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# Research on Redistributive Effects of Croatian Fiscal System

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# Research on redistributive effects of Croatian fiscal system

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## Abstract

The paper discusses motivation aspects, research methods, and preliminary results of the research on fiscal incidence and redistributive effects in Croatia. The research project started with choosing appropriate framework for analysis. Following many other authors, the incidence of fiscal subsystem consisting of direct taxes (SSC and PIT), public pensions, means-tested and non-means tested cash benefits is measured. Transition from pre- to post-transfer-and-benefit income will be analyzed to reveal which instruments contribute most to the inequality reduction. Based on preliminary calculations from 2005 data, Croatian system of direct taxes, pensions and social benefits seems to be highly redistributive, with public pensions being the most contributive instrument, followed by SSC and PIT.

**Keywords:** income inequality, redistribution, fiscal instruments

**JEL:** D31, H22, H23, H53

## 1. Introduction

The state affects the living standards of individuals in many ways: through provision of *public services*, like defense, health, education, maintaining infrastructure, through *cash and in-kind transfers* to certain groups of people, *subsidies* to firms; in order to finance the expenditures, the state must take from the citizens a part of their income or assets, mostly in form of *taxes*. Furthermore, each interaction of the state with the market – through taxation, consumption of goods, and production of public services and regulation of economy – affects *relative prices* of consumption, capital and labor goods and services, which are now different from those that would prevail on the free market.

Government involvement in the market affairs results in varying net increases or decreases of the living standards for different individuals. What is the distribution of these changes in the living standards among the population? Is distribution of the benefits and burdens of state activities equitable? Economists in the field of fiscal incidence and distributive justice attempt

to answer these questions. The task of fiscal incidence research is to measure the difference between the living standards of different individuals in the situation without government intervention and the actual situation.

Instead of analyzing total fiscal system, researchers often decide to concentrate on its segments: single tax forms or groups of taxes and/or benefits. In terms of classification by Kesselman and Cheung (2004), these studies fall into "inequality" (INEQ) group.[1] These authors mention some important deficiencies of INEQ studies: a) inclusion only of direct taxes and benefits in analysis, excluding indirect taxes and in-kind government benefits, b) assumption that income earners cannot shift the burden of personal taxes, c) assumption that existence of taxes and transfers does not affect market incomes, d) annual instead of lifetime perspective.

Among INEQ studies are those that *capture fiscal subsystems consisting of direct taxes and cash benefits*. Despite numerous constraints, they provide a consistent framework closely connected with the traditional economic analysis of inequality and poverty. The unit of analysis is usually a household, while a measure of living standard is income. Transition from market income to disposable income is traced where the total redistributive effect can be decomposed to show contributions of different fiscal instruments.

Research by Immervoll et al (2005) measures redistributive effects of wide range of direct taxes and transfers, explaining transition in income inequality from market to disposable income. This is done her for 15 EU (old member) states, using a unified framework of

[1] Kesselman and Cheung (2004) recognize three large groups of fiscal incidence research studies: „Inequality (INEQ) studies measure the inequality reduction from taxes borne directly by individuals, principally the personal income tax. Computable general equilibrium (CGE) studies examine the distribution of lifetime utility 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."

EUROMOD, a microsimulation model that enables greater conceptual consistency and comparability than common studies based on country-specific data. The fiscal instruments are divided into several groups: personal income tax, social security contributions (those paid by employer are excluded), means-tested benefits, non means-tested benefits, and state pensions (the last are defined to be restricted to those aged 65 or more, while the rest is included into benefits). The authors conclude that the variation in size and structure of direct taxes and cash benefits is among the most important determinants in income inequality across countries. Another recent INEQ study is Kim and Lambert (2007) which measures redistributive effects of US direct taxes and transfers in the period from 1994 to 2004, with emphasis on estimation of horizontal inequity. Similar study, covering also tax expenditures, is done by Ervik (1998) for eight developed countries. The focus of Duclos and Lambert (2000) and Duclos, Jalbert and Araar (2003) studies is on methodological issues in measurement of horizontal inequity, but the results for redistributive effects of Canadian tax and transfer system in the period from 1981 to 1994 are also presented. Förster and Pearson (2002) analyze wider range of factors influencing income inequality, among them taxes and transfers in OECD countries. Jännti (1997) concentrates on five developed countries and applies various decompositions to isolate contributions of different income sources – among them taxes and transfers – to overall inequality.

In Croatia, distribution of fiscal burdens and benefits and income redistribution are only partially investigated. There is some knowledge about distribution of personal income tax (Kesner-Škreb et al, 2001; Urban, 2006) and value added tax (Blažić and Denona, 2000). Nestić (2005) whose work primarily focused on net income inequality gives some insights into distribution of social benefits. However, no attempt was made to provide a combined incidence calculation for several tax and benefit instruments.

The study of the World Bank (2006) has recently confirmed the findings of previous research (World Bank, 2001; Nestić, 2005) that the income inequality in Croatia is mild in international comparisons and among the lowest when transition countries from the region are concerned. Gini coefficient of disposable income amounted to 0.275 in 2004.[2] Poverty rate, measured using international poverty line $PPP 4.3 per day per person was 4% in the same year, significantly lower than in the rest of the region.[3]

Is this relatively low inequality of income distribution and poverty rate inherent to Croatian economy and society or perhaps it is a consequence of fiscal activities of government? *Given the experience from other countries, and the fact that the share of government in GDP is high, we can put forward a hypothesis that government in Croatia has a significant influence on distribution of income.*

There are always complaints in public (and certainly, there will always be) that some groups of people are receiving too small share from the government, while other groups pay too little for what they obtain from it. It is therefore not surprising that the changes in the fiscal system are often motivated by attempts to change distribution of fiscal burdens and benefits in favor of one group of people or another. However, since the fiscal incidence is still not enough explored, conclusions about reform paths must often be based on "feelings" and not on positive cognition.

*This paper discusses motivation aspects, research methods, and preliminary results of the research on fiscal incidence and redistributive effects in Croatia.* It follows the approach by Immervoll et al (2005) and Kim and Lambert (2007), and captures the fiscal subsystem

[2] Measurement based on disposable income including in-kind income and self-reported rental values for owner-occupied dwellings; household income equivalized using modified OECD scale (1;0.5;0.3).

[3] However, this indicator may be a consequence of relatively higher average living standards than in other observed countries.

consisting of several important fiscal instruments: social security contributions, personal income tax, public pensions, and means-tested and non means-tested cash benefits.

Based on results from other country studies, and after preliminary analysis of data for the year 2005 (further details below), several theses for the research could be derived: (a) Government redistributive policies are one of the prime determinants of disposable income inequality in Croatia; (b) The largest part of income redistribution process is achieved through the public pension system; (c) Fiscal instruments are highly efficient in reducing inequality (well-targeted and introducing low horizontal inequalities).

The rest of the paper is organized as follows. Section 2 begins with description of data source and preparation process, and continues with definitions of income components and aggregates. The rest of this section gives a short overview of income inequality (redistribution) measures, and various decompositions of these measures by which effectiveness of fiscal system and individual instruments can be evaluated. Section 3 illustrates some of the most important preliminary results obtained for year 2005. Section 4 resumes the findings and traces the path of the next stages in research.

## 2. Data and methodology

### *2.1. Data*

The empirical research on incidence and redistributive effects of direct taxes and benefits in Croatia started in the beginning of 2007, with acquisition of microdata from the household budget survey databases (Anketa o potrošnji kućanstava; APK) obtained from Croatian Statistical Office (Državni zavod za statistiku; DZS), for the period 2001 to 2005.[4] APK

[4] The first APK was collected in 1998. However, because of changes in methodology these older surveys (1998-2000) are not comparable with new ones, and were not available from the provider. Acquisition of 2006 APK data is planned (in process).

contains the relevant data on incomes (on individual level), consumption (on household level) and other indicators for representative sample of households. However, the data on incomes are registered only in net terms (net of PIT and other individual taxes). Therefore, a microdata-model that applies tax code to the data had to be developed, which transforms the net incomes into gross incomes, identifying amounts of PIT and SSC for each individual. The data on social transfers are already available in APK.

### *2.2. Measures of living standard*

*Pre-fiscal* income usually includes market income augmented by the value of production for own use, alimonies, and non-government transfers. *Post-fiscal* income relates to disposable income of households, and is equal to pre-fiscal income diminished by direct taxes, and augmented by cash benefits. However, in this research the term „post-fiscal“ is not really appropriate, because fiscal system influences living standards beyond effects of direct taxes and cash benefits, through indirect taxes and in-kind benefits. Therefore, it seems more correct to use the terms pre-tax-and-benefit and post-tax-and-benefit income (henceforth pre-TB and post-TB income). Depending on what the analyst decides to include into “market income”, “taxes” and “benefits”, various definitions of pre-TB income can be used to evaluate redistributive effects. For example, public pensions may be treated as part of the market income (and not as benefits), while contributions to the pension system are treated as means of long-term investment (not taxes).

One definition of pre-TB income is presented by equations (1) to (4), with symbols explained in Table 1. Pre-tax income here does not contain any income coming from the state budgets, but captures all SSC, thus treating them as taxes. Notice that public pensions are presented by no less than four variables. The first division is inspired by Immervoll et al (2005), introducing 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.[5] Use of pre-PIT pensions (XMML and XMST) in this case would mean that, in transition from pre-TB income (X) to post-TB income (N), the PIT contained in pre-PIT pensions *precedes* its tax base. This creates an anomaly that would be observed later when it comes to measurement of redistributive effects and reranking of individual fiscal instruments.[6]

Equations (5) to (8) present "Inverted basic" definitions of incomes, taxes and benefits, that are obtained by exchanging content with corresponding variables from (1) to (4). Pre-TB income in (5), $\widetilde{X}$, is equal to post-TB income in (4), etc. The variables will be needed in Section 3.

"Basic" definition of income

(1) $X$ = OXBM + NNTD + TRNK + DOPM + DOPZ + DOPN

(2) $T$ = DOPM + DOPZ + DOPN + POPO

(3) $B$ = NNEZ + BOLO + DDOP + PUZD + PORD + NJEG + (NMML + NMST)

(4) $N = X - T + B =$
= (OXBM + NNTD + TRNK + DOPM + DOPZ + DOPN) – (DOPM + DOPZ + DOPN + POPR) + (NNEZ + BOLO + DDOP + PUZD + PORD + NJEG + XMML + XMST)
= OXBM – POPO + NNTD + TRNK + NNEZ + BOLO + DDOP + PUZD + PORD + NJEG + NMML + NMST

"Inverted basic" definition of income

(5) $\widetilde{X} = N$ = (OXBM – POPO) + (NNTD + TRNK + NNEZ + BOLO + DDOP + PUZD + PORD + NJEG) + (NMML + NMST)

(6) $\widetilde{T} = B$ = NNEZ + BOLO + DDOP + PUZD + PORD + NJEG + (NMML + NMST)

(7) $\widetilde{B} = T$ = DOPM + DOPZ + DOPN + POPO

(8) $\widetilde{N} = \widetilde{X} - \widetilde{T} + \widetilde{B} =$
= (OXBM – POPO + NNTD + TRNK + NNEZ + BOLO + DDOP + PUZD + PORD + NJEG + XMML + XMST) – (NNEZ + BOLO + DDOP + PUZD + PORD + NJEG + NMML + XMST) + (DOPM + DOPZ + DOPN + POPO)
= OXBM + NNTD + TRNK + DOPM + DOPZ + DOPN

[5] Pensions in Croatia are not taxed by SSC. PIT is not levied on other social transfers.

[6] See Appendix for explanation and example. Immervoll et al (2005) pointed out to this problem, but did not go into details explaining the reasons why it occurs.

Table 1. Variables of income, taxes and benefits

| Notation | Description | |
|---|---|---|
| **General** | | |
| X | Pre-tax-and-transfer income | |
| N | Post-tax-and-transfer income | |
| T | Total taxes | |
| B | Total benefits | |
| **Market incomes** | | |
| OXBM | Market income taxable by PIT (excluding pensions): wages and salaries, self-employment income, rental income, income from part-time and contractual work, income from property rights, and capital income | |
| NNTD | Non-taxable market income (agriculture production) | |
| **Non-market non-government (periodic) incomes** | | |
| TRNK | Transfers from private persons, alimonies, etc | |
| **Public pensions** | | |
| XMML | Public pensions to persons aged less than 65 (before PIT) | |
| NMML | Public pensions to persons aged less than 65 (after PIT) | |
| XMST | Public pensions to persons aged 65 and more (before PIT) | |
| NMST | Public pensions to persons aged 65 and more (after PIT) | |
| **Taxes** | | |
| DOPM | SSC to the pension system | |
| DOPZ | SSC to the health system | |
| DOPN | SSC to the unemployment protection system | |
| POPR | Personal income tax and local surtax (total) | |
| POPO | Personal income tax and local surtax (on OXBM) | |
| POPM | Personal income tax and local surtax (on XMML and XMST) | |
| **Benefits** | | |
| NNEZ | Unemployment benefit | |
| BOLO | Sickness benefit | |
| DDOP | Child allowance | |
| PUZD | Family support allowance (FSA) | |
| PORD | Maternity allowance | |
| NJEG | Rehabilitation supplement | |

Note the following relationships: (XMML+XMST) – POPM = (NMML+NMST); POPM = POPR – POPO
XMML + XMST – POPR = NMML + NMST – POPO

### *2.3. Measures of income inequality and redistributive effect*

Income inequality will be measured by the generalized (extended) Gini coefficient, while in certain cases generalized entropy index will appear very useful. Redistributive effect (*RE*) is a difference between Gini coefficients of pre-TB ($G_X$) and post-TB income ($G_N$) [$RE = G_X - G_N$]. Vertical component of redistributive effect (shorter: vertical effect) is a difference between $G_X$ and concentration coefficient of post-TB income ($D_N$) [$V = G_X - D_N$]. Thus, both indexes, *RE* and *V*, describe transition from pre-TB to post-TB

income, and if there would be no reranking, the following equalities would prevail: $G_N = D_N$ and $RE = V$. Reranking is common in practice, and is measured as difference between post-TB income Gini and concentration coefficients [$R = G_N - D_N$]. Finally, redistributive effect (*RE*) can be decomposed into vertical (*V*) and reranking (*R*) components as $RE = V - R$.

### *2.4. Decomposition of redistributive effect: contributions of individual fiscal elements*

Contributions of individual fiscal instruments to redistributive effect of the whole system were calculated by researchers in different ways. Immervoll et al (2005) proceed in the following manner. *To* the post-TB income (*N*) they *add* amount of each tax instrument $T^i$ (*i*=1,…,*m*) separately, obtaining *m* variables $N + T^i$. *From* the post-TB income (*N*) they *subtract* amount of each benefit instrument $B^j$ (*j*=1,…,*n*) separately, obtaining *n* variables $N - B^j$. Then they obtain Gini coefficients for variables $N + T^i$ and $N - B^j$, namely $G^i_{N+T}$ and $G^j_{N-B}$, and calculate the difference between them and the post-TB income Gini coefficient, $G^i_{N+T} - G_N$ and $G^j_{N-B} - G_N$. These differences can then be ranked to indicate the most (the least) redistributive instruments.

The reference income base in the case above is post-TB or disposable income. Immervoll et al (2005) are "excluding" particular tax or benefit from the base and compare inequality of the resulting variable with inequality of the reference one. In their words: "Starting from a situation where this instrument does not exist, what are the distributive effects of it?" The same method could be used taking pre-TB income as a reference, and ranking the differences $G_X - G^i_{X-T}$ and $G_X - G^j_{X+B}$.

What is the appropriate reference income base in measurement of redistribution? Pre-TB income is commonly used in research of tax progressivity. However, there are authors who

oppose this view. Thus, Lerman and Yitzhaki (1995) "think that the after-tax ranking is the appropriate ranking for calculating progressivity". The research will show that the relative contributions of fiscal instruments in achieving redistribution vary significantly depending on the reference base used. For example, taxes seem much more important if post-TB income is used.

Another way to evaluate contributions of individual fiscal instruments is to decompose the vertical effect (V) in the manner proposed by Lambert (2001), the approach used by Kim and Lambert (2007). The vertical component of redistributive effect is identical to:

$$V = \frac{g\pi_T + b\rho_B}{1 - g + b} \tag{9}$$

where $\pi_T$ is Kakwani progressivity index of taxes [$\pi_T = D_T - G_X$], and $\rho_B$ is Kakwani regressivity index of benefits [$\rho_B = -\pi_B = -(D_B - G_X)$], whereas $g$ and $b$ represent shares of taxes and benefits in pre-TB income, respectively.

The decomposition (9) can be adapted to reflect contributions of $m$ individual taxes and $n$ benefits:

$$V = \frac{\sum_{i=1}^{m} g^i \pi_T^i + \sum_{j=1}^{n} b^j \rho_B^j}{1 - g + b} \tag{10}$$

where $\pi_T^i$ is Kakwani progressivity index of tax instrument $i$, $\rho_B^j$ is Kakwani regressivity index of benefit $j$, while $g^i$ and $b^j$ are shares of tax $i$ and benefit $j$ in pre-TB income.

The question of the appropriate reference base remains; eq. (9) and (10) used pre-TB income, but post-TB could be used quite as well if the roles of pre- and post-TB income are exchanged, as shown by "Inverted basic definition of income".

### *2.5. Measurement of efficiency in attaining redistribution*

It was shown above that redistributive effect measures *effectiveness* of fiscal system (or individual instruments) in reducing income inequality. But, can we know how *efficient* is the system (and its instruments) in achievement of redistribution goals, in comparison with some other real or hypothetical system. A method to do this was suggested by Fellman, Jännti and Lambert (1999) which compare the actual system with certain hypothetical *optimal* system, obtaining a measure of redistributive efficiency of taxes ( $I_T$ ) and benefits ( $I_B$ ):

$$(11) \qquad I_T = \frac{G_X - G_N}{G_X - G_{X-T_{opt}}}$$

$$(12) \qquad I_B = \frac{G_X - G_N}{G_X - G_{X+B_{opt}}}$$

$G_{X-T_{opt}}$ measures inequality in optimal or "yardstick" tax system and $G_{X+B_{opt}}$ is inequality in optimal benefit system. Optimal system here is not defined as one that would achieve absolute equality[7], but one that for the amount of tax (benefit) which is set to be equal to the actual amount achieves maximum redistributive effect.

## 3. Preliminary results

### *3.1. Analysis by economic groups*

For purpose of this presentation pre-TB income, taxes and benefits are defined as in equations (1) to (4). Benefits (other than pensions) are further grouped into means-tested (child allowance and family support allowance) and non-means tested (unemployment benefit,

[7] In this case it would be $G_{X-T_{opt}} = 0$ and $G_{X+B_{opt}} = 0$, and $I_T$ and $I_B$ would be identical to the Blackorby-Donaldson indexes.

sickness benefit, maternity allowance and rehabilitation supplement). Household incomes, taxes and benefits are equivalized using the following formulas:

(13) $$y_i = Y_i / e_i$$

(14) $$e_i = 0.5 + 0.5 \cdot adults_i + 0.3 \cdot children_i$$

where $w_i$ are sample weights, $y_i$ equivalized incomes, and $e_i$ are deflators that depend on number of children and adults. The average income is calculated as:

(15) $$\bar{y} = \left( \sum_{i=1}^{N} w_i e_i \right)^{-1} \sum_{i=1}^{N} w_i e_i y_i$$

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 (henceforth WAA; people aged between 15 and 64 years, excluding those involved in secondary or tertiary education) under 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 one or more WAAs unemployed or inactive. "Elder only" households do not include WAA members. Note that part of the elder (those aged above 64 years) lives in the first three groups of households, together with WWAs and children (those aged less than 15 and those involved in secondary or tertiary education).

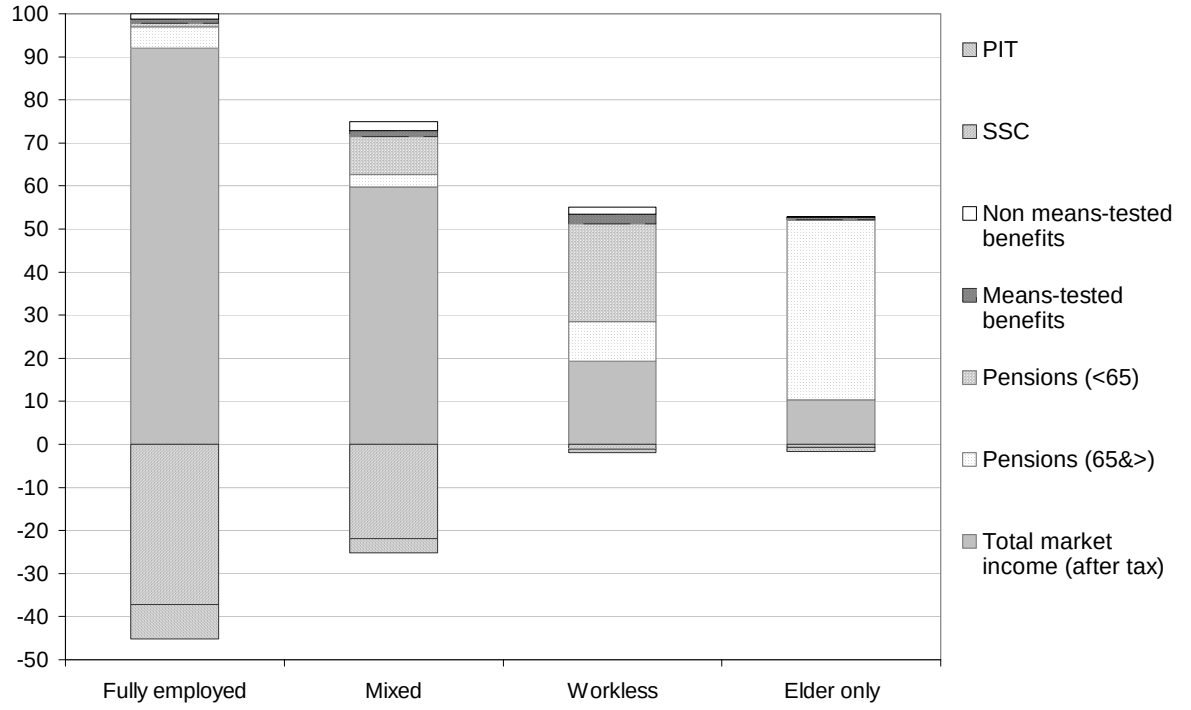
Table 2. Defining groups of households

| Type | Characterization | Equivalent units in 2005 (%) |
|---|---|---|
| Fully 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 |
| Elder only | EM = 0, UN = 0, EL > 0 | 17.8 |

EM = employed or self-employed, UN = unemployed or inactive; EL = the elder

Figures 1 and 2 show the composition of income in 2005 for the economic status groups. In Figure 1, part of the column above the horizontal axis presents average disposable income of that group expressed as a percentage of the average disposable income of the "Fully employed" group. The sum of (a) Total market income (after tax), (b) PIT and (c) SSC presents total pre-TB income. Large differences in average pre-TB income are visible across the groups, indicating high level of pre-fiscal income inequality. Roughly, the ratio of pre-TB average group incomes is 14:9:2:1, respectively. However, due to government taxes and transfers this ratio turns to significantly milder ratio 10:8:5:5 when we observe post-TB income. Both taxes and benefits help to achieve this result. Almost all taxes are paid by first two groups (this fact is still not proof of their progressivity; we turn to this issue later). "Pensions (65&>)" are present in all groups and naturally present the largest income component in the "Elder only" group. More interesting is distribution of "Pensions (<65)", particularly in the "Workless" group, where they make almost half of disposable income. At the same time, the benefits other than pensions represent relatively less important source of income of this group. Thus, public pensions act as a prime social benefit in Croatia.

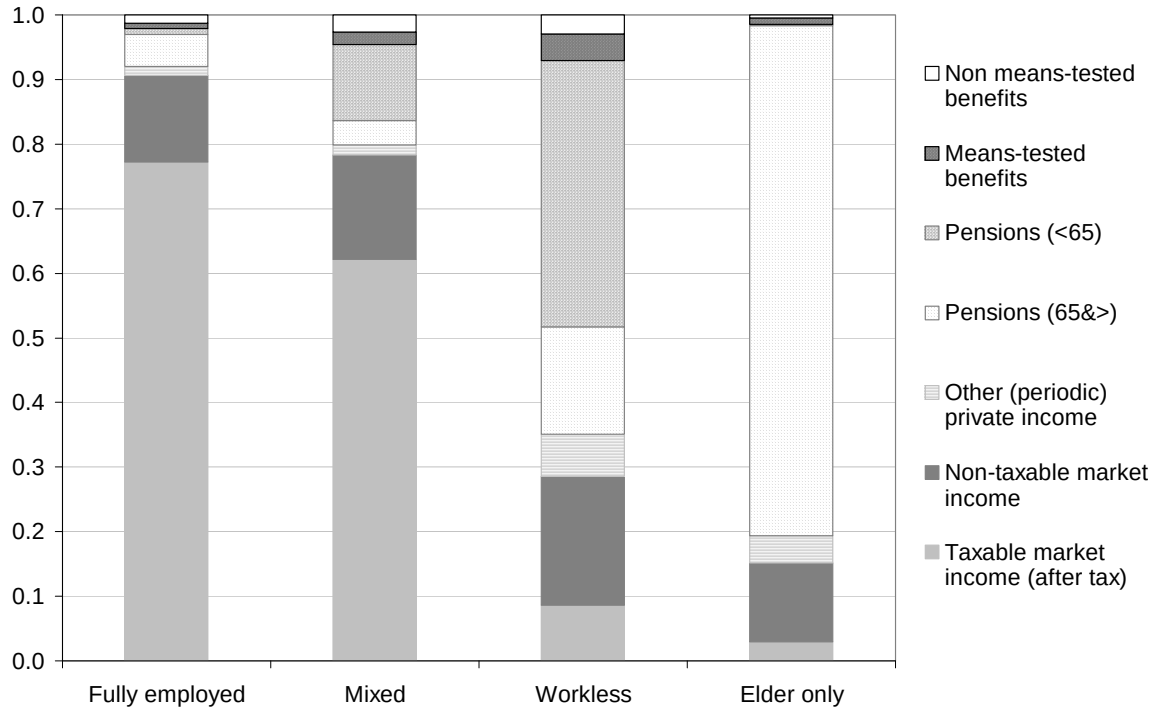
Figure 1. Composition of total income in 2005
Group averages expressed as percentages of "Fully employed" average disposable income




Source: author's calculations (preliminary)
Note: "Total market income (after tax)" is equal to OXBM+NNTD+TRNK–POPR; "Pensions (<65)" are equal to XMML, while "Pensions (65&>) present XMST.

In Figure 2 "Total market income (after tax)" is further divided into parts. Poorer groups depend relatively more on periodic private transfers. Non-taxable market income (mainly consisting of agriculture production for own use) is a significant part of income in all groups, but especially for the "Workless" group. Means-tested benefits are relatively more important than non means-tested benefits for "Workless" and "Elder only" while the opposite is true for the other two groups.

Figure 2. Composition of disposable income in 2005, by household groups




Source: author's calculations (preliminary)

Large reduction of inequality is confirmed by entropy indexes calculated for pre- and post-TB incomes, and two values of ethical parameter $\theta$. For $\theta = 0.5$ inequality index falls from 0.5915 to 0.1475, or 75%, while for $\theta = 2$ the decrease is two thirds, as can be seen from the Table 3. Redistributive instruments reduced both inequality *between* and *within* the groups, but the effect on the former was stronger, changing the ratio between the two from 47:53 to 21:79. Pre-TB income inequality for "Workless" and "Elder only" is much larger than for the other two groups (for many households pre-TB income is simply zero), but the fiscal system helps to reduce these differences too.

Table 3. Decomposition of generalized entropy index

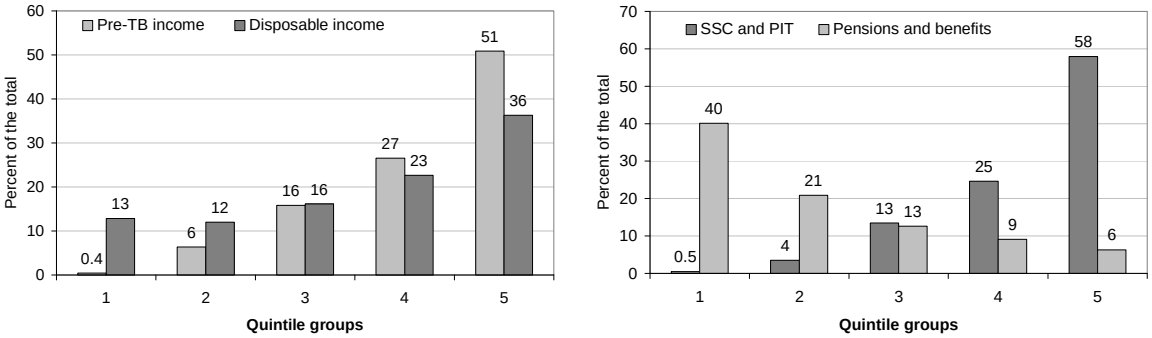
| | $\theta = 0.5$ | | | $\theta = 2$ | | |
|---|---|---|---|---|---|---|
| | X | N | reduction (%) | X | N | reduction (%) |
| $I$ | 0.5915 | 0.1475 | 75 | 0.4928 | 0.1671 | 66 |
| $I_B$ | 0.2777 | 0.0314 | 89 | 0.1998 | 0.0310 | 85 |
| $I_B / I$ | 0.47 | 0.21 | | 0.41 | 0.19 | |
| $I_W$ | 0.3138 | 0.1161 | 63 | 0.2931 | 0.1361 | 54 |
| $I_W / I$ | 0.53 | 0.79 | | 0.59 | 0.81 | |
| $I_1$ | 0.1680 | 0.1054 | 37 | 0.1831 | 0.1137 | 38 |
| $I_2$ | 0.1774 | 0.1093 | 38 | 0.2046 | 0.1193 | 42 |
| $I_3$ | 0.9735 | 0.1515 | 84 | 1.3597 | 0.1886 | 86 |
| $I_4$ | 1.4079 | 0.1313 | 91 | 3.8244 | 0.1971 | 95 |

Source: author's calculations (preliminary)

### 3.2. *Analysis by quintiles of pre-TB income distribution*

Distribution analysis is repeated for the households that are now sorted into quintile groups, and the results are shown in Figure 3. Poorest 40% households hold 6% of total pre-TB income, but end with one quarter of disposable income. They received 61% of all pensions and benefits, and paid 4% of all taxes. For the middle quintile group the fiscal effect is "proportional", meaning that their piece of income cake is unchanged in 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 gives us impression that total taxes are only mildly progressive. Although PIT is quite progressive (as will be shown below), its share in pre-TB income is low compared to SSC, which are proportional by nature. Again, we can assume that the social transfers – mainly pensions – will be the major redistributive factor in Croatia.

Figure 3. Distribution of income, taxes and benefits in 2005, by quintiles




Source: author's calculations (preliminary)

As Table 4 presents, fiscal system defined by equations (1) to (4) achieves reduction of pre-TB income inequality of about 40%, the similar result being obtained for all three ethical parameters ($\nu$) employed. Reranking introduced by the system is relatively high; it is increasing in $\nu$, which indicates that the major part of reranking is felt at the lower quantiles of pre-TB distribution.[8] Common interpretation of reranking measure is the following: Redistributive effect would be 25% (this based on the value of $R$ ($\%RE$) for $\nu = 2$) higher if reranking was eliminated. However, in making policy proposals based on these conclusions, the analyst must carefully consider the fiscal instruments involved. In our case, majority of reranking is probably caused by pensions (see below for analysis by instruments); eliminating reranking would therefore demand equalizing of all pensions, which is contrary to principles of contributory pension system.[9]

Table 4. Inequality and redistributive effect measured by generalized Gini coefficient, reference income base X defined by eq.(1)

| | $\nu = 1.5$ | $\nu = 2$ | $\nu = 3$ |
|---|---|---|---|
| $G_X$ | 0.3353 | 0.5125 | 0.7012 |
| $D_N$ | 0.1657 | 0.2448 | 0.3164 |
| $G_N$ | 0.1943 | 0.2986 | 0.4144 |
| $RE$ | 0.1410 | 0.2139 | 0.2869 |

[8] As value of ethical parameter is higher, relatively larger weights are given to the changes occurring at the lower quantiles of distribution.
[9] This question will be discussed in the next stage of the research.

| | | | |
|---|---|---|---|
| $RE$ ($\%G_X$) | 42 | 42 | 41 |
| $V$ | 0.1696 | 0.2677 | 0.3848 |
| $R$ | 0.0287 | 0.0537 | 0.0979 |
| $R$ ($\%G_X$) | 9 | 10 | 14 |
| $R$ ($\%RE$) | 20 | 25 | 34 |

Source: author's calculations (preliminary)

Table 6 contains information needed to decompose the redistributive effect into contributions of individual fiscal elements. Before they are used in decomposition, it is instructive to look at the single columns. Among taxes, PIT is the most *progressive* ($D_T$=0.7816), while among benefits, FSA is the most *regressive* ($D_B$=-0.5328); this is expected because the two instruments are designed and calibrated with purpose of income redistribution. "Pensions (65&>)" are very close in regressivity to FSA ($D_B$=-0.5020), but their amount is many times larger, and this makes pensions (65&>) the most influential element in redistribution (V=0.1276; while V of all taxes combined is 0.0329). Other pension category, "Pensions (<65)" is only half as regressive ($D_B$=-0.2588).

Columns $G_{X-T}$ and $G_{X+B}$ ($RE_T$ and $RE_B$) in Table 6 present the inequality of income (redistributive effect) that would prevail if only the particular instrument was applied to the pre-TB income. Rerankings are also calculated for this case; largest reranking relative to RE of 38% is measured for "Pensions (<65)", while for example, for PIT it is less than 2%. Reranking of FSA is relatively high (13% of RE), which poses another conceptual question: What is appropriate reference income base for measurement of reranking? For FSA, income that already contains pensions would be more suitable choice.

All decompositions from Table 6 are repeated for the "inverted basic" income definition, explained by equations (5) to (8), and the results are shown in Table 7. Comparison between Table 4 and 5 gives evidence about identities implied by eq. (1) to (8): $G_{\tilde{X}} = G_N$ and $G_{\tilde{N}} = G_X$.

Inverted taxes and benefits act in opposite direction, now regressively, causing increase in inequality, measured as negative vertical effect of -0.1392 for $\nu = 2$. Additional increase in inequality is due to reranking of 0.0748 for $\nu = 2$.

Table 5. Inequality and redistributive effect measured by generalized Gini coefficients, reference income base defined by eq. (5)

| | $\nu = 1.5$ | $\nu = 2$ | $\nu = 3$ |
|---|---|---|---|
| $G_{\tilde{X}}$ | 0.1943 | 0.2986 | 0.4144 |
| $D_{\tilde{N}}$ | 0.2907 | 0.4377 | 0.5876 |
| $G_{\tilde{N}}$ | 0.3353 | 0.5125 | 0.7012 |
| $RE$ | -0.1410 | -0.2139 | -0.2869 |
| $RE$ $(\%G_{\tilde{X}})$ | -73 | -72 | -69 |
| $V$ | -0.0963 | -0.1392 | -0.1733 |
| $R$ | 0.0446 | 0.0748 | 0.1136 |
| $R$ $(\%G_{\tilde{X}})$ | 23 | 25 | 27 |
| $-R$ $(\%RE)$ | 32 | 35 | 40 |

Source: author's calculations (preliminary)

To ask the main question again: Which instruments are most important in achieving redistribution in Croatia? Tables 6 and 7 now contain all the relevant data to compare results for two approaches: "decomposition" [Lambert (2001)] and "exclusion" [Immervoll et al (2005)] approach, and two reference bases: actual pre-TB income and actual post-TB income. These data can be found in columns 7 (redistributive effects of single instruments) and 12 (contributions to the overall vertical effect) of the Tables 6 and 7, but for the moment let us look only at the rankings obtained for those results. The rankings copied from the columns 8 and 13 of Tables 6 and 7 are pasted into the Table 8, and sorted in ascending order of the first column.

[Tables 6 and 7 here]

When Pre-TB is the reference income „decomposition“ and „exclusion“ methods give almost identical results (colums 1 and 2 of Table 8). ‘Exclusion method & post-TB income’ (Table 8, column 4; this model is used by Immervoll et al, 2005) ranks the first three instruments in the same way as models 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 8, column 3) and all other models. “Pensions (<65)” have only rank 5 here in contrast to rank 2 for all other models, while PIT is with rank 2 just below the “Pensions (65&>)” which are unambiguously prime redistributive instrument.

Table 8. Contributions to redistributive effect, rankings obtained by different methods

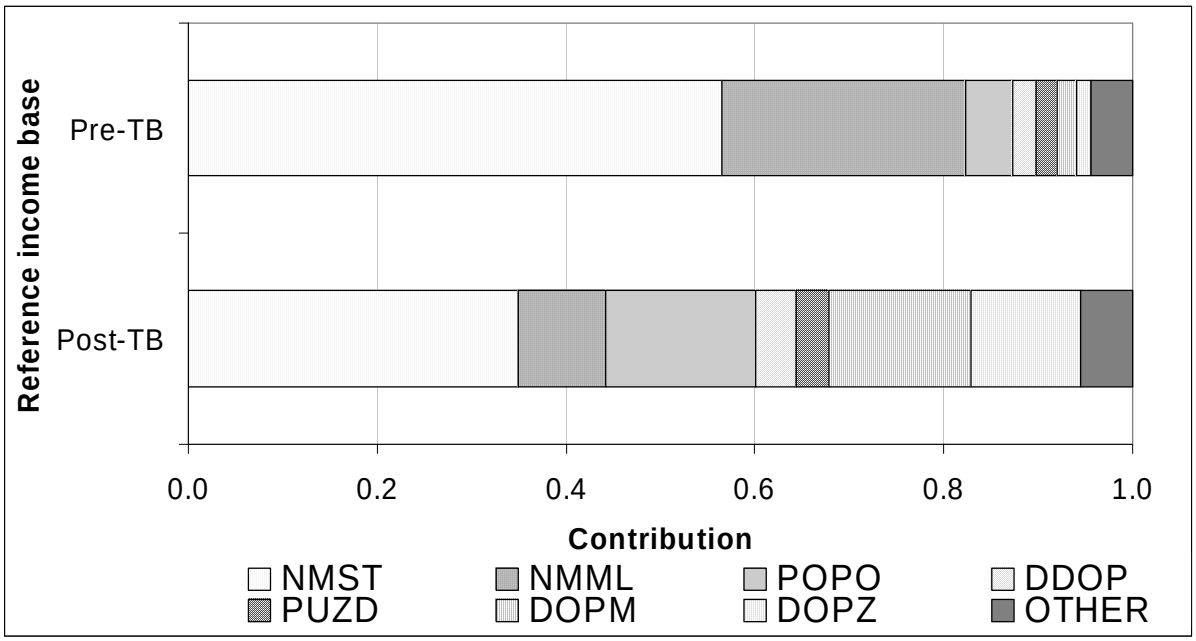
| Method | Decomposition of vertical effect | Exclusion of one-by-one instrument from the base | Decomposition of vertical effect | Exclusion of one-by-one instrument from the base |
|---|---|---|---|---|
| Reference income: | Pre-TB | Pre-TB | Post-TB | Post-TB |
| | 1 | 2 | 3 | 4 |
| Pensions (65&>)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

Source: author’s calculations (preliminary)

The difference between taking Pre-TB and Post-TB income for the reference base can be even better illustrated by Figure 4. Pensions capture over 80% of redistributive effect if the former is chosen, but only 44% in the latter case. Contribution of “Pensions (<65)” shrinks from 26% to 9%, while for PIT it grows from 5% to 16% when the base is changed from Pre- to Post-TB income. While almost negligible factors when Pre-TB is used, for Post-TB income base

combined SSCs become major contributor to redistribution with 28% of overall vertical effect.

Figure 4. Contributions to vertical effect obtained by decomposition




Source: author's calculations (preliminary)

## 4. Conclusion

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

The empirical part of research consisted of: (a) data preparation, (b) building of a micro-data model that converts net incomes into gross incomes and identifies amounts of PIT and SSC for each person in the data sample, (c) programming the calculation procedures into computer software (which will also make easier later sensitivity analysis), and (d) calculation of descriptive and statistical measures for analysis of income redistribution.

It must be noted that *none* of the above stages of empirical research was finished in time of writing this paper. In (a) addition of 2006 year data is planned. In (b) the model must be additionally reviewed and validated; macro-validation should be undertaken through comparison of aggregated sample data with actual amounts of taxes and benefits obtained in the government budgets. Part (c) is very close to the final version, but methodologies other than those presented in the paper may become interesting after re-review of the literature. In (d) only preliminary calculations for 2005 were done; it remains to obtain indicators for all other periods, and to undertake sensitivity analysis.

Main motives for the research were to provide more comprehensive picture of fiscal incidence in Croatia and create a framework, or starting point, for further research and measurement. Up to now, only impact of single instruments was provided, particularly of PIT. Although useful for policymakers and public to reveal tax burden distribution and progressivity of PIT, this sort of research does not fit into welfare analysis framework, as unit of analysis is individual taxpayer; the data contain only taxable incomes, etc. New research extends the analysis to much larger part of the fiscal system. Combined PIT and SSC made 38% of total general government revenue, while share of social benefits (excluding health system expenditures) in total expenditures was 34% in 2006.[10] However, these numbers also speak that huge part of fiscal system is still outside the coverage of this analysis, namely VAT, excise taxes and corporate income tax, government services such as defense and judiciary, or in-kind transfers

[10] Ministry of Finance (Republic of Croatia), 2007, Annual Report Of The Ministry Of Finance For 2006

such as education and health care. The second motive of research is to measure redistributive effects of the above-defined fiscal subsystem and check the hypothesis that this system achieves significant reduction of income inequality. Furthermore, it is important to analyze how particular instruments contribute to overall redistribution.

It is well known that in measurement of progressivity of taxes and benefits or overall (net) fiscal system, the crucial question is one of the reference income base. This issue is nonetheless important in measurement of horizontal inequity (and reranking). Different approaches in choosing reference income bases may result in quite different conclusions about redistributive effects of individual fiscal instruments, as is shown by analyses in the paper. Therefore, the next stage of research will aim to find appropriate recipe for researchers concerning reference income base.

This paper has not dealt with policy issues and recommendations, but these will be covered in the final stage of the research project. Nevertheless, already now a number of questions can be raised to which this research will be able to either find answers, or contribute in finding them. Let us mention only a few of them. How does Croatian fiscal system stand in comparison with EU countries in terms of achieving equity goals? Are the individual instruments and the system as a whole *enough* redistributive? Are there some instruments that are not equitable? Should taxes be more progressive? Can the overall redistributive effect be significantly altered through increase (decrease) of the PIT rate schedule progressivity? How can total welfare be increased keeping the amount of expenditures and taxes unchanged? What equity role have public pensions now, and how it should be in future? How can other fiscal instruments be incorporated into the current model in order to obtain more comprehensive picture of fiscal incidence?

Table 6. Decomposition of vertical effect, reference income base X defined by eq.(1), $\nu = 2$

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $D_T^i$ | $D_T^i - G_X$ | $t^i$ | $V_T^i$ | $D_{X-T}^i$ | $G_{X-T}^i$ | $RE_T^i$ | $RE_T^i$ (rank) | $R_T^i$ | $R_T^i$ (%*RE*) | $con_T^i$ | $con_T^i$ (%*V*) | $con_T^i$ (rank) |
| DOPM | 0.5518 | 0.0393 | 0.1355 | 0.0062 | 0.5063 | 0.5070 | 0.0055 | 5 | 0.000672 | 12.2 | 0.0055 | 2.1 | 6 |
| DOPZ | 0.5518 | 0.0393 | 0.1050 | 0.0046 | 0.5079 | 0.5083 | 0.0042 | 7 | 0.000378 | 8.9 | 0.0043 | 1.6 | 7 |
| DOPN | 0.5826 | 0.0701 | 0.0104 | 0.0007 | 0.5118 | 0.5118 | 0.0007 | 12 | 0.000006 | 0.8 | 0.0008 | 0.3 | 12 |
| POPO | 0.7816 | 0.2691 | 0.0480 | 0.0136 | 0.4989 | 0.4992 | 0.0133 | 3 | 0.000233 | 1.7 | 0.0134 | 5.0 | 3 |
| Taxes | 0.5898 | 0.0773 | 0.2989 | 0.0329 | 0.4796 | 0.4837 | 0.0288 | | 0.004108 | 14.2 | 0.0239 | 8.9 | |
| | $D_B^j$ | $G_X - D_B^j$ | $b^j$ | $V_B^j$ | $D_{X+B}^j$ | $G_{X+B}^j$ | $RE_B^j$ | $RE_B^j$ (rank) | $R_B^j$ | $R_B^j$ (%*RE*) | $con_B^j$ | $con_B^j$ (%*V*) | $con_B^j$ (rank) |
| NNEZ | -0.1355 | 0.6480 | 0.0061 | 0.0039 | 0.5086 | 0.5091 | 0.0034 | 8 | 0.000482 | 14.0 | 0.0041 | 1.5 | 8 |
| BOLO | -0.1284 | 0.6409 | 0.0029 | 0.0019 | 0.5106 | 0.5110 | 0.0015 | 11 | 0.000330 | 21.4 | 0.0019 | 0.7 | 11 |
| DDOP | -0.0940 | 0.6065 | 0.0102 | 0.0061 | 0.5064 | 0.5067 | 0.0058 | 4 | 0.000353 | 6.1 | 0.0064 | 2.4 | 4 |
| PUZD | -0.5328 | 1.0453 | 0.0054 | 0.0056 | 0.5069 | 0.5075 | 0.0050 | 6 | 0.000649 | 13.0 | 0.0059 | 2.2 | 5 |
| PORD | 0.0353 | 0.4772 | 0.0045 | 0.0021 | 0.5104 | 0.5107 | 0.0018 | 10 | 0.000329 | 18.4 | 0.0022 | 0.8 | 10 |
| NJEG | -0.1541 | 0.6666 | 0.0041 | 0.0027 | 0.5098 | 0.5104 | 0.0021 | 9 | 0.000625 | 30.1 | 0.0028 | 1.0 | 9 |
| NMML | -0.2588 | 0.7713 | 0.0864 | 0.0613 | 0.4512 | 0.4681 | 0.0444 | 2 | 0.016869 | 38.0 | 0.0691 | 25.8 | 2 |
| NMST | -0.5020 | 1.0145 | 0.1439 | 0.1276 | 0.3849 | 0.4131 | 0.0994 | 1 | 0.028176 | 28.3 | 0.1513 | 56.5 | 1 |
| Benefits | -0.3801 | 0.8926 | 0.2633 | 0.1861 | 0.3265 | 0.3554 | 0.1571 | | 0.028955 | 18.4 | 0.2437 | 91.1 | |

Source: author's calculations (preliminary)

Notes: $con_T^i = \frac{t^i}{1-t+b}\left(D_T^i - G_X\right)$; $con_B^j = \frac{b^j}{1-t+b}\left(G_X - D_B^j\right)$

Table 7. Decomposition of vertical effect, reference income base X defined by eq.(5), $\nu = 2$

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $D^i_{\tilde{B}}$ | $G_{\tilde{X}} - D^i_{\tilde{B}}$ | $\tilde{b}^i$ | $V^i_{\tilde{B}}$ | $D^i_{\tilde{X}+\tilde{B}}$ | $G^i_{\tilde{X}+\tilde{B}}$ | $-RE^i_{\tilde{B}}$ | $(-RE^i_{\tilde{B}})$ (rank) | $R^i_{\tilde{B}}$ | $R^i_{\tilde{B}}$ (%*RE*) | $con^i_{\tilde{B}}$ | $con^i_{\tilde{B}}$ (%*V*) | $con^i_{\tilde{B}}$ (rank) |
| DOPM | 0.4528 | -0.1542 | 0.1405 | -0.0252 | 0.3238 | 0.3204 | 0.0218 | 4 | -0.003431 | 15.8 | -0.0209 | 15.0 | 3 |
| DOPZ | 0.4528 | -0.1542 | 0.1089 | -0.0188 | 0.3174 | 0.3155 | 0.0169 | 5 | -0.001922 | 11.4 | -0.0162 | 11.6 | 4 |
| DOPN | 0.4893 | -0.1907 | 0.0107 | -0.0021 | 0.3007 | 0.3006 | 0.0021 | 9 | -0.000017 | 0.8 | -0.0020 | 1.4 | 9 |
| POPO | 0.7599 | -0.4613 | 0.0498 | -0.0242 | 0.3227 | 0.3209 | 0.0223 | 3 | -0.001883 | 8.5 | -0.0221 | 15.9 | 2 |
| Taxes | 0.5034 | -0.2048 | 0.3099 | -0.0485 | 0.3470 | 0.3554 | 0.0568 | | 0.008371 | -14.7 | -0.0612 | 44.0 | |
| | $D^j_{\tilde{T}}$ | $D^j_{\tilde{T}} - G_{\tilde{X}}$ | $\tilde{t}^j$ | $V^j_{\tilde{T}}$ | $D^j_{\tilde{X}-\tilde{T}}$ | $G^j_{\tilde{X}-\tilde{T}}$ | $-RE^j_{\tilde{T}}$ | $(-RE^j_{\tilde{T}})$ (rank) | $R^j_{\tilde{T}}$ | $R^j_{\tilde{T}}$ (%*RE*) | $con^j_{\tilde{T}}$ | $con^j_{\tilde{T}}$ (%*V*) | $con^j_{\tilde{T}}$ (rank) |
| NNEZ | -0.1873 | -0.4859 | 0.0063 | -0.0030 | 0.3016 | 0.3023 | 0.0037 | 8 | 0.000699 | -18.7 | -0.0030 | 2.1 | 8 |
| BOLO | -0.0361 | -0.3346 | 0.0030 | -0.0010 | 0.2996 | 0.3001 | 0.0015 | 11 | 0.000506 | -33.3 | -0.0010 | 0.7 | 11 |
| DDOP | -0.2901 | -0.5887 | 0.0106 | -0.0061 | 0.3047 | 0.3054 | 0.0069 | 6 | 0.000713 | -10.4 | -0.0060 | 4.3 | 6 |
| PUZD | -0.5937 | -0.8923 | 0.0056 | -0.0050 | 0.3036 | 0.3042 | 0.0056 | 7 | 0.000576 | -10.3 | -0.0048 | 3.5 | 7 |
| PORD | 0.0139 | -0.2847 | 0.0046 | -0.0013 | 0.2999 | 0.3006 | 0.0020 | 10 | 0.000691 | -34.6 | -0.0013 | 0.9 | 10 |
| NJEG | 0.1857 | -0.1129 | 0.0042 | -0.0005 | 0.2991 | 0.2997 | 0.0011 | 12 | 0.000638 | -57.4 | -0.0005 | 0.3 | 12 |
| NMML | 0.1503 | -0.1483 | 0.0895 | -0.0122 | 0.3108 | 0.3423 | 0.0437 | 2 | 0.031557 | -72.1 | -0.0128 | 9.2 | 5 |
| NMST | -0.0396 | -0.3382 | 0.1492 | -0.0439 | 0.3425 | 0.4090 | 0.1104 | 1 | 0.066522 | -60.2 | -0.0486 | 35.0 | 1 |
| Benefits | 0.0026 | -0.2960 | 0.2730 | -0.1112 | 0.4098 | 0.4837 | 0.1851 | | 0.073899 | -39.9 | -0.0780 | 56.0 | |

Source: author's calculations (preliminary)

Notes: $con^j_{\tilde{T}} = \frac{\tilde{t}^j}{1-\tilde{t}+\tilde{b}}\left(D^j_{\tilde{T}} - G_{\tilde{X}}\right)$; $con^i_{\tilde{B}} = \frac{\tilde{b}^i}{1-\tilde{t}+\tilde{b}}\left(G_{\tilde{X}} - D^i_{\tilde{B}}\right)$

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