INCOME REDISTRIBUTION IN CROATIA: THE ROLE OF INDIVIDUAL TAXES AND SOCIAL TRANSFERS

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Abstract

The paper discusses the methodology and preliminary results of an investigation of the redistributive effects of social security contributions (SSC), personal income tax (PIT), public pensions as well as means-tested and non-means-tested cash benefits in Croatia. The transition from a pre- to a post-tax-and-benefit income is analyzed in order to reveal which instruments contribute most to the reduction of inequality. The Croatian system of individual taxes, pensions and social benefits seems to be highly redistributive, with public pensions being the instrument that contributes most, followed by SSC and PIT.

Keywords: income inequality, redistribution, fiscal instruments

1 Introduction

The World Bank (2006) study confirmed previous findings (World Bank, 2001; Nestić, 2005) that disposable income inequality in Croatia is mild in international comparisons and among the lowest within the transition countries of the region.[1] Is this relatively low inequality of income distribution inherent to the Croatian economy and society, or is it a consequence of the fiscal activities of government? Given the experience of other co-

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[1] The Gini coefficient amounted to 0.275 in 2004. This value was based on disposable income, including the value of production for own use and self-reported rental values for owner-occupied dwellings. Household incomes were equivalized using a "modified OECD scale".

untries, and the fact that the share of government in GDP is high, a hypothesis can be set forward that government in Croatia has a significant influence on income distribution.

In Croatia, the distribution of fiscal burdens and benefits and its influence on income distribution have been only partially investigated. Kesner-Škreb et al (2001) and Urban (2006) have shown that the *progressivity* of PIT is relatively high and has been increasing over the last decade. On the other hand, the study of Blažić and Denona (2000) exposed the *regressivity* of the 1998 single-rate value added tax (VAT).[2] According to Nestić (2005) social transfers (excluding public pensions) slightly reduce disposable income inequality, while public pensions increase it significantly; a recent study by Babić (2008) presents similar results.[3]

However, there has been no attempt to provide a combined incidence calculation for several tax and benefit instruments. This paper presents such an investigation, which follows the approaches of Immervoll et al (2005), and Kim and Lambert (2007) to evaluate the redistributive effects of the fiscal subsystem consisting of SSC, PIT, public pensions, means-tested and non-means-tested cash benefits.

The paper is organized as follows. Section 2 describes the research framework, measurement and data issues. Section 3 illustrates some of the most important preliminary results obtained for the year 2005. Special attention is devoted to estimates of the contributions made by individual instruments to the overall redistributive effect, where the results diverge when different approaches are chosen. Section 4 resumes the main findings and poses questions for the next stage of research.

2 Methodology and data

2.1 Research framework

Government involvement in the market affairs results in varying net increases or decreases of living standards for different individuals. What is the distribution of these changes in the living standards among the population? Economists in the field of fiscal incidence attempt to answer this question.

Instead of analyzing total fiscal system incidence, researchers often decide to concentrate on segments of it: single tax/benefit forms or groups of taxes and/or benefits. In the review of tax incidence research by Kesselman and Cheung (2004), such studies are classified into the "inequality" (INEQ) group.[4] Among INEQ studies are those that *capture fiscal subsystems consisting of individual taxes and cash benefits.* Despite certain con-

[2] Simulations also indicated that zero rates on bread and milk products (introduced later in 1999) could not mitigate VAT regressivity.

[3] Nestić (2005) estimated the contribution of pensions to disposable income inequality at *plus* 16.5% in 2002, while other social transfers contributed *minus* 2.1%. Babić (2008) estimated the contribution of pensions at *plus* 3% in 2003 (3.3% in 2005), and of other social transfers at *plus* 0.4% in 2003 (0.5% in 2005). See Section 3.5 for further information.

[4] The second group is made up of "Computable general equilibrium" (CGE) studies which examine the distribution of lifetime burdens of stylized taxes using complex mathematical economic models. "Fiscal incidence" (FINC) studies compute the pattern of progressivity or regressivity for each tax and the entire tax system using microsimulation methods.

straints[5], this framework is widely used, because it is closely connected with the traditional economic analysis of inequality and poverty. The transition from market income to disposable income is traced where the total redistributive effect is decomposed to show contributions of individual fiscal instruments.

2.2 Measures of living standard

The task of fiscal incidence research is to measure the difference between the living standard of different individuals in the *pre-fiscal* and *post-fiscal* situation, i.e. the situations *before* and *after* the government intervention takes place. In the INEQ type of research, the term pre-fiscal relates to incomes *before* direct taxation and distribution of cash benefits, hence *pre*-tax-and-benefit (pre-TB) income. On the other side, the term post-fiscal relates to incomes *after* direct taxation and cash benefits, hence *post*-tax-and-benefit (*post*-TB) income.

Usually, pre-TB income includes market income together with the value of production for own use and non-government transfers. Post-TB income relates to the disposable income of households, and is equal to pre-TB income minus direct taxes plus cash benefits. However, the analyst may use alternative definitions of pre-TB income, taxes and benefits. For example, public pensions may not be treated as benefits, but rather as a sort of market income. Similarly, SSC to the pension system may be treated as a personal investment and not as a tax.[6]

The definition of pre-TB income employed in this paper is presented by equations (1) to (4), with symbols explained in Table 1. It treats all three kinds of SSC as "taxes" and public pensions as "benefits". Notice that public pensions are presented by no less than four variables. The first division is inspired by Immervoll et al. (2005), who introduced separate treatment of two groups of pensioners: those aged less than 65, and those aged 65 years and more. The second division is between the pre-PIT and post-PIT pension income. The use of pre-PIT pensions (*xpyo* and *xpol*), when public pensions are not part of pre-TB income, creates an anomaly that would prevent the proper estimation of redistributive effect and reranking of this fiscal instrument.[7] Therefore, *npyo* and *npol* will be used instead, and consequently the redistributive effect of PIT will be underestimated, but only slightly.[8]

[5] a) Inclusion only of direct taxes and benefits in analysis; exclusion of indirect taxes and in-kind government benefits, b) Assumption that income earners cannot shift the burden of personal taxes, c) Assumption that the existence of taxes and transfers does not affect market incomes, d) Annual instead of lifetime perspective.

[6] In these cases, pensions would be included into pre-TB income, and excluded from the benefits. SSC for the pension fund would be excluded from pre-TB income and from the taxes.

[7] For example, person A, whose only income is a pension of 100 m.u. (money units), pays 10 m.u. of PIT. Now, if we take *pre-PIT* pension as benefit variable (B) and PIT paid as tax variable (T), we have the following amounts for person A: pre-TB income=0, benefits=100, taxes=10. What happens in one-by-one instrument analysis? For PIT, we would obtain the curious result that person A was burdened by tax, despite having no pre-TB income. Thus, if benefits are taxable, the analyst should use amounts net of tax. Otherwise, the tax *precedes* its tax base in the transition from pre-TB to post-TB income. Another cure for this problem is to take post-TB income as the reference base instead of pre-TB income. That is exactly what Immervoll et al (2005) did, mentioning the issue explained above as one of the motives for such decision. Further details can be found in section 2.5.

[8] According to Urban (2006), pension income contributed less than 2% of total PIT revenue in 2004.

The definition of incomes, taxes and benefits

$$X = xtmi + ntmi + nmng + sscp + ssch + sscu \quad (1)$$

$$T = sscp + ssch + sscu + pito \quad (2)$$

$$B = uneb + sicb + chla + bspa + mata + rehs + (npyo + npol) \quad (3)$$

$$N = X - T + B = (xtmi + ntmi + nmng + sscp + ssch + sscu) - (sscp + ssch + sscu + pitt) + (uneb + sicb + chla + bspa + mata + rehs + xpyo + xpol) = xtmi - pito + ntmi + nmng + uneb + sicb + chla + bspa + mata + rehs + npyo + npol \quad (4)$$

2.3 Income redistribution: basic concepts and measurement

The capacity of a fiscal system to redistribute income is often comprehended as the change of income inequality in transition from pre-TB to post-TB income. The fiscal system reduces (increases) income inequality when the *relative net gains* it creates are larger (smaller) for the income-poor than for the income-rich. This unequal treatment of unequals – the poor and the rich in income – is referred to as *vertical inequity. Horizontal inequity,* on the other side, relates to unequal treatment of equals.[9] A further concept of *reranking* corresponds to the income scale rank-switching induced by fiscal system.[10]

With G_X and G_N as Gini coefficients of pre-TB and post-TB income, the redistributive effect is equal to $RE = G_X - G_N$.[11] RE can be decomposed as $RE = V_x - R_x$, where V_x is *vertical effect,* a measure of vertical inequity, and R_x is *reranking effect,* a measure of reranking.[12] It is calculated as $R_x = G_N - D_x^N$, where D_x^N is the concentration coefficient of post-TB income, based on the concentration curve of post-TB income, C_x^N, for which the units are ordered by pre-TB income. Since R_x is always positive[13], the decomposition formula implies that more reranking means less redistributive power. The vertical effect is obtained as $V_x = G_X - D_x^N$.[14]

2.4 Decomposition of redistributive effect: contributions of individual fiscal elements

Researchers who use INEQ models capturing several fiscal instruments are faced with a natural question: How can the contributions of each of these instruments to the overall redistributive effect be determined?

Immervoll et al.(2005) "exclude" a particular tax or benefit from the income base and compare the inequality of the resulting variable with the inequality of the reference variable. In their words: "Starting from a situation where this instrument does not exist, what are the distributive effects of it?" They proceed in the following manner. *To* the post-TB income they *add* amount of each tax instrument T_i ($i = 1,\ldots, p$) separately, obtaining p variables $N + T_i$. Next, *from* the post-TB income they *subtract* amount of each benefit instru-

[9] This occurs when persons A and B have same pre-TB income, but different post-TB income.

[10] For example, if C has a greater pre-TB income but a smaller post-TB income than D.

[11] A thorough presentation of theory and measurement is given in Lambert (2001) and Duclos and Araar (2006).

[12] In the indices V_x and R_x, the subscript x denotes the reference income, in this case pre-TB income.

[13] As C_x^N cannot lie below Lorenz curve of post-TB income (L_N), it follows that $R_x \geq 0$.

[14] Subscript x in index D_x^N denotes the variable by which the income units are ordered when concentration curve C_x^N was constructed.

Table 1 Variables of income, taxes and benefits

Notation	Description
	General
X	Pre-TB income
N	Post-TB income
T	Total individual taxes
B	Total cash benefits
	Market incomes
xtmi	Market income taxable by PIT: wages and salaries, self-employment income, income from part-time and contractual work, rental income and income from property rights
ntmi	Non-taxable market income: dividends, interest
	Non-market non-fiscal incomes
nmng	Value of production for own use; Periodic transfers from private persons: gifts, alimonies
	Public pensions
xpyo	Public pensions to persons aged less than 65, before PIT
npyo	Public pensions to persons aged less than 65, after PIT (hence also „Pensions (<65)“)
xpol	Public pensions to persons aged 65 and more, before PIT
npol	Public pensions to persons aged 65 and more, after PIT (hence also „Pensions (65&>)“)
	Taxes
sscp	SSC to the pension system
ssch	SSC to the health system
sscu	SSC to the unemployment protection system
pitt	Personal income tax and local surtax, total
pito	Personal income tax and local surtax, on xtmi
pitp	Personal income tax and local surtax, on xpyo and xpol
	Benefits
bspa	Basic support allowance (*Socijalna pomoć*)
uneb	Unemployment benefit (*Naknada za nezaposlenost*)
chla	Child allowance (*Doplatak za djecu*)
sicb	Sick-leave benefit (*Naknade za bolovanje duže od 42 dana*)
mata	Maternity allowances (*Primanja na ime porodnog dopusta; Primanja za opremu novorođenčadi*)
rehs	Rehabilitation supplement (*Naknade za tjelesno oštećenje i tuđu njegu; Iznos za rehabilitaciju i zapošljavanje invalidnih osoba*)

a) The benefits other than public pensions are sorted into six groups. Basic support allowances provide subsistence to the income-poor. Rehabilitation supplement covers assistance to physically injured people and those who are taking care of them; also included is support for rehabilitation and employment of people with invalidity. Child allowance is received by families with children and income below a certain means-test level. Sick-leave benefit is paid to the people on sick leave for longer than 42 days. Maternity allowances include maternity leave allowance and layette supplement. Unemployment benefit is received in the post-job-loss period; the amount does not depend on previous earnings. Social benefits are exempted from taxation.

b) All the benefits covered by this study are cash benefits. "In-kind benefits" or services produced by government (education, health protection, etc), are not included, as is customary in INEQ studies.

c) In Croatia, SSC for pension fund is equal to 20% of gross wage and is paid by employees (maximum base is set at 20% of 6 average gross wages; average obtained at the national level). SSCs for health and unemployment protection system are equal to 15.5% and 1.7% of gross wage, respectively, and are paid by employers. For the self-employed, SSCs are lump-sum amounts. Pensions are not taxed by SSC.

d) For employees, income taxable by PIT is defined as gross wage minus SSC for pension system. For the self-employed SSCs paid are treated as expenditures. Thus, SSCs do not enter the PIT base in Croatia.

e) This research uses the classical assumption that the whole burden of SSCs, irrespectively of their statutory incidence, is borne by employees. The same assumption relates to PIT.

f) Dividends were taxable by PIT only in the period from 2001 to 2004.

g) Observe the following relationships: (xpyo+xpol) – pitp = npyo+npol; pitp = pitt – pito; xpyo + xpol – pitt = npyo + npol – pito

Source: Author

ment B_j (j=1,…, q) separately, obtaining q variables. Then they obtain Gini coefficients for $N + T_i$ and $N - B_j$, namely G_{N+T_i} and G_{N-B_j}, and calculate the difference between these coefficients and the post-TB income Gini coefficient: $G_{N+T_i} - G_N$ and $G_{N-B_j} - G_N$. These differences can finally be ranked to indicate the most (the least) redistributive instruments.

Another way to evaluate contributions of individual fiscal instruments is to decompose the vertical effect (V_x) in the manner proposed by Lambert (1985), the approach empirically used by Kim and Lambert (2007). The original decomposition is adapted here to reflect the contributions of p individual taxes and q benefits:

$$V_x = \frac{\sum_i^p t_x^i \left(D_x^{T_i} - G_X\right) + \sum_j^q b_x^j \left(G_X - D_x^{B_j}\right)}{1 - t_x + b_x} \tag{5}$$

where t_x^i and b_x^j are shares of tax i and benefit j in pre-TB income, $t_x = \sum_i^p t_x^i$ and $b_x = \sum_j^q b_x^j$, whereas $D_x^{T_i}$ and $D_x^{B_j}$ are concentration coefficients of tax i and benefit j (based on concentration curves $C_n^{T_i}$ and $C_n^{B_j}$, for which the income units are ordered by pre-TB income). The relative contributions of tax i and benefit j to overall vertical effect are respectively obtained as $\lambda_x^{T_i} = \frac{t_x^i \left(D_x^{T_i} - G_X\right)}{1 - t_x + b_x} \frac{1}{V_x}$ and $\lambda_x^{B_i} = \frac{b_x^j \left(G_X - D_x^{B_j}\right)}{1 - t_x + b_x} \frac{1}{V_x}$.

2.5 Reference income

What is the appropriate reference income in the measurement of income redistribution? Pre-TB income is commonly used in research into tax progressivity. However, Lerman and Yitzhaki (1995) disagree, "think[ing] that the after-tax ranking is the appropriate ranking for calculating progressivity". The "exclusion" method of Immervoll et al (2005) uses post-TB income as a reference income, while the "decomposition" method of Lambert (1985) takes pre-TB income by default.

However, we could consider *an exercise* in which opposite reference bases are used for two methods. In that case, the "exclusion" method would rank the differences $G_X - G_{X-T_i}$ and $G_X - G_{X+B_j}$ (instead of $G_{N+T_i} - G_N$ and $G_{N-B_j} - G_N$). For the "decomposition" method things are slightly more complicated. While the redistributive effect is still equal to $RE = G_X - G_N$, the vertical effect is now $V_n = D_N^X - G_N$, and the reranking is calculated as $R_n = G_X - D_n^X$ (according to Lerman and Yitzhaki, 1995). Note that now we have $RE = V_n + R_n$, where the reranking positively contributes to the redistributive effect. Decomposition of the vertical effect in (6) is analogous to equation (5):

$$V_n = \frac{\sum_i^p t_n^i \left(D_n^{T_i} - G_N\right) + \sum_j^q b_n^j \left(G_N - D_n^{B_j}\right)}{1 + t_n - b_n} \tag{6}$$

where t_n^i and b_n^j are shares of tax i and benefit j in post-TB income, $t_n = \sum_i^p t_n^i$ and $b_n = \sum_j^q b_n^j$, whereas $D_n^{T_i}$ and $D_n^{B_j}$ are concentration coefficients of tax i and benefit j

(based on concentration curves $C_n^{T_i}$ and $C_n^{B_j}$, for which the income units are ordered by post-TB income). The relative contributions of tax *i* and benefit *j* to overall vertical effect are respectively obtained as $\lambda_n^{T_i} = \frac{t_n^i \left(D_n^{T_i} - G_N\right)}{1 + t_n - b_n} \frac{1}{V_n}$ i $\lambda_n^{B_i} = \frac{b_n^i \left(G_N - D_n^{B_j}\right)}{1 + t_n - b_n} \frac{1}{V_n}$.

We are interested whether the contributions to redistribution significantly change when the reference bases are reversed. The results of the exercise are presented in section 3.4.

2.6 Data

The empirical research started with acquisition of microdata from the household budget survey databases (Anketa o potrošnji kućanstava; APK) obtained from the Croatian Statistical Office (Državni zavod za statistiku; DZS), for the period 2001 to 2006. APK contains the relevant data on incomes (at individual level), consumption (at household level) and other indicators for a representative sample of households. However, the data on incomes are registered net of PIT and SSC. Therefore, the author developed a microdata-model that applies tax code to the data and transforms the net incomes into gross incomes, identifying the amounts of PIT and SSC for each individual.[15] The data on social transfers are already available in APK.[16]

3 Results

3.1 Analysis by economic groups

For purpose of this descriptive analysis, benefits (other than pensions) are further grouped into means-tested (child allowance and basic support allowance) and non-means-tested (unemployment benefit, sick-leave benefit, maternity allowances and rehabilitation supplement). Household incomes, taxes and benefits are equivalized using the following formula:

$$X_i^e = X_i / e_i \tag{7}$$

$$e_i = 0{,}5 + 0{,}5 \times adults_i + 0{,}3 \times children_i \tag{8}$$

where, for household *i*: X_i is income, X_i^e is equivalized income, and e_i is the deflator with parameters defined as in the "modified OECD scale".

[15] This model uses all the data on individuals and their household members available in APK: working status, number of children and dependent spouses; place of living; net incomes by source (wages, pensions, self-employment income, capital income, rents, etc.); outlays on items such as mortgage interest rate, life insurance (needed for calculation of PIT deductions).

[16] At that moment, the dataset used in this research was the best choice for given purpose. The usual caveats for survey and micro-simulated data apply. A superior choice would be the database compiled by merging datasets from various *official* sources (for example, population survey, tax administration, pension fund, relevant welfare state ministries and agencies, etc.). Such a database has been created for Slovenia (see Čok et al, 2008).

Households are divided into four groups depending on their members' working status and age. "Fully employed" households are those with one or more working-age adults (people aged between 15 and 64 years, excluding those involved in secondary or tertiary education henceforth WAAs) under the condition that all of them are employed or self-employed. In "mixed" households at least one WAA is employed or self-employed, and at least one WAA is either unemployed or inactive. In "workless" households, there are no employed or self-employed WAAs, while one or more WAAs are unemployed or inactive. "Elderly only" households do not include WAA members. Note that some of the elders (those aged above 64 years) live in the first three groups of households, together with WAAs and children (those aged less than 15 and those involved in secondary or tertiary education).

Table 2 Defining groups of households

Type	Characterization	Equivalent units in 2005 (%)
Full employed	em > 0, un = 0, el ≥ 0	33.5
Mixed	em > 0, un > 0, el ≥ 0	32.5
Workless	em = 0, un > 0, el ≥ 0	16.2
Elderly only	em = 0, un = 0, el ≥ 0	17.8

Notes: em = employed or self-employed, un = unemployed or inactive; el = the elderly

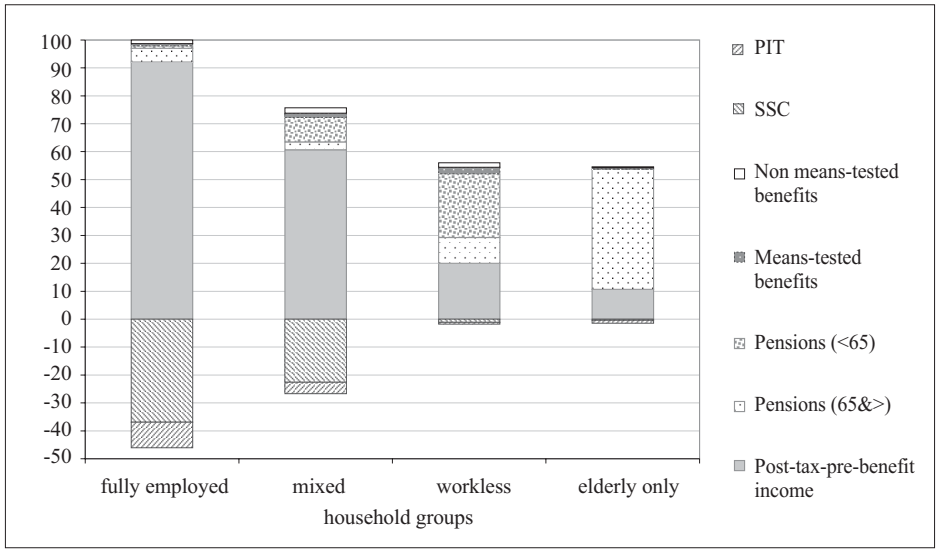
Source: Author

Figures 1 shows the composition of income in 2005 for the economic status groups. Part of each column above the horizontal axis presents the average disposable income of the corresponding group, expressed as a percentage of the average disposable income of the "fully employed" group. The sum of (a) post-tax-pre-benefit income, (b) PIT and (c) SSC, is equal to pre-TB income. Large differences in average pre-TB income are visible across the groups, indicating a high level of pre-fiscal income inequality. Roughly, the ratio of pre-TB average group incomes is 13:8:2:1, respectively. However, due to government taxes and transfers this ratio turns to the significantly milder ratio of 11:8:6:6, when we observe post-TB income. Both taxes and benefits help in the achievement of this result. Almost all taxes are paid by the first two groups. "Pensions (65&>)" can be found in all groups and naturally present the largest income component in the "elderly only" group. On the other hand, "Pensions (<65)" make almost half of disposable income of the "workless" group, largely outweighing non-pension benefits in overall importance for living standard.

3.2 Analysis by quintiles of pre-TB income distribution

Distribution analysis is repeated for households sorted into quintile groups, and the results are shown in Figure 2. The poorest 40% households hold 6.5% of total pre-TB income, but end with one quarter of disposable income. They received 59% of all pensions and other benefits, and paid 3.4% of all taxes. The middle quintile group receives in benefits just as much as it contributes through taxes, which keeps its piece of income cake un-

Figure 1 Composition of total income in 2005 by economic groups



Notes: Group averages expressed as percentages of "Fully employed" average disposable income. "Post-tax-pre-benefit income" is equal to xtmi+ntmi+nmng–pito.

Source: Author's calculations based on APK

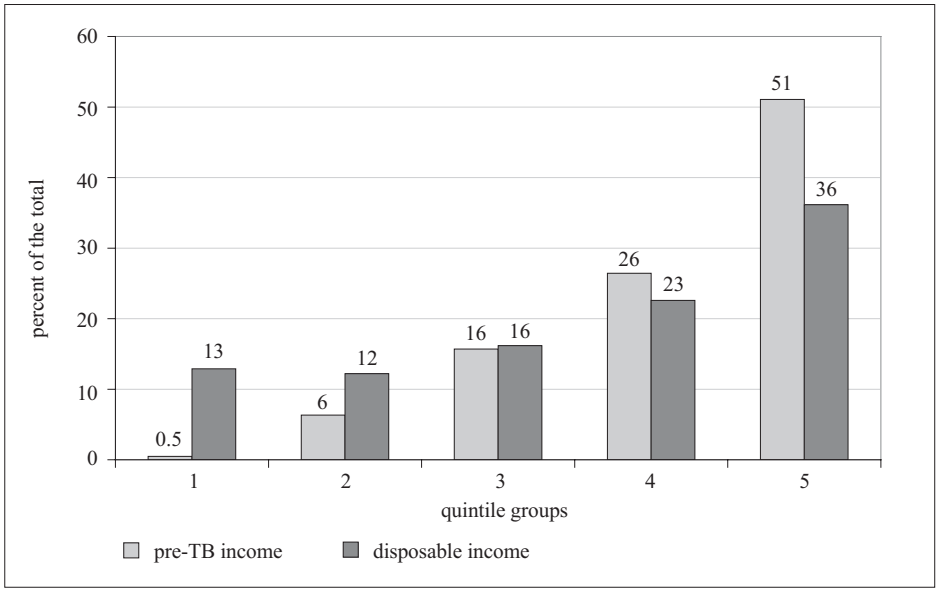
changed in the transition from market to disposable income. On the other hand, the share of the top quintile falls from 1/2 of pre-TB income to 1/3 of disposable income. Comparison of "SSC and PIT" columns with "Pre-TB income" columns for each quintile group gives us impression that total taxes are mildly progressive. We therefore expect that more important wheel of redistribution will be public pensions.

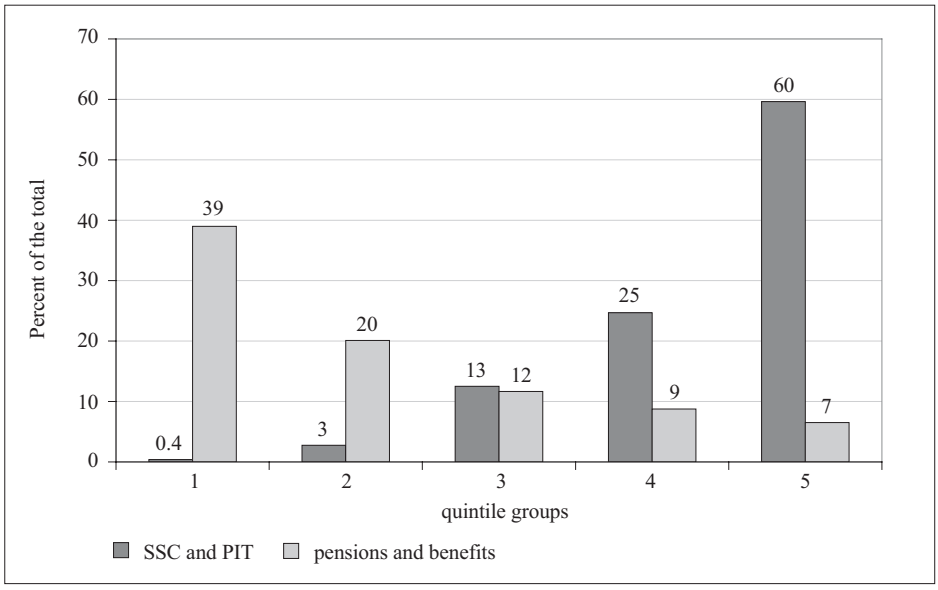
3.3 Measures of redistributive effect

As Table 3 presents, the fiscal system defined by equations (1) to (4) achieves a reduction of income inequality of about 40%, as the Gini coefficient decreases from 0.5144 to 0.2963 in the transition from pre-TB to post-TB income. The reranking introduced by the system is relatively high. A common interpretation of the reranking measure is the following: the redistributive effect would be 25% higher if reranking were eliminated. However, before making such a conclusion, the analyst must carefully consider the fiscal instruments involved. As will be seen later, most of the reranking is caused by pensions. In this case, elimination of reranking might call for considerable changes in the design of the pension and overall fiscal system.[17] It will be shown later how much reranking is caused by other instruments.

[17] The issue of reranking is controversial and will receive more attention later during this project.

Figure 2 Distribution of income, taxes and benefits in 2005, by quintile groups





Source: Author's calculations based on APK

3.4 Contributions of individual fiscal elements

Table 4 contains the information needed to decompose the redistributive effect into the contributions of individual fiscal elements. Before they are used in decomposition, it

Table 3 Inequality and redistributive effect

G_X	G_N	D_x^N	D_x^X	RE	RE (% G_X)	V_X	R_X	R_X (% RE)
0.5144	0.2963	0.2418	0.4389	0.2181	42	0.2726	0.0545	25

Source: author's calculations based on APK

is instructive to look at the individual columns. Among taxes, PIT is the most *progressive* ($D_x^{Ti} = 0.7710$), while among benefits, basic support allowance is the most *regressive* ($D_x^{Bj} = -0.5422$); this is expected because the two instruments are designed and calibrated with the purpose of income redistribution. "Pensions (65&>)" are very close in regressivity to basic support allowance ($D_x^{Bj} = -0.5045$), but their amount is many times larger, and this makes "Pensions (65&>)" the most influential redistributive element (V_x^{Bj}=0.1260; while V_x^T for all taxes together is 0.0406). The other pension category, "Pensions (<65)" is only half as regressive ($D_x^{Bj} = -0.2607$).

Columns 6 and 7 in Table 4 present the inequality of income (G_{X-T_i}; G_{X+B_j}) and redistributive effect (RE_x^{Ti} and RE_x^{Bi}) that would prevail if only the particular instrument was applied to the pre-TB income. Rerankings are also calculated for this case; the largest reranking relative to RE_x^{Ti} (RE_x^{Bi}) of 38% is measured for "Pensions (<65)", while for example, for PIT it is less than 2%.

All calculations are now repeated for post-TB income as a reference base, and the results are shown in Table 5. To ask the main question again: which instruments are most important in achieving redistribution in Croatia? Tables 4 and 5 contain all the relevant data to compare the results for two approaches: the "decomposition" (Lambert, 1985) and "exclusion" (Immervoll et al, 2005) approaches, and for two reference bases: pre-TB income and post-TB income. Redistributive effects of single instruments can be found in columns 7 and 12 of Tables 4 and 5 respectively, but for now we are more interested in the rankings shown in columns 8 and 13 of the same tables. These rankings are copied into the Table 6, and sorted in ascending order of the first column.

When pre-TB is the reference income "decomposition" and "exclusion" methods give almost identical results (columns 1 and 2 of Table 6). 'Exclusion method & post-TB income' (Table 6, column 4; this combination is used by Immervoll et al, 2005) ranks the first three instruments in the same way as the approaches in columns 1 and 2, while the five bottom-ranked instruments have the same order as in column 3. The most striking discrepancy appears between the 'decomposition method & post-TB income' (Table 6, column 3) and all other models. "Pensions (<65)" are only ranked 5 here in contrast to rank 2 in all other models, while PIT with the rank 2, is just below the "Pensions (65&>)" which are unambiguously the prime redistributive instrument.

The difference between pre-TB and post-TB income as reference bases is also illustrated by Figure 3, which presents the results obtained by the "decomposition" method (column 12 of Tables 4 and 5). Pensions together capture over 80% of the redistributive effect if pre-TB income is chosen, but only 40% in the case of post-TB income. The contribution of "Pensions (<65)" shrinks from 25% to 7%, while that of PIT rises from 5%

Table 4 Decomposition of vertical effect, reference income: pre-TB income

	1	2	3	4	5	6	7	8	9	10	11	12	13
	$D_x^{T_i}$	$D_x^{T_i} - G_X$	t_x^i	$V_x^{T_i}$	$D_x^{X-T_i}$	G_{X-T_i}	$RE_x^{T_i}$	$RE_x^{T_i}$ (rank)	$RE_x^{T_i}$	$RE_x^{T_i}$ (% RE)	$\lambda_x^{T_i}$	$\lambda_x^{T_i}$ (%V)	$\lambda_x^{T_i}$ (rank)
sscp	0.5696	0.0552	0.1341	0.0085	0.5059	0.5065	0.0079	4	0.0006	8.0	0.0078	2.8	4
ssch	0.5696	0.0552	0.1039	0.0064	0.5080	0.5084	0.0060	5	0.0004	5.9	0.0060	2.2	6
sscu	0.5847	0.0703	0.0106	0.0008	0.5136	0.5136	0.0008	12	0.0000	0.7	0.0008	0.3	12
pito	0.7710	0.2566	0.0558	0.0152	0.4992	0.4994	0.0150	3	0.0002	1.5	0.0150	5.5	3
Taxes	0.6070	0.0926	0.3045	0.0406	0.4738	0.4775	0.0369		0.0037	10.0	0.0296	10.8	
	$D_x^{B_j}$	$G_X - D_x^{B_j}$	b_x^j	$V_x^{B_j}$	$D_x^{X+B_j}$	G_{X+B_j}	$RE_x^{B_i}$	$RE_x^{B_i}$ (rank)	$RE_x^{B_i}$	$RE_x^{B_i}$ (% RE)	$\lambda_x^{B_j}$	$\lambda_x^{B_i}$ (%V)	$\lambda_x^{B_i}$ (rank)
uneb	-0.1388	0.6532	0.0060	0.0039	0.5105	0.5110	0.0034	8	0.0005	13.9	0.0041	1.5	8
sicb	-0.1413	0.6557	0.0029	0.0019	0.5125	0.5128	0.0016	11	0.0003	20.2	0.0020	0.7	11
chla	-0.1082	0.6226	0.0100	0.0062	0.5082	0.5086	0.0058	6	0.0003	6.0	0.0065	2.4	5
bspa	-0.5422	1.0566	0.0053	0.0056	0.5088	0.5094	0.0050	7	0.0006	12.9	0.0059	2.2	7
mata	0.0400	0.4744	0.0044	0.0021	0.5123	0.5127	0.0017	10	0.0003	18.6	0.0022	0.8	10
rehs	-0.1502	0.6646	0.0040	0.0026	0.5118	0.5123	0.0021	9	0.0006	28.6	0.0028	1.0	9
npyo	-0.2607	0.7751	0.0847	0.0605	0.4539	0.4705	0.0439	2	0.0166	37.9	0.0688	25.3	2
npol	-0.5045	1.0189	0.1411	0.1260	0.3884	0.4169	0.0975	1	0.0285	29.2	0.1508	55.3	1
Benefits	-0.3829	0.8973	0.2583	0.1842	0.3302	0.3596	0.1548		0.0294	19.0	0.2430	89.2	

Source: Author's calculations based on APK

Table 5 Decomposition of vertical effect, reference income: post-TB income

	1	2	3	4	5	6	7	8	9	10	11	12	13
	$D_n^{T_i}$	$D_n^{T_i} - G_N$	t_n^i	$V_n^{T_i}$	$D_n^{N+T_i}$	G_{N+T_i}	$RE_n^{T_i}$	$RE_n^{T_i}$ (rank)	$RE_n^{T_i}$	$RE_n^{T_i}$ (%RE)	$\lambda_n^{T_i}$	$\lambda_n^{T_i}$ (%V)	$\lambda_n^{T_i}$ (rank)
sscp	0.4728	0.1766	0.1406	0.0218	0.3180	0.3208	0.0246	4	0.002804	11.4	0.0237	16.6	3
ssch	0.4728	0.1766	0.1089	0.0173	0.3136	0.3154	0.0191	5	0.001800	9.4	0.0183	12.9	4
sscu	0.4897	0.1934	0.0112	0.0021	0.2984	0.2984	0.0022	9	0.000028	1.3	0.0021	1.4	9
pito	0.7447	0.4484	0.0586	0.0248	0.3211	0.3215	0.0252	3	0.000434	1.7	0.0250	17.6	2
Taxes	0.5233	0.2270	0.3192	0.0549	0.3512	0.3596	0.0633		0.008384	13.2	0.0691	48.5	
	$D_n^{B_j}$	$G_N - D_n^{B_j}$	b_n^j	$V_n^{B_j}$	$D_n^{N-B_j}$	G_{N-B_j}	$RE_n^{B_j}$	$RE_n^{B_j}$ (rank)	$RE_n^{B_j}$	$RE_n^{B_j}$ (% RE)	$\lambda_n^{B_j}$	$\lambda_n^{B_j}$ (% V)	$\lambda_n^{B_j}$ (rank)
uneb	-0.1848	0.4810	0.0063	0.0030	0.2993	0.2999	0.0037	8	0.000653	17.7	0.0029	2.0	8
sicb	-0.0685	0.3648	0.0030	0.0011	0.2974	0.2978	0.0016	11	0.000481	30.4	0.0010	0.7	11
chla	-0.3071	0.6033	0.0105	0.0064	0.3026	0.3032	0.0069	6	0.000566	8.1	0.0060	4.2	6
bspa	-0.5957	0.8920	0.0056	0.0050	0.3013	0.3018	0.0055	7	0.000491	8.9	0.0048	3.3	7
mata	0.0301	0.2662	0.0046	0.0012	0.2975	0.2982	0.0019	10	0.000678	35.6	0.0012	0.8	10
rehs	0.1846	0.1117	0.0042	0.0005	0.2967	0.2973	0.0011	12	0.000613	56.7	0.0004	0.3	12
npyo	0.1543	0.1420	0.0888	0.0138	0.3101	0.3391	0.0428	2	0.029000	67.7	0.0120	8.4	5
npol	-0.0242	0.3204	0.1480	0.0556	0.3519	0.4040	0.1078	1	0.052125	48.4	0.0452	31.7	1
Benefits	0.0116	0.2847	0.2708	0.1057	0.4020	0.4775	0.1813		0.075518	41.7	0.0735	51.5	

Source: Author's calculations based on APK

Table 6 Contributions to redistributive effect, rankings obtained by different methods

Method	Decomposition of vertical effect	Exclusion of one-by-one instrument from the base	Decomposition of vertical effect	Exclusion of one-by-one instrument from the base
Reference income	Pre-TB		Post-TB	
	1	2	3	4
Pensions (65&>)	1	1	1	1
Pensions (<65)	2	2	5	2
PIT	3	3	2	3
Child allowance	4	4	3	4
Basic support allowance	5	6	6	6
SSC to the pension system	6	5	4	5
SSC to the health system	7	7	7	7
Unemployment benefit	8	8	8	8
Rehabilitation supplement	9	9	12	12
Maternity allowances	10	10	10	10
Sick-leave benefit	11	11	11	11
SSC to the unemployment protection system	12	12	9	9

Source: Author's calculations based on APK

to 15% when the base is changed from pre- to post-TB income. While almost negligible when pre-TB is used, in post-TB income the combined SSCs become a major contributor to redistribution with 32% of the overall vertical effect.

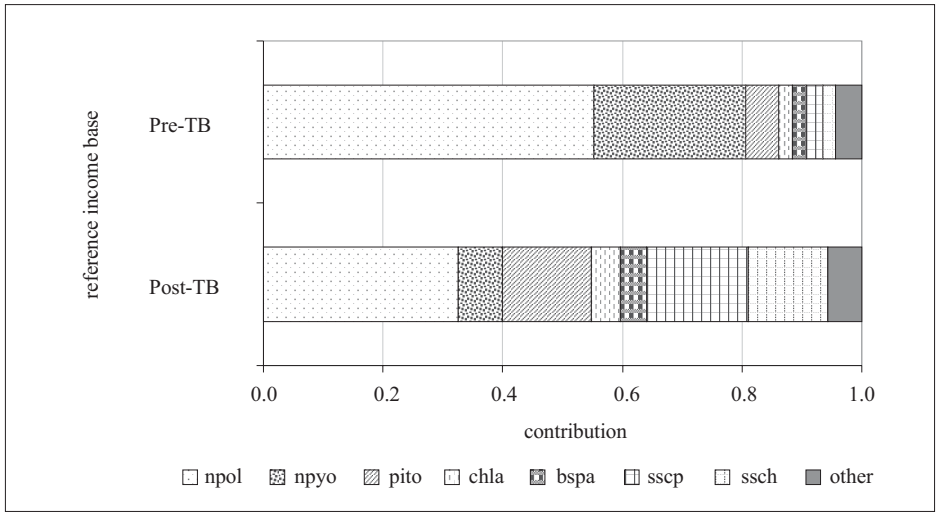
This discrepancy in the results obtained for the "decomposition method" and the different reference bases might be explained as follows.. When post-TB income is used as a reference base, reranking positively contributes to the redistributive effect (remember that). Now, observe in Table 5 (column 10) that "Pensions (<65)" achieve a remarkably high 67.7% of *RE* through reranking and only 32.3% through vertical effect. Since the "decomposition" approach considers only the vertical effect, it thus underestimates the contribution to the redistributive effect of instruments such as "Pensions (<65)".

3.5 Comparison of results with other studies for Croatia

Two studies for Croatia mentioned in the introduction contradict the findings of this research. Both Nestić (2005) and Babić (2008) concluded that public pensions are inequality-*increasing* instrument, which is completely opposite to the result from section 3.4 of this paper, which says that public pensions are the main inequality-*decreasing* instrument. Where does this discrepancy come from? Which result is true?

The above-mentioned studies used the methodology given in Rao (1969), Kakwani (1977), and Fei, Ranis and Kuo (1978), which relates to the decomposition of the Gini coefficient, separating the influences of different income sources on disposable income

Figure 3 Contributions to vertical effect obtained by decomposition



Source: Author's calculations based on APK

inequality. Thus, it decomposes income *inequality*, while the methodologies presented in section 2.4 decompose redistributive effect, or *change in inequality* of income that emerges in the transition from pre-TB to post-TB income.

The differences in results deserve attention, and the topic may be further investigated during the next stage of this research. In this paper, we can announce two possible reasons for the contradictory results:

a) *The inequality decomposition approach* (Rao, 1969, etc.) is very rigorous in declaring benefits as "inequality-reducing". Only if the concentration coefficient of benefit *j* is negative ($D_n^{Bj} < 0$), is this benefit said to be "inequality-reducing". Otherwise (i.e. if $D_n^{Bj} > 0$), benefit *j* is claimed to be "inequality-increasing". For the *vertical effect decomposition* approach (Lambert, 1985), the condition to declare benefit *j* as "inequality-reducing" is much less demanding: $D_n^{Bj} < G_N$.

The situation is opposite for taxes. For the *inequality decomposition* approach it only has to be $D_n^{Ti} > 0$ and tax *i* will be called "inequality-reducing". For the *vertical effect decomposition* approach the condition is much more demanding: $D_n^{Ti} > G_N$.

b) The two studies do not include taxes in the analysis. Thus, for example, in the examination of pension system, only one-half of it is covered – the pensions, but not the contributions. According to research by Čok and Urban (2007), it seems that the inclusion of taxes into the above mentioned *inequality decomposition* analyses could change the conclusions in favor of the "inequality-reduction" stance of some fiscal subsystems in Croatia.[18]

[18] This research applied inequality decomposition in the estimation of the redistributive effect of PIT in Croatia and Slovenia. It was based on administrative data. Pensions in Croatia in 2001 contributed *plus* 8.3%, to disposable income inequality with while PIT contributed *minus* 21.4%.

4 Conclusion

Research on fiscal incidence and redistributive effects in Croatia started from the choice of appropriate framework for analysis. Following many other researchers, the author decided to measure the incidence of the fiscal subsystem consisting of individual taxes (SSC and PIT), public pensions, means-tested and non-means tested cash benefits. The unit of analysis is the household, whose incomes, taxes and benefits are equivalized in order to adjust for differences in needs. Transition from *pre-* to *post*-tax-and-benefit income is carefully dissected and analyzed to reveal which instruments contribute most to the reduction of inequality. *According to preliminary calculations from 2005 APK data, the Croatian system of individual taxes, pensions and social benefits seems to be highly redistributive, public pensions being the instrument contributing the most, followed by SSC and PIT.*

It was also shown that the choice of reference income – between pre-TB and post-TB income – may lead to considerably different conclusions about contributions of individual fiscal instruments to overall redistributive effect. An exercise with Croatian data shows that when the reference base is changed from pre-TB to post-TB income in the context of the vertical effect decomposition defined by Lambert (1985), the contribution of public pensions falls from 80% to 40%, while the contribution of individual taxes rises from 11% to 47%. However, further research is required to understand these discrepancies.

This paper has not dealt with policy issues and recommendations, but these will be covered in the final stage of the research project. Nevertheless, a number of questions can already be raised to which this research will be able either to find answers or to contribute to the finding of them. Let us mention some of them. How does the Croatian fiscal system stand comparison with that of EU countries in terms of income redistribution? Are the individual instruments and the system as a whole redistributive *enough*? Are there some instruments that are not equitable? Should taxes be more progressive? Can the overall redistributive effect be significantly altered through changes of the PIT rate schedule? How can total welfare be increased keeping the total amount of expenditures and taxes unchanged?

LITERATURE

Babić, Z., 2008. "Redistribucijski učinci socijalnih transfera u Republici Hrvatskoj". *Revija za socijalnu politiku*, 15 (2), 151-169.

Blažić, H. and Denona, N., 2000. "Distributional Effects of VAT in Central and Eastern Europe: The case of Croatia". *Proceedings of Rijeka Faculty of Economics – Journal of Economics and Business*, 18 (1), 57-70.

Čok, M. and Urban, I., 2007. "Distribution of income and taxes in Slovenia and Croatia", *Post-Communist Economies*. 19 (3), 299-316.

Čok, M. [et al.], 2008. "Use of simulation models for the tax reform in Slovenia". *Financial Theory and Practice*, 32 (1), 29-43.

Duclos, J.-Y. and Araar, A., 2006. *Poverty and Equity Measurement, Policy and Estimation with DAD.* New York: Kluwer Academic Publishers

Fei, J. C. H., Ranis, G. and Kuo, S. W. Y., 1978. "Growth and family distribution of income by factor components". *Quarterly Journal of Economics*, 92, 17-53.

Immervoll, H. [et al.], 2005. "Household incomes and redistribution in the European Union: quantifying the equalising properties of taxes and benefits". *EUROMOD Working Paper* No. EM9/05.

Kakwani, N. C., 1977. "Applications of Lorenz Curves in Economic Analysis". *Econometrica*, 45 (3), 719-728.

Kesner-Škreb, M. [et al.], 2001. "Progresivnost poreza na dohodak u Hrvatskoj u razdoblju od 1995. do 1999.". *Financijska teorija i praksa*, 25 (2), 139-260.

Kesselman, J. R. and Cheung, R., 2004. "Tax Incidence, Progressivity, and Inequality in Canada". *Canadian Tax Journal / Revue Fiscale Canadienne*, 52(3), 709-789.

Kim, K. and Lambert, P. J., 2007. "Redistributive Effect of US Taxes and Public Transfers, 1994-2004". *University of Oregon Economics Discussion Paper,* No. 2007-3. Eugene, OR: University of Oregon.

Lambert, P. J., 1985. "On the redistributive effect of taxes and benefits". *Scottish Journal of Political Economy*, 32 (1), 39-54.

Lambert, P. J., 2001. *The Distribution and Redistribution of Income*. Manchester: Manchester University Press.

Lerman, R. I. and Yitzhaki, S., 1995. "Changing ranks and the inequality impacts of taxes and transfers". *National Tax Journal*, 48 (1), 45-59.

Nestić, D., 2005. "Income distribution in Croatia: what do the household budget survey data tell us?". *Financial Theory and Practice*, 29 (1), 59-73.

Rao, V. M., 1969. "Two Decompositions of Concentration Ratio". *Journal of the Royal Statistical Society*, 132 (3), 418-425.

Urban, I., 2006. "Progressivity of personal income tax in Croatia: decomposition of tax base and rate effects". *Financial Theory and Practice*, 30 (3), 207-231.

World Bank, 2001. *Croatia: Economic Vulnerability and Welfare Study*. Poverty Reduction and Economic Management Unit Europe and Central Asia Region, World Bank, Report No. 22079-HR

World Bank, 2006. *Croatia: Living Standards Assessment, Volume 1: Promoting Social Inclusion and Regional Equity*. Poverty Reduction and Economic Management Unit Europe and Central Asia Region, World Bank, Report No. 37992