributive effect. Section 3 delivers an overview of tax and benefit systems in Slovenia and Croatia, followed by a description of income definitions and databases used in the empirical analysis. In Section 4, we present and discuss our results based on the methodology and data sources presented in the latter two sections. The final section concludes with the main findings.

2 Decompositions of the Redistributive Effect

The starting point of our analysis is the redistributive effect, i.e. the change of income inequality induced by the fiscal system, where post-fiscal incomes, N, are equal to pre-fiscal incomes, X, minus taxes, T, plus benefits:

$$N = X - T + B. \tag{1}$$

In measurement terms, we set that $\Delta = I(X) - I(N)$, where Δ represents the redistributive effect, while $I(X)$ and $I(N)$ are indices of pre- and post-fiscal income inequality. In what follows, we shall outline several different, but interconnected decompositions of the redistributive effect.

In the Duclos *et al*. (2003) decomposition, inequality indices $I(\cdot)$ are derived using the Atkinson-Gini social welfare function:

$$W(X,\varepsilon,\nu)=\int_0^1 U(X(p),\varepsilon)\omega(p,\nu)dp\,, \tag{2}$$

where ε represents an ethical parameter configuring the Atkinson's (1970) utility function, $U(X(p),\varepsilon)=(X(p))^{1-\varepsilon}/(1-\varepsilon)$, for $\varepsilon\neq 1$ and with p denoting the quantiles of pre-fiscal income distribution, and $X(p)$ is the income at p. The term ν is another ethical parameter, characterizing the Donaldson and Weymark's (1980) and Yitzhaki's (1983) S-Gini rank-dependent weighting scheme, $\omega(p,\nu)=\nu(1-p)^{\nu-1}$.

The equally distributed equivalent income is an inverse function of $W(\cdot)$ and is obtained as $\xi(X,\varepsilon,\nu)=\left[(1-\varepsilon)W(X,\varepsilon,\nu)\right]^{1/(1-\varepsilon)}$ for $\varepsilon\neq 1$. Finally, the Atkinson-Gini inequality index is calculated as follows:

$$I(X)=1-\xi(X,\varepsilon,\nu)/\mu^X\,, \tag{3}$$

where μ^X is the mean pre-fiscal income. Post-fiscal income inequality, $I(N)$, is obtained analogously, using the quantiles of post-fiscal income distribution.

The Duclos *et al*. (2003) model decomposes the redistributive effect as follows:

$$\Delta=V-C-R=[I(X)-I(N^E)]-[I(U^P)-I(N^E)]-[I(N)-I(U^P)]\,. \tag{4}$$

The vertical effect, $V=I(X)-I(N^E)$, represents the potential redistributive effect or the reduction of inequality that would be achieved by the counterfactual, horizontally equitable system. The discrepancy between potential and actual redistributive effect is divided into the classical horizontal inequity effect, $C=I(U^P)-I(N^E)$, and reranking effect, $R=I(N)-I(U^P)$, which measure two different manifestations of horizontal inequity. The former effect (*C*) measures horizontal inequity emerging from violation of the "classical horizontal equity principle", which says that equals should be treated equally. The latter effect (*R*) evaluates horizontal inequity arising from the infringement of the "no-reranking principle", requiring that fiscal process does not change ranks of income units in transition from pre- to post-fiscal income.[1]

In equation (4), $N^E=N^E(p)$ represents expected post-fiscal incomes, obtained as $N^E(p)=\int_0^1 N(q\mid p)dq$, where $N(q\mid p)$ denotes post-fiscal income at the *q*-th quantile among all those income units belonging to the *p*-th quantile of pre-fiscal income distribution. $U^P=U^P(p,\varepsilon)$ is the expected post-fiscal utility at the *p*-th quantile,

[1] For example, families A and B have pre-fiscal incomes of 10$, while C and D have 20$. Suppose that A, B, C and D end up with post-fiscal incomes of 8$, 16$, 12$ and 24$, respectively. Among pre-fiscal equals (A, B) and (C, D) classical horizontal inequity has occurred, while between pre-fiscal unequals (B, C) reranking has taken place.

obtained as $U^P(p,\varepsilon)=\int_0^1 U(N(q\mid p),\varepsilon)dq$. For N^E and U^P, we obtain the respective social welfare functions:

$$W(N^E,\varepsilon,\nu)=\int_0^1 U(N^E(p),\varepsilon)\omega(p,\nu)dp,$$
$$W(U^P,\varepsilon,\nu)=\int_0^1 U^P(p,\varepsilon)\omega(p,\nu)dp,$$

while the corresponding inequality indices are $I(N^E,\varepsilon,\nu)=1-\xi(N^E,\varepsilon,\nu)/\mu^N$ and $I(U^P,\varepsilon,\nu)=1-\xi(U^P,\varepsilon,\nu)/\mu^N$, where μ^N is the mean post-fiscal income.

When $\nu=1$ the weights $\omega(p,\nu)$ are all equal and reranking disappears, $R=I(N)-I(U^P)=0$. For $\varepsilon>0$, the vertical and classical horizontal inequity effect, $V(\varepsilon,1)$ and $C(\varepsilon,1)$, become indices consistent with the Duclos and Lambert's (2000) model of classical horizontal inequity measurement.

On the other hand, When $\varepsilon=0$, utilities are identical to incomes: $U(y,0)=y$. Therefore, $U(N(q\mid p),0)=N(q\mid p)$ across all p and $N(q\mid p)$, and it follows that $W(N^E,0,\nu)=W(U^P,0,\nu)$ and $I(N^E,0,\nu)=I(U^P,0,\nu)$. The consequence for the Duclos *et al*. (2003) model is that the classical horizontal inequity effect collapses to zero, and the decomposition (4) can be rewritten as:

$$\Delta(0,\nu)=V(0,\nu)-R(0,\nu)=(I(X,0,\nu)-I(N^E,0,\nu))-(I(N,0,\nu)-I(N^E,0,\nu)). \quad (5)$$

It can be shown that $I(X,0,\nu)$, $I(N,0,\nu)$ and $I(N^E,0,\nu)$ are the S-Gini coefficient of pre-fiscal income, G_X^ν, the S-Gini coefficient of post-fiscal income, G_N^ν, and the S-Gini concentration coefficient of post-fiscal income, $D_{N;X}^\nu$, respectively.[2]

Consequently, V_K^ν is equal to the S-Gini Kakwani's (1984) index of the vertical effect, $V_K^\nu=G_X^\nu-D_{N;X}^\nu$, and R_{APK}^ν is the S-Gini Atkinson (1980), Plotnick (1981) and Kakwani (1984) index of reranking, $R_{APK}^\nu=G_N^\nu-D_{N;X}^\nu$.[3] The Kakwani's (1984) decomposition of the redistributive effect into vertical and horizontal components can be rewritten in the S-Gini terms as:

$$\Delta^\nu=V_K^\nu-R_{APK}^\nu=(G_X^\nu-D_{N;X}^\nu)-(G_N^\nu-D_{N;X}^\nu). \quad (6)$$

[2] Duclos and Araar (2006) showed that the S-Gini index of inequality is equal to $G(X,\nu)=(\mu^X)^{-1}\int_0^1(\mu^X-X(p))\omega(p,\nu)dp$, i.e. to deviations of incomes from the mean, weighted by the weights $\omega(p,\nu)$, which depend only on the single ethical parameter ν. When $\nu=2$, $G(X,\nu)$ is equivalent to the standard Gini coefficient. Consequently, the indices from the family $G(X,\nu)$ are called "single parameter Gini" indices or (more conveniently) the "S-Gini" indices.

[3] Originally, all these indices were defined for $\nu=2$.

As mentioned above, the post-fiscal income is obtained by subtracting taxes from pre-fiscal income and adding the benefits, i.e. $N = X - T + B$. Urban (2012) decomposes marginal changes of V_K^ν, R_{APK}^ν and Δ^ν, to show how each tax and benefit instrument contributes to these effects. This model is rooted in the Lerman and Yitzhaki's (1985) decomposition of overall income inequality into contributions of income sources, and is applied to the terms from the Kakwani's (1984) decomposition of the redistributive effect. It raises the following question: if actual values of each tax and benefit were changed independently from each other by some small factor e, what would be the shares of this tax or benefit in total changes of vertical, reranking and redistributive effects? These shares are given on the right hand sides of the following three equations, for changes of V_K^ν, R_{APK}^ν and Δ^ν, respectively:

$$G_X^\nu - D_{N;X}^\nu = \tau(D_{T;X}^\nu - D_{N;X}^\nu) + \beta(D_{N;X}^\nu - D_{B;X}^\nu), \tag{7}$$

$$\begin{aligned}&(G_N^\nu - D_{N;X}^\nu) + (G_X^\nu - D_{X;N}^\nu) = \\ &= \tau\left[(D_{T;X}^\nu - D_{T;N}^\nu) + (G_N^\nu - D_{N;X}^\nu)\right] + \beta\left[(D_{B;N}^\nu - D_{B;X}^\nu) - (G_N^\nu - D_{N;X}^\nu)\right],\end{aligned} \tag{8}$$

$$D_{X;N}^\nu - G_N^\nu = \tau(D_{T;N}^\nu - G_N^\nu) + \beta(G_N^\nu - D_{B;N}^\nu), \tag{9}$$

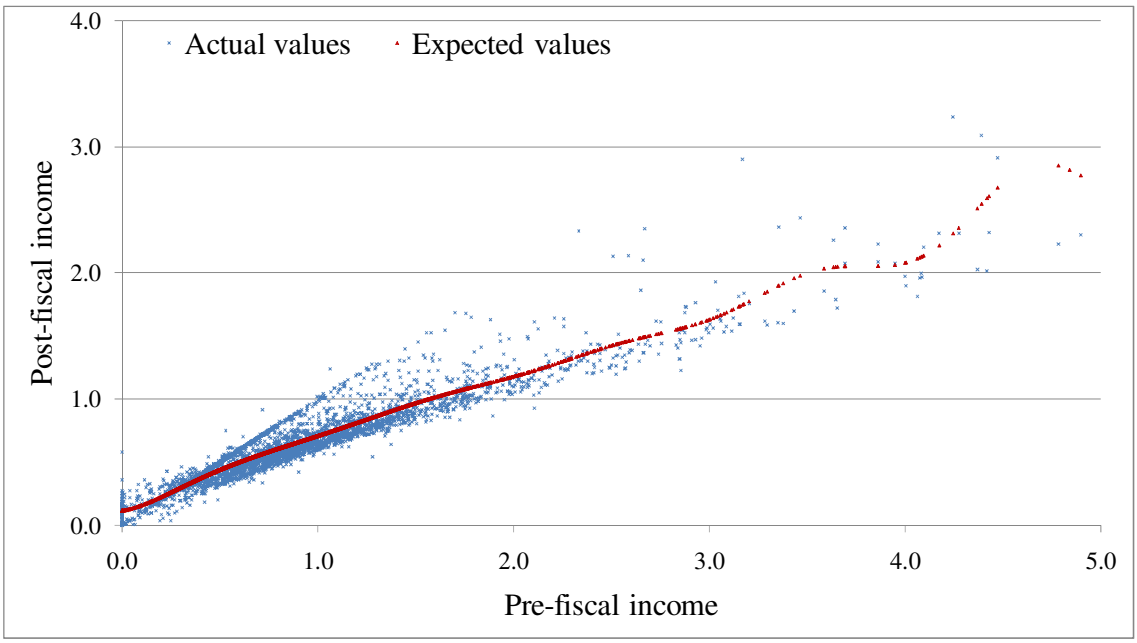
where τ and β are the shares of taxes and benefits in pre-fiscal income, $D_{T;X}^\nu$ and $D_{B;X}^\nu$ ($D_{T;N}^\nu$ and $D_{B;N}^\nu$) are the S-Gini concentration coefficients of taxes and benefits with respect to pre-fiscal (post-fiscal) income ranking, and $D_{X;N}^\nu$ is the S-Gini concentration coefficients of pre-fiscal income with respect to post-fiscal income ranking. The contributions in expressions (7), (8) and (9) are evaluated on the post-fiscal margin.

The sum of contributions to the marginal change of Atkinson-Plotnick-Kakwani reranking effect from (8) is equal to $(G_X^\nu - D_{N;X}^\nu) - (D_{X;N}^\nu - G_N^\nu)$, which is different from $R_{APK}^\nu = G_N^\nu - D_{N;X}^\nu$. Similarly, the sum of contributions to the marginal change of redistributive effect from (9) is equal to $D_{X;N}^\nu - G_N^\nu$, which is different from $\Delta^\nu = G_X^\nu - G_N^\nu$. These differences arise from the fact that expressions (8) and (9) reflect *marginal changes* of reranking and redistributive effects (divided by e), and not their *overall values*, equal to R_{APK}^ν and Δ^ν. Urban (2012) shows that the ratio $\left[(G_N^\nu - D_{N;X}^\nu) + (G_X^\nu - D_{X;N}^\nu)\right] / (D_{X;N}^\nu - G_N^\nu)$ will be greater than the ratio R_{APK}^ν / Δ^ν; in other words, the share of the marginal change of reranking effect in the marginal change of redistributive effect will be greater than the share of reranking effect in redistributive effect obtained for the "overall indices".

3 Tax and Benefit Systems and the Data

For the purpose of the present article, pre-fiscal income was defined as the sum of market incomes from different sources (both subject and non-subject to PIT) and pensions. Income from own-use production and transfers of money and goods from other persons were not included. Taxes were assembled into three groups: employers' social security contributions, employees' social security contributions and the PIT. Benefits were divided into means-tested and non-means-tested social benefits. Public pensions were part of pre-fiscal income and were not included into benefits. Post-fiscal income was obtained according to expression (1). Figure 1 presents pre-fiscal and post-fiscal sample incomes in Slovenia (in terms of mean pre-fiscal income).[4] Table 1 further provides a very brief overview of the tax and benefit system in Slovenia and Croatia.

Figure 1: Pre-fiscal and post-fiscal sample incomes in 2007 in Slovenia



Note: The "Actual values" represent the actual values of post-fiscal incomes, N_i^x, while the "Expected values' show the estimates of expected post-fiscal incomes, N_i^E, plotted against pre-fiscal incomes, X_i^x.
Source: Own calculations.

[4] Graphic representation of sample incomes in Croatia is omitted due to similarity to the Slovenian sample; the distribution of sample incomes in Croatia is somewhat less dispersed, though.

According to the PIT system in Croatia, capital incomes (capital gains, dividends, and interest) were not subject to taxation. Income from employment, domestic pensions and income from self-employment were subject to progressive tax schedule with four tax brackets, with marginal tax rates of 15%, 25%, 35% and 45% in 2007.[5] Tax schedule was then applied to the tax base, obtained as the difference between the overall income and the amount of personal allowance and other tax allowances. For some income sources (e.g. income from contractual work and rental income), different flat rates were applied, ranging from 15% to 45%. The surtax is obtained as a percentage of PIT, with the rates ranging from 0% to 18%, set by the local municipalities. Unit of taxation was an individual taxpayer.

Employers' and employees' social security contributions were equal to 17.2% and 20% of gross wage, respectively. Combined social security contribution rate for the self-employed was equal to 35%.[6] Pension insurance system contained two mandatory pillars: "solidarity" pension insurance and "capitalized accounts". Majority of the insured were participating in both pillars, paying 15% of the gross wage to the former and 5% to the latter. In our analysis below, we treated only the social security contributions to the "solidarity" pillar as taxes, while the outlays to "capitalized accounts" were equivalent to personal savings.

Slovenia had a similar PIT system, though with several differences. PIT in Slovenia was set at the individual level (as in Croatia), and levied on six categories of income: income from employment (including pensions), business income, income from agriculture and forestry, income from rents and royalties, income from capital, and other income accruing to persons liable to tax. Current personal income tax code was adopted in 2007, when a 20% flat tax rate for income from capital income was introduced. Other, non-capital income was subject to progressive tax schedule with three tax brackets and marginal tax rates of 16%, 27% and 41%. Rate of social security contributions (without any ceiling) was set at 22.1% for employees and 16.1% for employers. The self-employed paid an overall rate of 38.2% by themselves.

[5] Submission of a tax file can be obligatory (in certain pre-defined conditions and for certain groups of taxpayers) or voluntary (when a taxpayer wants to use some allowances and deductions). Since 2010, there are three tax brackets with marginal tax rates of 12%, 25% and 40%.

[6] The base for social security contributions of the self-employed was set to 35% – 110% of the national average gross wage for different groups of the self-employed (those working in agriculture and forestry, craftsmen, freelancers etc.).

Table 1: Tax and benefit system in Slovenia and Croatia

	Slovenia	Croatia
Taxes		
PIT	– personal income tax	– personal income tax and surtax
Employers' social security contributions	– for health insurance – for pension insurance – for unemployment insurance – for maternity leave insurance	– for health insurance – for unemployment insurance
Employees' social security contributions	– for health insurance – for pension insurance – for unemployment insurance – for maternity leave insurance	– for pension insurance
Benefits		
Means-tested	– child benefit – unemployment assistance – scholarships – pension supplement[a]	– basic support allowance – child allowance
Non-means-tested	– birth grant – parental allowance[b] – childcare supplement – large-family supplement – unemployment wage compensation – disability supplement	– unemployment benefit – sick-leave benefit – maternity and layette supplement – support for rehabilitation and employment of people with disabilities

Notes: [a] Mean-tested benefit for low-income pensioners.
[b] Non-mean-tested benefit for a parent, who is not eligible for the insurance-based wage compensation during the parental leave.

Source: Own classification based on administrative sources.

The data for two countries arrived from different sources. For Croatia, we used the Household Budget Survey data for the year 2007, collected by the Croatian Bureau of Statistics. For Slovenia, the data were taken from the administrative database prepared also for the year 2007 by the Statistical Office of the Republic of Slovenia. Samples contain 3,151 households for Slovenia and 2,983 households for Croatia. We chose year 2007, as it is the most recent year for which comparable data for both countries were available. Since then, tax and benefit system in neither country has changed substantially.

Unit of analysis was a household. Incomes were deflated by an equivalence factor, obtained by using the "modified OECD scale", $\beta_k = 1 + 0.5(a_k - 1) + 0.3c_k$, where a_k and c_k are the number of adults and children in household *k*, respectively.

4 Results of the Analysis

To start with, Table 2 presents the results of decompositions. The upper section of the table gives the estimates of different inequality indices, as well as of the redistributive effect for four combinations of values of ethical parameters. The lower section of the table contains estimates of vertical, classical horizontal inequity and reranking effects, obtained by application of the Duclos *et al*. (2003) and Kakwani (1984) models.

Table 2: Income inequality, the redistributive effect and its decomposition in 2007

	$\nu = 2\,,\ \varepsilon = 0$				$\nu = 2\,,\ \varepsilon = 0.5$			
	Slovenia		Croatia		Slovenia		Croatia	
	Value	% pfi	Value	% pfi	Value	% pfi	Value	% pfi
$\hat{I}(X_i^x)$	0.3640	100.0	0.3932	100.0	0.4286	100.0	0.4673	100.0
$\hat{I}(N_i^n)$	0.2876	79.0	0.3139	79.8	0.3276	76.4	0.3598	77.0
$\hat{I}(N_i^x)$	0.2757	75.7	0.3065	78.0	0.3176	74.1	0.3535	75.7
$\hat{I}(N_i^E)$	0.2757	75.7	0.3065	78.0	0.3095	72.2	0.3476	74.4
$\hat{\Delta}(\varepsilon,\nu)$	0.0765	21.0	0.0792	20.2	0.1010	23.6	0.1074	23.0
	Value	% RE	Value	% RE	Value	% RE	Value	% RE
$\hat{V}(\varepsilon,\nu)$	0.0884	115.5	0.0867	109.4	0.1191	117.9	0.1197	111.4
$\hat{C}(\varepsilon,\nu)$	0.0000	0.0	0.0000	0.0	0.0081	8.0	0.0059	5.5
$\hat{R}(\varepsilon,\nu)$	0.0119	15.5	0.0074	9.4	0.0100	9.9	0.0063	5.9

	$\nu = 3\,,\ \varepsilon = 0.5$				$\nu = 1\,,\ \varepsilon = 0.5$			
	Slovenia		Croatia		Slovenia		Croatia	
	Value	% pfi	Value	% pfi	Value	% pfi	Value	% pfi
$\hat{I}(X_i^x)$	0.5481	100.0	0.5929	100.0	0.1204	100.0	0.1365	100.0
$\hat{I}(N_i^n)$	0.4313	78.7	0.4724	79.7	0.0746	61.9	0.0827	60.6
$\hat{I}(N_i^x)$	0.4179	76.2	0.4632	78.1	0.0746	61.9	0.0827	60.6
$\hat{I}(N_i^E)$	0.4087	74.6	0.4567	77.0	0.0672	55.8	0.0774	56.7
$\hat{\Delta}(\varepsilon,\nu)$	0.1169	21.3	0.1205	20.3	0.0458	38.1	0.0539	39.4
	Value	% RE	Value	% RE	Value	% RE	Value	% RE
$\hat{V}(\varepsilon,\nu)$	0.1394	119.3	0.1362	113.1	0.0532	116.1	0.0591	109.8
$\hat{C}(\varepsilon,\nu)$	0.0091	7.8	0.0066	5.5	0.0074	16.1	0.0053	9.8
$\hat{R}(\varepsilon,\nu)$	0.0134	11.5	0.0091	7.6	0.0000	0.0	0.0000	0.0

Notes: % pfi = percentage of pre-fiscal inequality, $\hat{I}(X_i^x)$;
% RE = percentage of redistributive effect, $\hat{\Delta}(\cdot)$.

Source: Own calculations.

As explained in Section 2, when $\varepsilon = 0$, the Atkinson-Gini indices of inequality become S-Gini indices, while the Duclos *et al.* (2003) model turns into S-Gini Kakwani's (1984) model.[7] Furthermore, if $\varepsilon = 0$ and $\nu = 2$ we obtain standard Gini indices and Kakwani's (1984) model as originally conceived. This is presented by the first scenario in Table 2. The last scenario takes the combination of $\nu = 1$ and $\varepsilon = 0.5$, consistent with the Duclos and Lambert's (2000) model. Thus, the first and the last scenarios are the "extreme" ones – the former lacking the classical horizontal inequity

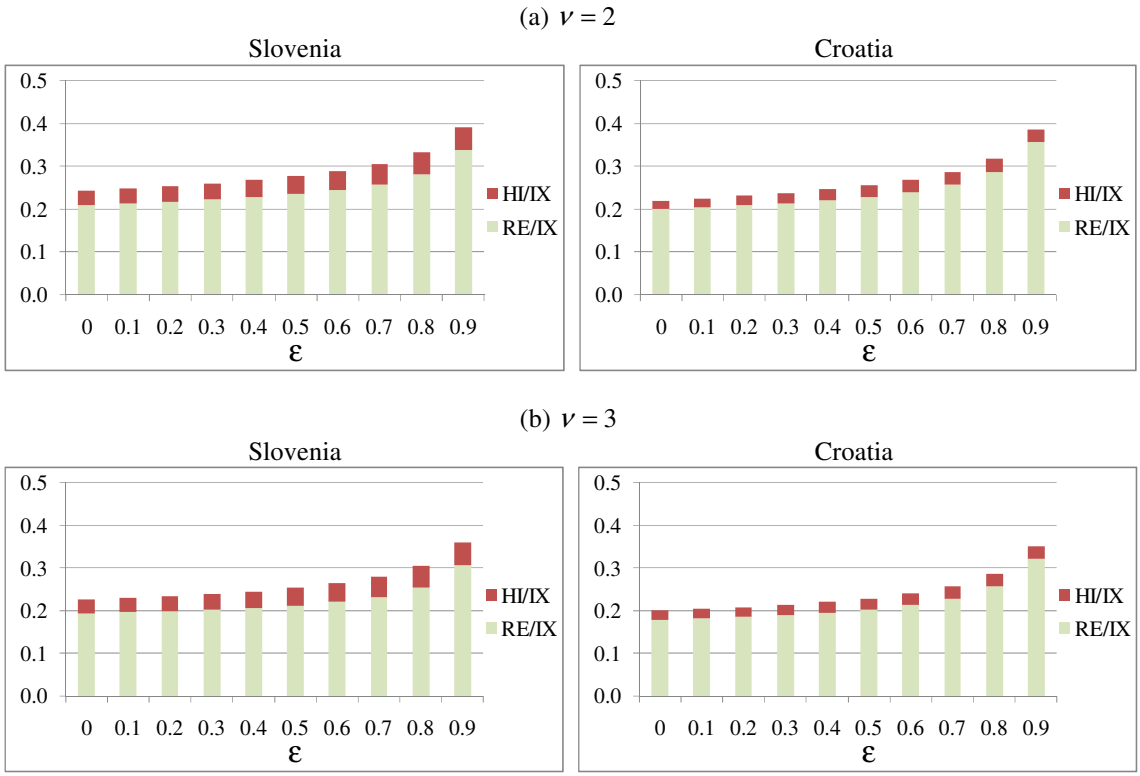
[7] For detailed technical exposition of the Duclos *et al.* (2003) and Kakwani (1984) models, and step-by-step implementation procedures see Urban (2011).

term, and in the latter the reranking term being absent. On the other hand, scenarios 2 and 3 contain both the reranking and classical horizontal inequity effects.

Comparing the results from Table 2 for Slovenia and Croatia across the different scenarios, several important conclusions can be drawn. First, Croatia had higher pre-fiscal income inequality than Slovenia, as reflected in $\hat{I}(X_i^x)$. The indicator $\hat{\Delta}(\varepsilon,\nu)$, expressed as percentage of $\hat{I}(X_i^x)$, suggests that the relative redistributive effect in two countries was of similar magnitude, but slightly higher in Slovenia. Consequently, post-fiscal income inequality was also higher in Croatia than in Slovenia by about 10%, as indicated by $\hat{I}(N_i^n)$. Second, horizontal inequity was significantly larger in Slovenia, as can be seen by inspecting the combined value of $\hat{C}(\varepsilon,\nu)$ and $\hat{R}(\varepsilon,\nu)$, which ranges from 15.5% to 19.3% of the redistributive effect in Slovenia, and from 9.8% to 13.1% of the redistributive effect in Croatia.

Figure 2 illustrates the same results for a larger range of values ε. The columns of the histograms are divided into two parts: the bottom part represents the share of the redistributive effect in pre-fiscal income inequality, i.e. the ratio of $\hat{\Delta}(\varepsilon,\nu)$ to $\hat{I}(X_i^x)$, while the top part shows the share of overall horizontal inequity in pre-fiscal income inequality, i.e. the ratio of $\hat{C}(\varepsilon,\nu)+\hat{R}(\varepsilon,\nu)$ to $\hat{I}(X_i^x)$. The full height of each column represents the vertical effect of the tax and benefit system, since according to expression (4), $\hat{V}(\varepsilon,\nu)=\hat{\Delta}(\varepsilon,\nu)+\hat{C}(\varepsilon,\nu)+\hat{R}(\varepsilon,\nu)$.

Figure 2: Shares of redistributive and horizontal inequity effects in the pre-fiscal income inequality in 2007



Notes: RE/IX = $\hat{\Delta}(\varepsilon,\nu)/\hat{I}(X_i^x)$; HI/IX = $[\hat{C}(\varepsilon,\nu)+\hat{R}(\varepsilon,\nu)]/\hat{I}(X_i^x)$.

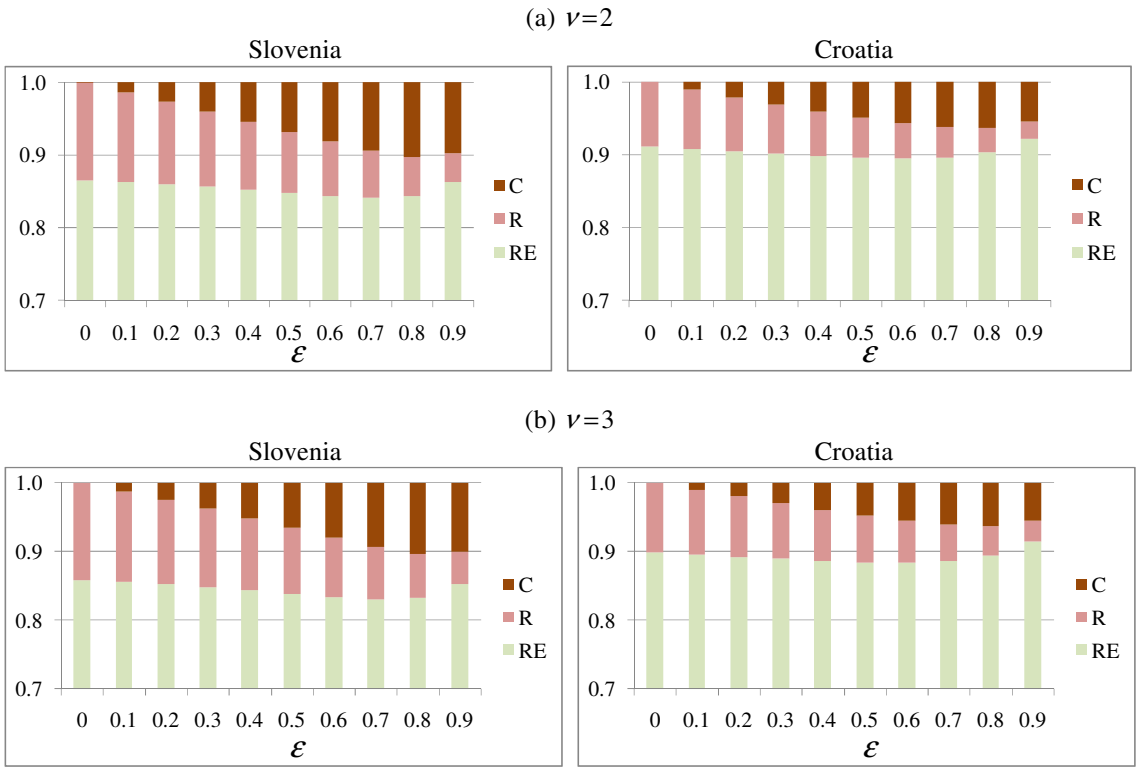
Source: Own calculations.

Slovenia achieved a larger relative redistributive effect than Croatia, but the difference decreased with ε, so that for $\varepsilon > 0.7$ the share of $\hat{\Delta}(\varepsilon,\nu)$ in $\hat{I}(X_i^x)$ was higher for Croatia. The differences between the two countries were much more noticeable in the case of horizontal inequity; it can be easily observed that Slovenia had significantly larger horizontal inequity than Croatia. Taking the redistributive effect and horizontal inequity together, we also see that the vertical effect was larger in Slovenia.

Next, Figure 3 looks more closely into the relationships between different effects, obtained by the Duclos *et al*. (2003) decomposition. Again, we use the property that the vertical effect is a sum of the redistributive effect, classical horizontal inequity and reranking effects, trying to reveal the share of each in the vertical effect.

The share of overall horizontal inequity in the vertical effect, measured as $[\hat{C}(\varepsilon,\nu)+\hat{R}(\varepsilon,\nu)]/\hat{V}(\varepsilon,\nu)$, ranged from 14% (for $\nu=2$ and $\varepsilon=0.9$) to 17% (for $\nu=3$ and $\varepsilon=0.7$) in Slovenia, and between 8% (for $\nu=2$ and $\varepsilon=0.9$) and 11% (for $\nu=3$ and $\varepsilon=0.6$) in Croatia. The reranking effect dominated the classical horizontal inequity effect at lower values of ε, but as ε increased, the latter effect took over. It is interesting to notice that the shares of classical horizontal inequity effect across different values of ε were the same for $\nu=2$ and $\nu=3$. On the other hand, larger ν brought larger shares of reranking in the vertical effect. Therefore, the share of overall horizontal inequity in the vertical effect increased with ν.

Figure 3: Shares of redistributive, classical horizontal inequity and reranking effects in the vertical effect in 2007



Source: Own calculations.

Thus, one of the main conclusions from the above comparison of two countries is that the Slovenian tax and benefit system created much larger horizontal inequity than the Croatian tax and benefit system, while the redistributive effect was only slightly higher in Slovenia. How could this be explained, i.e. what tax and benefit instruments were responsible for these results? The answers are provided by applying the Urban's (2012) decomposition of vertical, reranking and redistributive effects, with the results presented in Table 3 and Figure 4.

Table 3: Decomposition of vertical, reranking and redistributive effects by tax and benefit instruments in 2007, $\nu=2$

(a) Slovenia

	sscer	*sscee*	*pit*	*mt*	*nmt*	*taxes*	*benefits*	*overall*
Section 1: Contributions								
mcVK	0.0170	0.0231	0.0348	0.0138	-0.0003	0.0749	0.0135	0.0884
mcRAPK	0.0079	0.0108	0.0055	0.0003	0.0012	0.0242	0.0015	0.0257
mcRE	0.0091	0.0122	0.0294	0.0135	-0.0015	0.0507	0.0120	0.0627
Section 2: Contributions as percentage of overall *mcRE*								
mcVK	27.1	36.8	55.6	22.0	-0.5	119.5	21.5	140.9
mcRAPK	12.6	17.3	8.8	0.4	1.9	38.6	2.3	40.9
mcRE	14.5	19.5	46.8	21.6	-2.4	80.8	19.2	100.0
Section 3: Normalized contributions								
mcVK	0.44	0.43	1.00	1.83	-0.11	0.59	1.31	0.52
mcRAPK	1.29	1.29	1.00	0.23	2.69	1.21	0.90	0.96
mcRE	0.28	0.27	1.00	2.13	-0.64	0.47	1.38	0.44
% pfinc	10.2	14.0	9.1	2.0	0.7	33.3	2.7	36.0

(b) Croatia

	sscer	*sscee*	*pit*	*mt*	*nmt*	*taxes*	*benefits*	*overall*
Section 1: Contributions								
mcVK	0.0218	0.0212	0.0269	0.0098	0.0069	0.0700	0.0167	0.0867
mcRAPK	0.0057	0.0056	0.0015	0.0012	0.0029	0.0128	0.0040	0.0168
mcRE	0.0162	0.0157	0.0254	0.0087	0.0040	0.0572	0.0127	0.0699
Section 2: Contributions as percentage of overall *mcRE*								
mcVK	31.2	30.4	38.5	14.0	9.9	100.1	23.9	124.0
mcRAPK	8.1	8.0	2.2	1.7	4.1	18.2	5.8	24.0
mcRE	23.1	22.4	36.3	12.4	5.8	81.8	18.2	100.0
Section 3: Normalized contributions								
mcVK	0.46	0.47	1.00	1.73	1.17	0.59	1.45	0.66
mcRAPK	2.10	2.16	1.00	3.61	8.55	1.88	6.12	2.25
mcRE	0.36	0.37	1.00	1.62	0.73	0.51	1.16	0.57
% pfinc	10.3	9.9	5.9	1.2	1.3	26.0	2.5	28.5

Notes: *sscer* – employers' social security contributions, *sscee* – employee's social security contributions, *pit* – personal income tax, *nmt* – non-means-tested benefits, and *mt* – means-tested benefits; *mcVK*, *mcRAPK*, and *mcRE* – decompositions of marginal changes of the Kakwani vertical, Atkinson-Plotnick-Kakwani and redistributive effects, according to expressions (7), (8) and (9), respectively; % pfinc = percentage of pre-fiscal income.

Source: Own calculations.

Let us first observe the relative shares of taxes and benefits in pre-fiscal income, shown in the bottom row of Table 3. In both countries, the overall size of taxes was much higher than the size of benefits. Namely, in Croatia (Slovenia) taxes made 26% (33.3%) of pre-fiscal income, against the share of benefits equal to 2.5% (2.7%) of pre-fiscal income. The reason for this disproportion is clear; social security contributions were used to finance the outlays of the pension and health systems, but the respective benefits that the households obtained from these systems were not covered by the analysis.[8]

Table 3 is divided into three sections. Section 1 presents the contributions to marginal changes of the Kakwani vertical, Atkinson-Plotnick-Kakwani and redistributive effects, obtained by (7), (8) and (9), and respectively shown in rows denoted as *mcVK*, *mcRAPK* and *mcRE*. These contributions are then divided by the total sum of contributions to redistributive effect (from the column "overall"), and shown in Section 2. Finally, in Section 3 we divide the original contribution of each instrument by its share in pre-fiscal income, and then additionally by the respective ratio obtained for PIT.

In Section 2 of Table 3 we can observe that in Slovenia (Croatia) the marginal change of reranking effect amounted to 40.9% (24.0%) of the marginal change of redistributive effect. This was much higher than the share of reranking effect in the redistributive effect, equal to 15.5% (9.4%); see Table 2 for $\nu = 2$ and $\varepsilon = 0$. Such a result could be expected already at the end of Section 2. However, the relative difference between the two countries is confirmed by both types of ratios; Slovenian system thus created about 70% more reranking than the Croatian tax and benefit system.

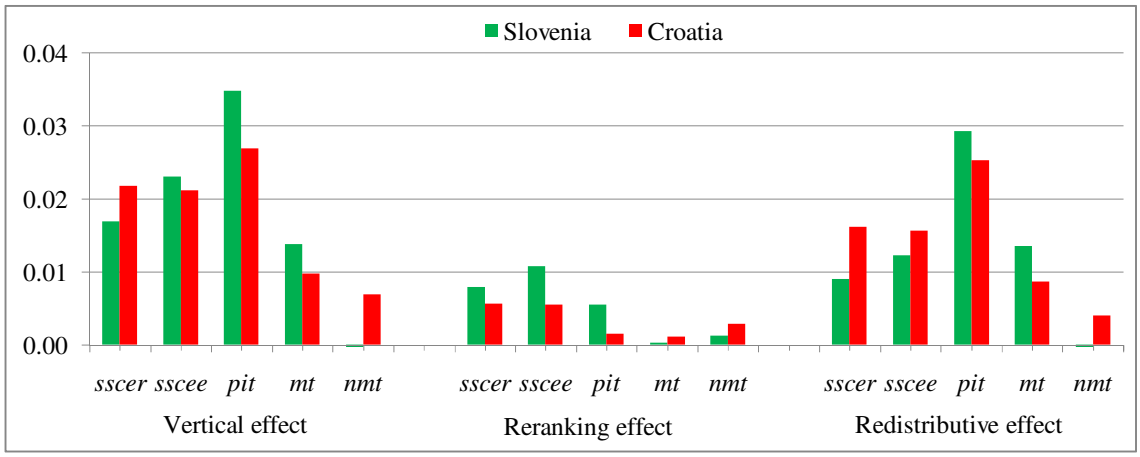
Section 2 also indicates that in Slovenia the PIT was the largest contributor to both the vertical (55.6%) and the redistributive (46.8%) effect. This was similar in Croatia, but the contributions were smaller (38.5% and 36.3%). However, in both countries PIT had a much larger share in pre-fiscal income than benefits. When we "normalized" contributions, as done in Section 3 of Table 3, the means-tested benefits became the strongest contributor; in Slovenia (Croatia) they induced a 1.83 (1.73) times larger vertical effect, and 2.13 (1.62) times larger redistributive effect than PIT, per one euro of tax or benefit. From this perspective, social security contributions had a much weaker influence on income redistribution (between one third and one half of the PIT's).

Social security contributions had the strongest role in creation of reranking. Taken together, they decreased the potential redistributive effect by 29.9 (16.1) percentage points in Slovenia (Croatia). This result was not unexpected, because we know that these taxes were paid prevalently by the employees and not by pensioners and other inactive groups that make a large part of population in these countries. Slovenian PIT created much more reranking (8.8% of *mcRE*) than Croatian PIT (2.2% of *mcRE*).

On the other hand, Croatian benefits induced a lot more reranking (5.8% of *mcRE*, combined) than benefits in Slovenia (2.3% of *mcRE*). Another large difference between two countries was the role of non-means-tested benefits. In Croatia they made a relatively large contribution to the redistributive effect (5.8% of *mcRE*), while in Slovenia they increased inequality (–2.4% of *mcRE*).

[8] The exceptions are social security contributions for unemployment insurance in both countries and social security contributions for maternity leave insurance in Slovenia. However, their size is relatively small in comparison to pension and health expenditures.

Figure 4: Contributions of taxes and benefits to vertical, reranking and redistributive effects in 2007, for $\nu = 2$



Notes: *sscee* – employee's social security contributions, *sscer* – employers' social security contributions, *pit* – personal income tax, *nmt* – non-means-tested benefits, and *mt* – means-tested benefits.

Source: Own calculations.

5 Concluding Remarks

Even though Croatia and Slovenia share a similar background, they have developed in different ways during the last two decades. A major consequence of this divergent development is higher pre-fiscal income inequality in Croatia. Both countries also differ in the characteristics of their tax and benefit systems. In this article, we focused on the analysis of the redistributive effects of tax and benefit systems consisting of employers' and employee's social security contributions, personal income tax, and a wide range of means-tested and non-means-tested social benefits.

For the purpose of our analysis, we employed a series of decompositions of the redistributive effect that, to the best of our knowledge, has not been done before in this manner. First, we decomposed the redistributive effect into vertical, classical horizontal inequity, and reranking effects. Additionally, we performed the well-known Kakwani's decomposition of the redistributive effect, which contains only the vertical and reranking effects. Finally, all the effects obtained from the Kakwani's decomposition were uniquely decomposed to reveal contributions of individual tax and benefit instruments to the vertical, reranking and redistributive effects. In particular, this is the first application of the Duclos *et al.* (2003) and Urban's (2012) methodology in comparative analyses of tax and benefit systems.

The results reveal that the Slovenian tax and benefit system created a much larger vertical effect than the Croatian tax and benefit system. However, the former system also induced much more horizontal inequity, which cancelled the advantage in vertical effect, with the final result that the redistributive effect was only slightly higher in Slovenia. In both countries, the overall size of taxes was much higher than the size of benefits. Namely, in Croatia (Slovenia) taxes made 26% (33.3%) of pre-fiscal income, against the share of benefits equal to 2.5% (2.7%) of pre-fiscal income. The reason of this disproportion is clear: social security contributions were used to finance the outlays

of the pension and health systems, but the respective benefits obtained by households from these systems were not covered by the analysis.

Moreover, the contributions of taxes and benefits were evaluated on the post-fiscal income margin, answering to the question: if actual values of each tax and benefit are changed independently from each other by some small factor e, what are the shares of this tax or benefit in total marginal changes of vertical, reranking and redistributive effects? Despite their small share in comparison to taxes, the benefits created about one fifth of the overall redistributive effect in Slovenia and Croatia. However, there was a large difference between the impact produced by means-tested and non-means-tested social benefits in the two countries. In Slovenia, the vertical effect of non-means-tested social benefits was close to zero, indicating that these benefits were on average almost proportional to pre-fiscal income. On the other hand, in Croatia non-means-tested social benefits did induce a vertical effect, albeit relatively smaller than the vertical effect of means-tested social benefits.

On the revenue side, PIT was the largest contributor to the vertical effect in both countries. Absorbing 9.1% of pre-fiscal income in Slovenia, it accounted for 55.6% of the vertical effect; in Croatia the PIT took up 5.9% of pre-fiscal income and was responsible for 38.5% of the vertical effect. Social security contributions contributed significantly to the vertical effect; in Slovenia (Croatia) they accounted for 63.9% (61.6%) of the vertical effect. Social security contributions also introduced quite a lot of reranking in both countries. This result was not unexpected, because we know that these taxes were paid prevalently by the employees and not by pensioners and other inactive groups that made a large part of population in these countries. The contribution of PIT to reranking in Croatia was surprisingly low, amounting to only 2.2% of the redistributive effect, compared to 8.8% of the redistributive effect in Slovenia. Reranking caused by Slovenian non-means-tested social benefits further aggravated their negative contribution to redistributive effect. However, the contribution of benefits in Croatia to reranking was six times higher than in Slovenia, evidencing another divergence between the two systems.

Taking into account these results, we can conclude that Slovenia revealed lower pre-fiscal income and post-fiscal equality than Croatia. Even though Croatian tax and benefit system contributed substantially to the equalisation of post-fiscal income, it was still slightly less redistributive compared to the Slovenian tax and benefit system. Croatian PIT induced much less horizontal inequity than the Slovenian PIT, while the opposite was true for benefits.

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