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Progressivity of Taxes and Transfers: the Mexican Case 2012

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Abstract:
The paper examines the redistributive effect achieved by the tax-benefit system in Mexico in 2012 using personal income tax, indirect taxes, social security contributions and social benefits. Our goal is to analyze progressivity of the fiscal system and go further to demonstrate how the different taxes and benefits contribute to the total redistribution effect. A set of popular tools of studying progressivity, such as the concentration curves and Kakwani progressivity index, are used. In addition, we propose an analytical method to decompose the total progressivity measured by the contributions of different taxes or benefits. We conclude that Mexican tax-benefit system is progressive, with greater pre-fiscal income inequality and high redistributive effect for some specific figures of transfers. The contribution from Vertical Equity (VE) is relatively important, but Horizontal Inequity (HI) lightens its impact. Income taxation does not contribute largely to VE. Further, some program benefits target unequally the deprived population, and then decreases the positive effect induced by VE.

1. Introduction

During the last century, taxation and social transfers have been of great relevance for many Latin American countries including Mexico. The transfers related to social programs provide income assistance in the form of social benefits to deprived people, being unemployed, for maternity, food stamps, work injury, sickness, old age, or even for training to increase opportunities in the labor market. Many of these transfers are financed by social security contributions, as well as by other taxes (direct or indirect). In this paper, we focus on tax and benefit systems consisting of social transfers, personal income tax and indirect taxes in Mexico. Tax and benefit systems have a significant influence on disposable income distribution when they are able to reduce market income differences.

Mexico appears as a country with high levels of income inequality and we try to provide some elements that contribute to highlight this inequality as well as to provide a basis to improve the tax system and depicting general lines for future fiscal reforms. Our aim is to compute total progressivity, comparing between the progressivity for total taxes as well as that of total transfers, and showing the most progressive taxes or transfers for this country in 2012. The hypothesis is that liabilities on total taxation are slightly progressive in Mexico. Indeed, even for the income tax where low-income earners have a low tax burden, this progressivity is lightened by the non-progressivity of VAT.

"Equal must be treated equally": this ethical value is related with the negative impact of Horizontal inequality (HI) on redistributive effect, and where the governmental intervention may increase income disparities. To assess the extent of HI and its impact, we adopt Duclos-Jalbert-Araar (2003) approach (DJA henceforth). In this paper, we also develop a new methodology to decompose the total progressivity of any fiscal system by tax and benefit components.

The studied benefits concern in general the social assistance programs (such as programs for the elderly, *Oportunidades* program for the poor, food aid and assistance for the unemployed with temporary employment, as the most relevant). The selection is based on the relevance and the potential to fight poverty of these programs. Only four prior benefits described have recently shown a high level of progressivity on its allocation for the Mexican households (CONEVAL, 2009).[†] Such programs should have a greater impact on these groups of individuals and taxpayers, i.e. should be the main recipients of the resources.

The rest of the paper is organized as follows. In section 2, we provide a literature review of progressivity. Section 3 introduces the tax-benefit system in Mexico and describes the used data. Section 4 shows the empirical application and reports the main findings. We conclude in section 5 and report some insights for future studies.

2. The progressive tax/benefit system: a posture of redistributive analysis

In recent years, there has been a renewed interest in discussing theoretical and empirical issues about the redistributive mechanisms of income. The role of the State is to improve the

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[†] There is an official report indicating that if four of the transfers had not been applied (*Oportunidades, elderly and 70, public scholarships and Procampo*) 2.6 million additional individuals would be found in poverty (CONEVAL, 2009).

social welfare of population. This can be performed the usual through to redistributive mechanisms of income, which are the collection of taxes and the provision of benefit programs. The redistribution of income is regularly justified when failures occur in free markets. The study of progressivity and redistributive effect constitute a basic input to perceive the social efficiency of the fiscal system. It also allows having an overview on the shape of distributions from contributors to the incidence of taxes and benefits.

2.1 Empirical studies of progressivity and evidence.

Policy recommendations for Latin American countries have been focused on the development of a tax structure that emphasizes government revenue through indirect taxes (Bird and Gendron, 2011) which can be the basis for an effective mechanism for redistribution; conversely, this recommendation can lead to a number of distant scenarios. However, a taxation system with efficiency, pay equity and its ability to redistribute among the various contributors should be considered. In order to increase revenues and to cope with inequality, the policy maker must consider if the tax system has to be modified (Musgrave, 1990).

Since the seminal work of Pechman and Okner (1974) for the United States, there has been a significant amount of related research that has enriched the original inquiry. In this seminal work, a proportional tax system was found as a result of the mutual mix neutralization induced by progressive and regressive taxes. More research of the topic can be found for other developed countries and more recently, for some developing and transitional economies (Duclos and Tabi, 1996; Davidson and Duclos, 1997; Makdissi and Wodon, 2002; Duclos, et al, 2003; Duclos, et al. 2005; Araar, 2008; Kaplanoglou and Newberry, 2008; Bibi and Duclos, 2010; Bird and Gendron 2011; Lustig, et al. 2012; Cok, et al, 2012).

For the Canadian case, Duclos and Tabi (1996) and Davidson and Duclos (1997) using microdata from the Canadian Surveys of Consumer and Finances assessed effective progressivity with the Tax-Redistributive approach (*TR*). These indices are based on social welfare evaluation and therefore, an effective progressive tax system in the country was found in the 1980s in the former paper despite a relative regressive scheme for some tax figures existed when transfers were added in the assessment. In the latter article a more progressive distribution was found in the post-fiscal distribution of income for the beginning of the 1990s.

Makdissi and Wodon (2002) settled a theoretical framework based on the stochastic dominance approach to study social efficiency of the indirect tax reforms. Duclos, et al. (2005) have applied, for instance, this approach to study the impact of two important programs in Mexico (Liconsa and Procampo).

Araar (2008) tries to propose an operational method to enable the comparison of progressivity of the fiscal systems overtime. He has performed an empirical application using the Canadian data to estimate the impact of fiscal system on the size and wellbeing of socio-economic classes. He concludes for the progressivity of the fiscal system that enables to maintain the size of poor and middle classes.

Kaplanoglou and Newberry (2008) have estimated for Greece in 1999 the HI and Vertical redistribution components using only indirect taxes finding that a less vertical negative effect can be attained even when more HI is induced in the classical sense and re-ranking by the indirect reforms for this country. Bibi and Duclos (2010) study the poverty dominance of fiscal system for five developed countries. They show how the redistributive effect have major impact on reducing poverty for Sweden, the UK dominates all other countries in terms of social transfers, but Canada emerges as the country with the greatest success on taxation avoiding increasing poverty levels with this variable. Also, in Canada and Sweden the social transfers and the taxes support one of the best results on reducing poverty. Bird and Gendron (2011) establishes that there is actually very little evidence at the time of their literature examination in terms of tax-benefit incidence for developing and transitional countries. They explain the need for research on these countries to work on reforms to reduce HI improving the indirect taxation.‡

For two transitional countries, Slovenia and Croatia, Cok, et al. (2012) have performed one of the most complete empirical applications using a wide variety of figures to complete the whole fiscal system in both countries and obtain a comparison of the vertical and horizontal components from the two countries. They have applied the DJA approach for Croatia and found that even both countries share a similar background they present different outputs from their fiscal systems. They found how the fiscal system in Slovenia has created a much more impact on vertical effects than in Croatia, but for the former country the fiscal system also induced much more horizontal inequity when sensitivity analysis is carried out using greater aversion to inequality for the lower tail of distribution.

Lustig's, et al. (2012) research provides good insights in pursuing the progressivity incidence for the Mexican fiscal system figures and its impact on poverty measures comparing it with five other countries in Latin America. Using the concentration approach and *Probit* models to inquire about mobility, their results show that a more progressive tax-benefit system is found for the sort of countries in recent years; Bolivia, Mexico and Peru have the lowest impacts on poverty reduction, while Argentina, Uruguay and Brazil presented the greatest reductions and are the countries with the most redistributive fiscal systems.

This work from Lustig still uses Kakwani (1977) and Reynolds-Smolensky (1977) progressivity indices, as well as concentration curves when combining total taxes and benefits to obtain the horizontal and vertical effects following the Lambert (1985) approach; unfortunately, it does not provide in detail the main sources from progressivity or regressivity nor even the re-ranking implied in the process, which are the tasks of our paper.

The issue of *Horizontal Inequality* is not commonly treated as much as the *Vertical Equity* (VE) issue (Duclos and Araar, 2006). Huesca and Serrano (2005) explore an application for VAT in Mexico. Their work focuses on the contribution of VAT to revenues and the redistribution of income giving insights that is weakly progressive and with low fundraising potential. Their results indicate that the Mexican VAT contributes to VE, but the problem arises to reduce the HI existing in that country due to the exemptions and zero rates on food, books, public

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‡ By this time, Duclos, et al. (2003) had already developed a new fashioned methodology to estimate and decompose the change on inequality induced from the vertical equity, HI and re-ranking in a fiscal system using a non-parametric method to detect the "equals" in the distribution.

transportation, drug medications as well as rents for leasing, giving a low taxable base for this tax figure.

Valero-Gil (2002) using microdata from the 2000 year survey of income and expenditure for Mexico found that some goods should not be subsidized when considering low levels of elasticity on food and medicines, once inequity aversion parameters have been taking into account for the entire population. Flores (2003) discusses the Mexican Government proposal of an increase in VAT on food and transferring cash to the lower groups of income, finding how the VAT increase would improve revenues and reduces inequality in less than a percentage point in the Gini index.[§]

Valero-Gil (2006) develops an estimation of optimal taxation and his results indicate the need for raising VAT on food for reasons of economic efficiency, but for redistribution asserts that those products should not be taxed. Vargas (2009) with a static approach departs from the evolution and distribution of income in Mexico for twenty years, analyzing the tax burden in the country and evaluating the incidence of benefits generated by public spending. Using microdata of income and expenditure with the concentration method, found the tax system to be progressive due to the high concentration of the tax burden in the top deciles of income.

SHCP (2012)[**] found that the top decile of income in the Mexican households contributes with 30.6% of the total tax payments of VAT (for the general rate), enjoys 12 per cent for their zero rate expenditures and 24.9 per cent in exemptions, nearly 37 per cent of revenues not collected from these contributors. In this overview, it can be observed a higher tax burden with more incidences for the top income levels, but nobody can have the certainty of a fair treatment for the pre-fiscal situation with equal contributors in the tax system.

3. Methodology and data

A tax is found to be progressive if it burdens more the non-poor group. This implies a decrease in inequality and a rise in the share for the net income in the poor group of households. In the literature of progressivity, there are two main distinct concepts of progressivity: the local and the global ones. In the pioneered work of Musgrave and Thin (1948) two main approaches were proposed for the measurement of local progressivity, which are the liability progression and residual progression. Kakwani (1977) has addressed a serious criticism to this approach since the latter looks only for the extent of local progressivity. Kakwani proposed an index of progressivity for taxes that is equal to the difference between the concentration index for the tax and the Gini index of gross income.[††]

[§] Indirect taxes (such as VAT) have been criticized as a tool that affects negatively the population, in this sense, Bird and Gendron (2011) give elements of why in the real world people keep the belief that indirect taxes such as VAT are regressive. Furthermore, they indicate that a well-designed VAT may be more progressive than a direct (on income) tax, because the latter strategy only impacts a portion of the taxable base (Bird and Gendron, 2011: 75).

[**] These results should be taken cautiously because its estimation of the tax-burden distribution does not exclude informal expenditures, making the VAT payments to be overestimated.

[††] Duclos and Tabi (1996) report that, the local progressivity can induce the same conclusion of global progressivity in the case where local progressivity is observed elsewhere.

When we denote the inequality index of gross income I_X, limited to the interval $[0 , 1]$ and the index from the concentration of any given tax by $C_{(T)}$ which is bounded on the interval $[-1, 1]$, the formula for the Kakwani index is written in expression (1):

$$K_T = C_T - I_X \qquad (1)$$

K_T is the Kakwani index of progressivity of tax T, such technique is standard and has been applied in a wide range of empirical works. Besides, the quantification method of progressivity, a dominance stochastic approach can also be used to take a judgment about the progressivity of a given tax (see Yitzhaki and Thirsk, 1990; Yitzhaki and Slemrod, 1991). Mainly, this exercise can easily be conducted by comparing between concentration and Lorenz curves. In what follows, we present the theoretical framework used to assess and analyze the stochastic dominance progressivity conditions.[‡‡]

3.1 Progressivity curves.

Progressivity curves are derived from the progressivity conditions by comparing between the Lorenz curve of market (gross) income $L_X(p)$ and the concentration curve of taxes or net income $C_{T/N}(p)$. $T(p)$ represents the tax/net income of those with income equal to $X(p)$. We denote the progressivity curve that enable the comparison between the Lorenz and concentration curves at percentile p by $PR(p)$. In what follow, we present the main rules to check the progressivity based on Lorenz and concentration curves:

- The tax T is Tax Redistribution (TR) progressive if
$$PR(p) = L_X(p) - C_T(p) > 0 \; \forall p \in \,]0,1[$$
- The transfer B is Tax Redistribution (TR) progressive if :
$$PR(p) = C_B(p) - L_X(p) > 0 \; \forall p \in \,]0,1[$$
- The tax T is Income Redistribution (IR) progressive if :
$$PR(p) = C_{X-T}(p) - L_X(p) > 0 \; \forall p \in \,]0,1[$$
- The transfer B is Income Redistribution (IR) progressive if :
$$PR(p) = C_{X+B}(p) - L_X(p) > 0 \; \forall p \in \,]0,1[$$

In some time, the progressivity conditions are not checked elsewhere. In such case, one can return to progressivity indices.

3.2 Decomposing progressivity by tax sources: The analytical approach

As was already mentioned above, among the popular indices to assess the extent of progressivity of a given tax it can be used the Kakwani index. By construction, the Kakwani index is based on the scheme of distribution of tax (*Tax Redistribution*) to capture the extent

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[‡‡] Precisely, we are concerned by the second order inequality dominance. For more insights related to taxes and benefits see Davidson and Duclos (1997).

of progressivity and other indices are based on the scheme of net incomes (*Income Redistribution*) to assess the level of progressivity, as is the case for the Reynolds-Smolensky (1977) progressivity index (Davidson and Duclos, 1997).

Some taxes, like VAT, are composed from different sources of tax. More important, a given source of tax can comprise a higher level of progressivity compared to another. How is the extent of progressivity for each source of tax and how is its contribution to total progressivity? The same questions can be applied to benefits. In what follow, we propose an analytical form of decomposition for some popular progressivity indices. Assume that the tax T is composed from K tax sources. We denote the tax source k by T_k such as $T = \sum_{k=1}^{K} T_k$. Also, we denote the average tax T by μ_T and that of T_k by μ_{Tk}. Formally, the natural decomposition of the Kakwani index of progressivity that we propose takes the following form:

$$TR_T = \sum_{k=1}^{K} \frac{\mu_{Tk}}{\mu_T} (C_{Tk} - G_X) \tag{2}$$

From the formula (2) we remark that when the tax sources are considered likewise as in income sources, the output turns in part to a decomposition of inequality by income sources (see Rao, 1969 and Araar, 2006). It is helpful to recall that Kakwani (1977) has already tried to show how its index can be linked to the different tax sources. Mainly, his proposed decomposition weighs the progressivity indices of tax sources by the ratio between the average tax rate from the tax sources and that of the total taxes.

Starting from this form of decomposition of the Kakwani index, a set of interesting conclusions can be drawn about the importance of contribution of a given tax Tk by its component: $\frac{\mu_{Tk}}{\mu_T} (C_{Tk} - G_X)$:

- The contribution of a given tax to the progressivity of total taxes depends on the importance of its share (μ_{Tk}/μ_T). Of course, when the average of the tax is very low, the contribution of the later to the total progressivity must be low even if it shows a higher level of progressivity.
- The contribution of a given tax to the progressivity of total taxes depends also on its own level of progressivity($C_{Tk} - G_X$).

Besides the proposed decomposition of the Kakwani index, we propose also the decomposition Reynolds-Smolensky (1977) index as follows:

$$IR_T = \sum_{k=1}^{K} \frac{\mu_{Tk}}{\mu_X - \mu_T} (C_{Tk} - G_X) \tag{3}$$

It is evident that the relative contribution of taxes to the total progressivity will be the same for the proposed decompositions of Kakwani and Reynolds-Smolensky indices of progressivity and will add up to one. Further, these decompositions are relevant because when we observe a low level of progressivity for any tax, like VAT for instance, we cannot easily determine the source of this low level of progressivity. This decomposition will provide more insights about knowing, at first hand, what are the tax (or benefit) sources that contribute the most to the total progressivity.

3.3 Vertical and horizontal inequity of the tax-benefit system (DJA model).

"Equals must be treated equally" an ethical value which is easily defendable. By HI we would like to show the extent of unequally tax treatment of equals (those that have the same level of gross income). By *reranking* (R) we refer to the impact of change in gross income rank caused by the tax/benefit system. By the term VE, we refer to the impact of a tax/benefit system on inequality where equals are treated equally. Duclos et al. (2003) have proposed a nice method to decompose the redistribution effect or change in inequality into these three components. With this application, we can decompose the difference between gross income X, and net income N inequalities as written in the formula (4):

$$\Delta I(\varepsilon, \rho) = \underbrace{I_X - I_N^E}_{\text{VE}} - \underbrace{(I_N^P - I_N^E)}_{\text{HI}} - \underbrace{(I_N - I_N^P)}_{\text{R}} \qquad (4)$$

Where $I(\varepsilon, \rho)$ is the Gini-Atkinson index (Araar and Duclos, 2003). I_N^P stands for the coefficient of concentration of N when the ranking variable is $X(p)$ and I_N^E as the concentration index of purged net income from local inequality (we assume that each individual have the expected value of net income according to the level of his gross income). Let us explaining how each of the three components captures the extent of what they are proposed to assess:

- *Horizontal inequity* $(I_N^P - I_N^E)$: In the case where there is no local inequality in net incomes, we have that, $I_N^P = I_N^E$ and the horizontal inequality is nil. The more the local inequality of net incomes at percentile p, the lower is the local social welfare ($\xi(N \mid X = Q(p))$) and the higher is I_N^P and then the component *Horizontal inequity.*
- *Re-ranking* $(I_N - I_N^P)$: In the case where the rank based on gross income is similar to that based on net incomes, we have then: $I_N = I_N^P$ and the re-ranking component is nil. The more the re-ranking the lower is I_N^P, and then, the higher is the re-ranking component.
- *Vertical Equity* $(I_X - I_N^E)$: This component captures the change in inequality after removing the cost of horizontal inequality. The more the tax/benefit system equalizes net income, the higher is the vertical equity.

3.4 Mexican database of ENIGH 2012.

For the empirical exercise the 2012 ENIGH is used as the most recent data at the moment of this research, with a sample of 9,007 households and about 31 million expanded. Based on the information provided by its microdata we proceed to build the distribution according to per capita units of income following both, direct and indirect identification methods (Lustig, et al. 2012: 8). Once disposable household income (denoted by N) is obtained, it is possible to calculate the figures shown in table 1 to rebuild the pre-fiscal (Market income) denoted by X. When the vector on *N* is obtained after taxes, the current tax rules per each source of income are applied. Thus, different tax brackets were taken into account for the taxpayers, tax credits

and tax allowances per wage-earners were used as well. In order to rebuild the fiscal system from *N* in the surveys the tax translation hypothesis in Pechman (1985) are considered. For the empirical exercise, we use the income tax from both wage-earners and individuals that reported income sources as benefits obtained from business, so we are able of estimating the progressivity and incidence for these sorts of direct taxes in the survey. For the indirect taxes we estimate VAT and special tax on goods and services (IEPS) according to the tax rules, those controlled by informal activities related to the place of purchase provided by the same survey.[§§]

The border with the United States (US) has a special VAT treatment different from the rest of the country in the year 2012, so this has been controlled as well applying the 11% to the expenditures located in all these cities included in the survey. We believe this process do not add taxes beyond the actual paid by taxpayers.

In the case of benefits we collect them at the household level from the same survey using the following: scholarships and cash transfers for education, *Oportunidades* social assistance program, 70 and more (for the *elderly* without pension); *Programa de Apoyo Alimentario* (PAL, program for food assistance); transfer for *temporary employment*; and finally, *other assistance* programs.[***] At the end, market income is estimated just adding the total taxes, pensions and federal contributions from wages to the social security system (*SSC*) minus the transfers received per household as follows:

$$X = N + T - P + SSC - B \qquad (5)$$

where *X* stands for the market income, *N* as the post-fiscal income, *T* as the tax burden, *P* the pensions, *SSC* as the social security contributions and *B* are the benefits (See table 2). We do not consider transfers at a more aggregated level such as public education or health care, since our purpose is to determine progressivity isolated from the taxes paid as well as from the benefits received directly in a microeconomic perspective. Also for indirect taxes, we do not use a system of demand elasticity estimation to assess the marginal economic efficiency of various sources of tax payments as the analysis focus on a static comparative framework.

Table 1. Tax and benefit system in Mexico.

Taxes [a]	Indicators
ISR	-Income tax
VAT	-Value added tax
IEPS	-Special consumption tax
Employer's social security contributions	-For health insurance
	-For pensions
	-For housing (public lending to finance a house)
Employees' social security contributions	-For health insurance

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[§§] We have considered the 15 different places where at least five do not collect VAT or IEPS. Those places not contributing for indirect taxes are *Flea* markets and street vendors, purchases outside the country, others known as "loncherías, fondas, torterías" as informal cafeterias, taquerias or street dinning places, Canteens or informal bars (Pulquerías in spanish), and last but not least, the informal freelance vendors not officially registered according to the survey.

[***] Just as the research of Dok, et al (2012) and Lustig, et al (2012) we do not add retirement and pensions as a benefit component because of its contributive nature, but this is included in the net income figure.

	-For pensions
	-For housing (public lending to finance a house)
Benefits [b]	
Means-tested	-Oportunidades
	-Elderly
	-Program for food support
	-Scholarships
	-Procampo
	-Unemployment assistance (Temporal Employment)
Non-means-tested	-Pensions (Not included in benefits, but included in net income)
	-Others (Are transfers from unknown source in the survey)

Notes: [a] Obtained by using simulation methods.

[b] Obtained by using direct identification methods.

Source: Own classification based on administrative sources.

4. Empirical application

In this section, we start by analyzing the incidence from the tax-benefit data with descriptive statistics to move on the next section for evaluating the tax-benefit system and applied the proposal methodology previously described.

4.1 Pattern of taxes and benefits by quintiles

Departing from Table 2 it can be seen a process of redistribution going from the market income to the net one in favor to the lowest two quintiles of the population. The shares on totals for the first three quintiles increased significantly but just quintiles two and three show higher averages on income after taxes and benefits.

Average income is greater in richer quintiles but decreases when moving from market to net income in the third, fourth and the top respectively; however, the income shares on totals are too low for the first two quintiles. In the case of taxes and total benefits a lower tax burden for the first quintile (poorest) is also observed, whereas from the second quintile upwards the net effect of paying taxes is much higher and at first sight, this is much greater and progressive for the higher quintiles. Summarizing, redistribution is observed for the lowest quintiles with a net tax burden that rises rapidly from the third quintile than social benefits cannot seemingly offset.

Table 2. Shares and means (by population quintiles) of gross and net incomes,
taxes and transfers per capita in Mexico, 2012
(Shares in % and means in pesos)

Quintile	Market income		Net income		Total taxes		Total benefits		Pension		SSC	
	Share	Mean	Share	Mean	Share	Mean	Share	Mean	Share	Mean	Share	Mean
1	2.84	487.21	4.97	796.65	2.38	51.63	41.13	133.56	23.03	229.00	0.45	1.50
2	7.01	1207.88	7.99	1,281.12	4.92	106.54	22.85	74.07	11.49	114.14	2.51	8.43
3	11.62	2004.95	12.28	1970.48	8.95	193.84	13.58	43.93	13.73	136.65	6.32	21.21
4	19.29	3323.73	19.24	3090.79	18.04	390.68	13.16	42.71	16.58	165.04	14.95	50.00
5	59.24	10232.93	55.71	8940.59	65.52	1420.59	9.38	30.47	35.39	352.18	75.81	254.40
Total	100.00	3450.46	100.00	3215.19	100.00	432.53	100.00	64.95	100.00	199.38	100.00	67.08

Source: Author's elaboration using ENIGH, 2012.

For the case of taxes and its burden on the population distribution, it is shown that an apparent progressivity is due to direct taxes on income (ISR), which could be offset by the VAT payments. It can be seen in Table 3 how VAT shows a greater burden as well as a higher mean on payments for the first quintile. The poorest quintile contributes with a share of 3.5 per cent and the second with 6.6 per cent, and their mean of this tax is higher than the corresponding for the ISR, with $27.6 and $52.5 pesos per capita. The remaining shares and means for IEPS and SSC are less evident and show certain progressivity along the quintiles.

Table 3. Shares and means (by population quintiles) of income and indirect taxes
and Social contributions per capita in Mexico, 2012 (Shares in % and means in pesos)

Quintile	Income tax		VAT		IEPS		SSC	
	Share	Mean	Share	Mean	Share	Mean	Share	Mean
1	1.65	18.80	3.50	27.60	2.26	5.22	0.45	1.50
2	3.91	44.57	6.63	52.49	4.09	9.48	2.51	8.43
3	7.47	84.94	10.83	85.49	10.11	23.41	6.32	21.21
4	16.78	191.22	19.34	152.57	20.19	46.89	14.95	50.00
5	70.11	800.89	59.67	473.54	63.21	146.16	75.81	254.40
Total	100.00	228.01	100.00	158.30	100.00	46.22	100.00	67.08

Source: Author's elaboration using ENIGH, 2012.

 Table 4 presents the distribution of benefits for all the quintiles by social program expenditure. It can be perceived how the most redistributive benefit comes from *Oportunidades*, where the lowest two quintiles have a share more than 76 per cent of the amount spent by this program; in addition, the benefit shares are also high for the *elderly* program with a share of 66 per cent in the same quintiles. Meanwhile, 73 per cent of the transfers from *PAL* program is the share for the lowest two quintiles, being this benefit one of the transfer that goes to the most disadvantaged due to its inherent characteristics of operation rules on food needs, but in absolute terms is one of the lowest benefit in per capita units of income. The benefits that concentrate little more than 60 per cent for the lower two quintiles are *Procampo* and the *temporary employment*. *Procampo* needs to be highlighted,

when 25 per cent of the cash-transfers went to the top quintiles as well as the *scholarship* program with over 60 per cent of the benefits.

Table 4. Shares and means (by population quintiles) of benefits per capita in Mexico, 2012
(Shares in % and means in per capita Mexican pesos)

quintiles	oportunidades	Elderly	PAL	School	Procampo	Emp. temp	Others
				Shares			
1	50.69	44.07	47.51	9.37	35.18	43.86	28.01
2	25.96	22.13	25.69	12.47	25.03	17.22	16.13
3	13.07	12.60	5.85	17.33	14.42	9.19	12.66
4	7.92	10.20	16.96	37.97	9.52	28.18	19.91
5	2.20	11.27	4.05	22.96	15.69	1.69	23.38
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00
quintiles				***Means***			
1	79.85	28.86	1.66	3.70	13.31	0.90	5.27
2	40.89	14.48	0.90	4.93	9.47	0.35	3.04
3	20.61	8.24	0.20	6.83	5.47	0.19	2.39
4	12.49	6.69	0.59	15.00	3.60	0.58	3.75
5	3.47	7.38	0.14	9.07	5.95	0.03	4.42
Total	31.47	13.13	0.70	7.91	7.56	0.41	3.77

Source: Author's elaboration using ENIGH, 2012.

4.2 Incidence and coverage of taxes and benefits.

From the Table 5 it can be seen the coverage rate of benefits. The greatest coverage is attained by *Oportunidades* program, where the poorest first quintile receives about 51 per cent and the second 28 per cent. This shows how this program targets well the poor group. The next important benefits according to its population coverage are the *Elderly program* and the *Scholarships*, with almost 7 and 6 per cent respectively.

Table 5. *Coverage of the benefits* by population quintiles in Mexico, 2012
(Coverage in %)

Benefits	1	2	3	4	5	subtotal
Oportunidades	50.97	28.01	14.75	8.09	2.97	20.96
Elderly	12.95	8.42	5.13	4.80	3.41	6.94
PAL	2.33	1.20	0.47	0.72	0.22	0.99
Scholarship	4.17	4.52	6.53	7.54	5.49	5.65
Procampo	10.59	5.31	3.79	2.31	0.94	4.59
Temp. Emp.	0.65	0.36	0.22	0.48	0.06	0.35
Others	3.81	1.84	2.12	1.91	1.11	2.16
\Population	67.13	44.89	30.78	22.17	13.14	36.35

\ Population with at least one benefit program.
Source: Author's elaboration using ENIGH, 2012.

The *elderly* benefit is among the programs with large coverage for the poorest quintile; while scholarships for education cover more than 7 per cent in the fourth quintile. Considering the average benefit for the top quintiles (Table 4) suggests that these latter transfers tend to be regressive. The program with the largest coverage for the poorest quintile is *Oportunidades*, followed by *Elderly* program, *Procampo*, educational scholarships and other transfers at the final coverage position; while for the richest quintile, scholarships are located at first place, followed the *Elderly and Oportunidades* programs, being the rest of the benefits almost non-existent for this quintile.

4.3 General impact in the fiscal system: VE and HI -Application of DJA-

In order to determine the overall effect for the tax-benefit system on inequality and to show the different distributive components we use the DJA model. As it can be observed from table 6, the vertical equity component of the tax/benefit system is important and reacts with a decrease of about 16.5% of the Gin-Atkinson index of inequality. However, the HI reduces the VE by about 25%, which is in our view relatively huge. The same feature is observed for the re-ranking component. It can also be seen that benefits induces part of the positive redistributive effects with 7.2 points of VE and HI reduces its impact in a lesser extent (10.5 per cent).

Table 6. DJA decomposition of vertical and horizontal equity in the fiscal system, Mexico 2012.

Component	Notation	Joint estimation	Share/*	from Benefits	Share/*	from Taxes	Share/*
Inequality in gross income	$I_X(\varepsilon = 0.5, \rho = 2)$	0.6366	100.0	0.6366	100	0.6366	100
Inequality in net income	$I_N(\varepsilon = 0.5, \rho = 2)$	0.5798		0.5999		0.6305	
Concentration index of net income	$I_N^P(\varepsilon = 0.5, \rho = 2)$	0.5655		0.5981		0.6292	
Concentration index of purged net income	$I_N^E(\varepsilon = 0.5, \rho = 2)$	0.5412		0.5937		0.6265	
Redistributive effect:	$\Delta I(\varepsilon, \rho)$	*0.0567*		*0.0367*		*0.0061*	
Vertical equity	V: $I_X - I_N^E$	0.0954	16.5	0.0429	7.2	0.0101	1.6
Horizontal inequity	H: $(I_N^P - I_N^E)$	0.0244	25.6	0.0045	10.5	0.0027	26.7
Re-ranking	R: $(I_N - I_N^P)$	0.0143	14.9	0.0018	4.2	0.0013	12.8

/* V/I_N ; H/V, and R/V.

Source: *Author's estimation using ENIGH, 2012.*

As the total Tax component just produces a slightly contribution to VE (1.6 per cent) and a high level of HI (reduction on VE) for about 27 per cent as well as a great level of negative re-ranking (12.8 per cent), it may be appropriate to look for the benefit components to detect which transfer contribute (or not) to decrease HI and re-ranking the most. These results can be compared to those found for Slovenia and Croatia in Cok et al, (2012) using same parameters for the Gini-Atkinson index as a moderate situation ($\varepsilon = 0.5, \rho = 2$) to measure the corresponding components. Initial inequality is 0.428 and 0.467 respectively in each foreign country and redistribution is much greater in both countries than in Mexico, with a difference

$\Delta I(\varepsilon, \rho)$ above 10 points for each country, having a reduced reranking in Croatia, however, the post-fiscal inequality was much greater in Mexico, where redistribution barely achieved 5.6 points of reduction.

It is helpful to recall here that the apparent low vertical equity with tax system is expected in the case where the progressivity and change in income with the tax system affects mainly those in the top of the distribution. In table 7 we provide a series of simulations when adding each benefit to the pre-fiscal income, one at a time to capture in a more detail its redistributive effects. It can be seen that *Oportunidades* program induces more redistributive effects than the rest of the benefits with VE component near to 4.4 per cent, meanwhile HI accounts for 7.8 per cent and Reranking as few as 2.2 per cent.

Table 7. Simulations for DJA decomposition of vertical and horizontal equity
with benefits, Mexico 2012.

Component	scholarships	Oportunidades	procampo	elderly	Pal	empleo	others
Inequality in gross income	0.6366	0.6366	0.6366	0.6366	0.6366	0.6366	0.6366
Inequality in net income	0.6360	0.6126	0.6321	0.6285	0.6362	0.6361	0.6355
Concentration index of net income	0.6359	0.6120	0.6318	0.6281	0.6362	0.6361	0.6354
Concentration index of purged net income	0.6355	0.6098	0.6301	0.6247	0.6359	0.6357	0.6348
Impact of simulations							
VE	0.0010	0.0268	0.0065	0.0119	0.0006	0.0009	0.0018
HI	0.0004	0.0021	0.0017	0.0034	0.0002	0.0004	0.0006
R	0.0001	0.0006	0.0004	0.0005	0.0000	0.0000	0.0001
Redistributive effect: $\Delta I(\varepsilon, \rho)$	*0.0006*	*0.0240*	*0.0044*	*0.0080*	*0.0004*	*0.0005*	*0.0011*

Source: *Author's estimation using ENIGH, 2012.*

Among the reasons of the high level of horizontal inequality are the two conventional error types of targeting of the benefit programs. In figure 1 we depict the conditional standard deviation using non-parametric regression from the benefits. This enables to give the importance of local inequality of the studied benefits. When we focus on the bottom part of the distribution, the elderly and *opportunidades* programs are the ones which exhibit the highest variability's. This result is conforming from what is reported in Table 6 and where the HI component is high in margin with these programs.

Figure 2 presents the expected net income after the fiscal system has acted. The dots are the post-fiscal of sample income units expressed in Mexican pesos per capita. It can be observed that for each market income (X) in the top part of the distribution a large amount of units of post-fiscal incomes are located below the 45° line which corroborates the progressivity in the fiscal system. Vertical and horizontal lines show the level of the official poverty thresholds and these are helpful to depict the effect between the two types of incomes. Table A1 in the appendix shows the poverty levels in the country and for each province.

Figure 1. Conditional standard deviation for transfers, México 2012
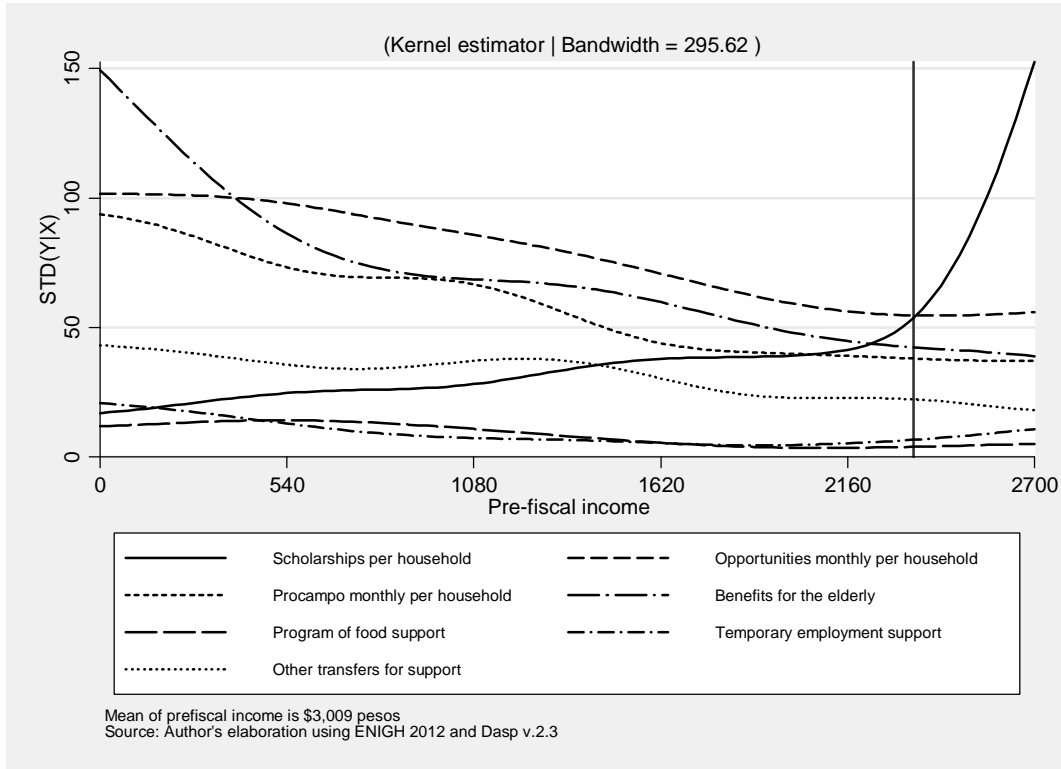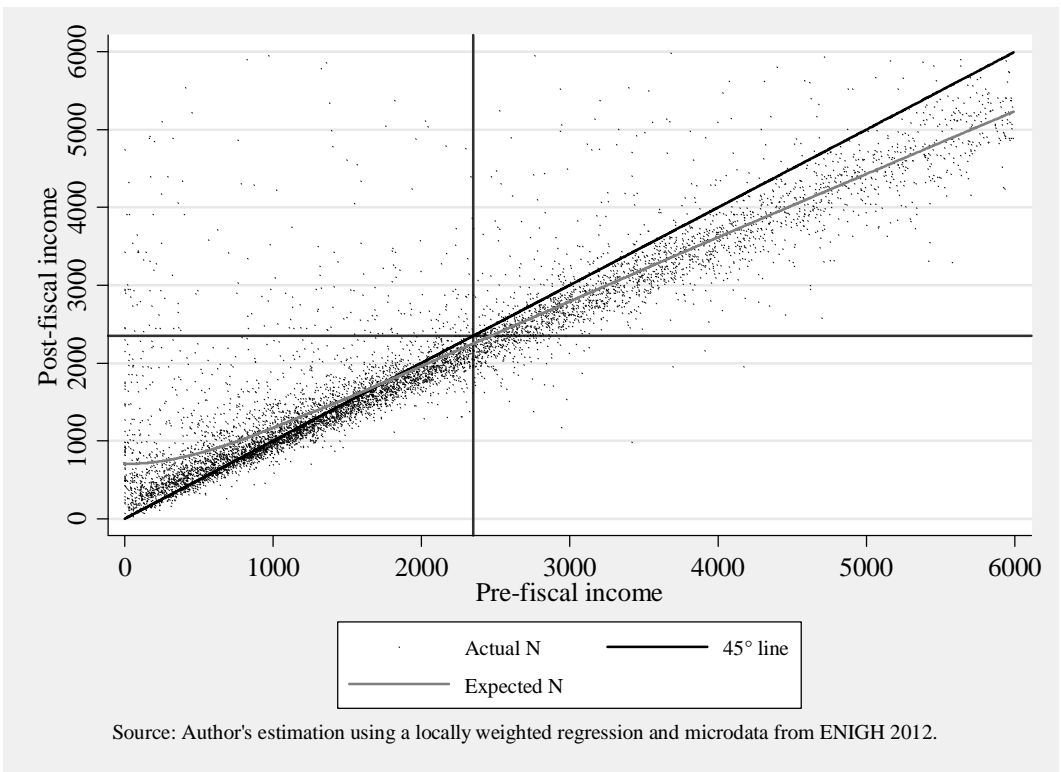(Mexican pesos, 3rd quarterly)

(Kernel estimator | Bandwidth = 295.62)

——— Scholarships per household	– – – Opportunities monthly per household
· · · · · Procampo monthly per household	–·–·– Benefits for the elderly
— — Program of food support	–··–·· Temporary employment support
· · · · · Other transfers for support	

Mean of prefiscal income is $3,009 pesos
Source: Author's elaboration using ENIGH 2012 and Dasp v.2.3

Figure 2. Scattergram of pre and post-fiscal incomes, México 2012
(Mexican pesos, 3rd quarterly)

· Actual N	——— 45° line	
——— Expected N		

Source: Author's estimation using a locally weighted regression and microdata from ENIGH 2012.

These lines separate four areas:

- Below and to the left of the thresholds (panel A) the poor and the households more affected by redistribution, since they represent around one half of the entire population (CONEVAL, 2009) and most of them are located well below the expected net income;
- Below and to the right area (Panel B) are individuals who were not poor, but their income level was reduced by the tax system and the post-fiscal situation push them to fell in poverty. This is explained inter alias by the HI component;
- Left upper area (panel C) shows the slight cloud for data of persons who ceased to be poor when they have seen increasing their post-fiscal income, which by the way, are some few (poverty gap may exhibit more improvement with the fiscal system).
- The top right side (Panel D) which allows to observe the level of inequality caused by the tax system in the case of individuals with incomes much higher in the pre-fiscal situation (Reranking). It seems that income in panel D grew much more in the post-fiscal position with the cloud of data above the estimated curve for *N*, and those who progressively for the system have seen a decrease on their income as part of a greater burden of the taxes and a lower incidence of the transfers for themselves.

4.3.1 The Progressivity of total taxes and total benefits.

Figure 3 and 4 show how the fiscal system seems to be progressive. The concentration curve (on the left side) for total taxes is elsewhere below the market income's Lorenz curve. This confirms the progressivity that the tax system. This is also the case for total benefits, where its concentration curve is elsewhere above the Lorenz curve. For the net effect of the tax/benefit system, we find that the latter is IR progressive, since the concentration curve of net incomes is above the Lorenz curve of gross incomes.

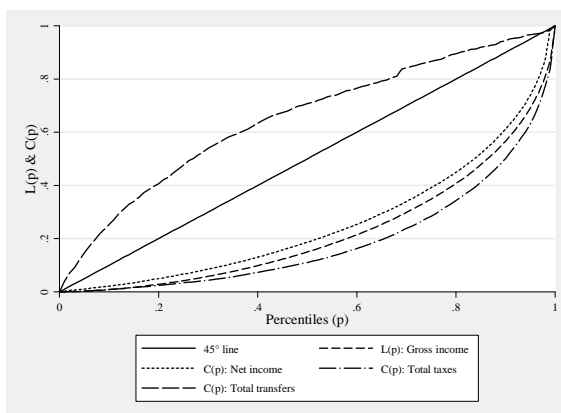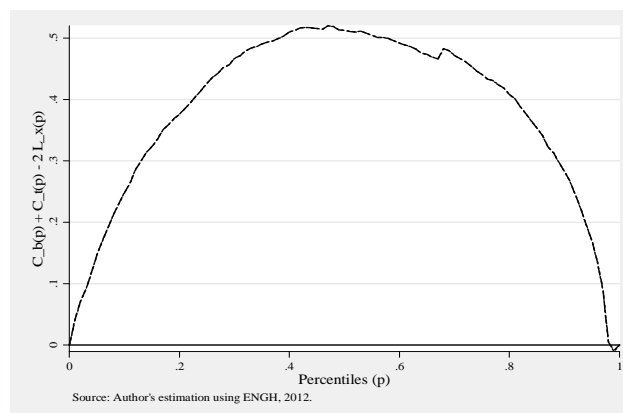Figure 3. Progressivity of taxes and transfers: Mexico 2012

Figure 4. Progressivity curve of the Tax-benefit system in Mexico, 2012

4.4 Progressivity for the tax-benefit system: Taxes vs transfers.

Are total benefits more progressive than total taxes? As we can observe in Figure 4 total benefits are more progressive than total taxes in Mexico. This can be explained by the generous programs of transfers that target in priority the poorer groups, but it is important to recall that progressivity measures the incidence from benefits according to the position of the individuals or families already involved in the programs as well as considering its tax burden in the system. So, we assume that income revenues and revealed preferences from recipients and contributors are already given.

4.4.1 Progressivity in detail of taxes and transfers

In order to capture the effects in the fiscal system we estimate progressivity curves for each tax and benefit (see figure 5 and 6). In the case of direct and indirect taxes it can be checked that income tax is more progressive, while the VAT presents a neglected level of regressivity. Using the Tax-Redistributive approach –TR– (Duclos and Araar, 2006) it can be seen a greater progressivity for direct taxes and a greater incidence for the highest tax-payers (figure 5). The fact that the TR approach presents greater progressivity is the result that it burdens on taxpayer segments composed by individuals with more economic capacity; meanwhile, the VAT incidence affects more the lower percentiles, reducing the burden for the middle - and high- income households.

Table 8. Kakwani index for pre-fiscal and post-fiscal figures, Mexico 2012.

Variables	Gini_X	Conc_N	KT/B	std. Error
Reynolds-Smolensky	0.5521	0.5183	0.0338	0.0020
Taxes		*C(Ti, Bi)*		
Total Taxes	0.5521	0.6210	0.0689	0.0061
ISR	0.5521	0.6717	0.1196	0.0093
VAT	0.5521	0. 5498	-0.0023	0.0108
IEPS	0.5521	0.5987	0.0466	0.0116
Social security contrib	0.5521	0.7279	0.1758	0.0141
Total Benefits				
B (without pensions)	0.5521	-0.3004	0.8525	0.0234
Oportunidades	0.5521	-0.4660	1.0181	0.0163
Elderly	0.5521	-0.3342	0.8863	0.0345
PAL	0.5521	-0.3968	0.9489	0.0867
Scholarship	0.5521	0.2185	0.3336	0.0457
Procampo	0.5521	-0.2265	0.7786	0.0598
Temp. Emp.	0.5521	-0.3497	0.9018	0.1691
Others	0.5521	0.0024	0.5497	0.1132
Pensions	0.5521	0.1166	0.4355	0.0490

Source: Author's elaboration using ENIGH, 2012.

In the case of special duties to products and services, progressivity is presented and some relative regressivity occurs for the highest percentiles. The progressivity curves for the benefits are shown in figure 4 as well. It can be seen how all the benefits are progressive but those have different intensity. If we rank the transfers from the more progressive to the least one (see also Table 8), we put at first order *Oportunidades*, followed by temporary employment, and *PAL* as the three benefits having the greatest progression. *Elderly* benefits go for the fourth place, leaving the fifth to *Procampo*, the sixth to other transfers and the last place to *Scholarships*.

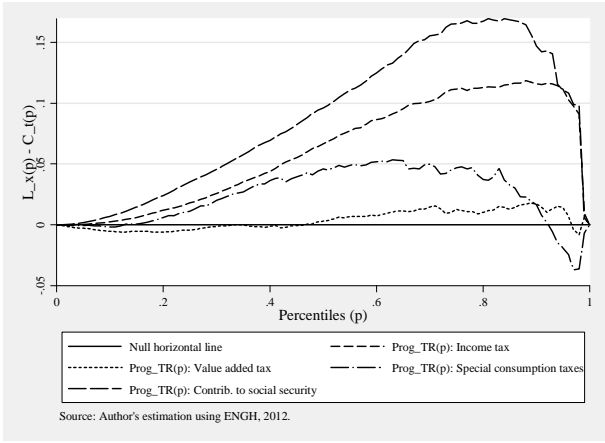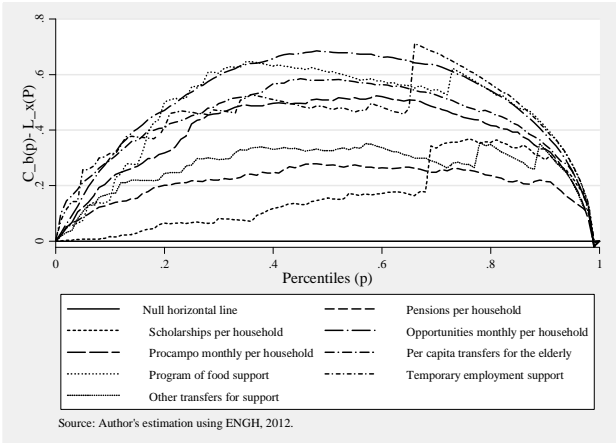Figure 5. Progressivity curves of the taxes in Mexico, 2012

Figure 6. Progressivity curves of the benefits in Mexico, 2012

Source: Author's estimation using ENGH, 2012.

The previous analysis on progressivity of taxes and benefits can lead us a good way of elaborating policy and recommendations to improve the effects on each program and the sort of taxes applied, even for better designing taxation policy such as the neglected Mexican indirect tax reform to impose VAT on food and medicines in recent times (which is beyond the goal of this paper). Our results for VAT progressivity show a decreasing burden for the middle and top earners as an indication of a high level of HI induced by this form of tax (see figure 6); however, we move forward to decompose the effects in the case of the VAT to dig deeply and find the component that might be driven the hidden regressivity.

4.5 Analytical approach decomposition of tax sources

In this section we apply the decomposition of Kakwani index for indirect taxes as we previously found to be the reason of relative contribution to regressivity in the Mexican fiscal system. Why this decomposition can be relevant to highlight policy makers? In practice, if we observe a low level of progressivity of a given tax, like VAT, we cannot easily determine the source of this low level of progressivity. In others words, what are the tax sources that contribute the most to the total progressivity? To illustrate this better, we present in what follow the empirical results for Mexico 2012 in table 9. As it was seen before, the progressivity of the VAT tax is practically zero (Kakwani index was about: -0.0023).

When Kakwani index is negative and from the progressivity curves for taxes shown in Figure 5, it can be interpreted as measurement of the extent of absolute regressivity, at least for those percentiles with negative difference. Thus, the relative contribution can be interpreted as the contribution to the total regressivity. For instance, the relative negative contribution of *Food and beverages* on total VAT indicates that this group of consumption is regressive as it reduces the progressivity by itself.

Based on the results, even if some VAT tax sources show a high level of progressivity like those of *Transportation and related goods and services*, the total VAT tax effect show practically a nil level of progressivity (-0.0023). Among the post consumptions that the government can act to improve the progressivity of the total VAT taxation, we find the *Health care* and in *Housing* expenditures, including *utilities* posts, and in a lesser extent *communication services* as well *as clothing and footwear.*

Table 9. Progressivity decomposition by source of VAT: Mexico, 2012.

VAT on :	Tax Share	Gini index of Gross Income	Concentration Index	Absolute Contribution	Relative Contribution
[a] Food and beverages	2.62	0.5521	0.2896	-0.0069	309.74
[b] Alcohol & tobacco	1.22	0.5521	0.5973	0.0006	-24.97
Restaurants & related services	6.09	0.5521	0.6889	0.0082	-375.76
Housing, including utilities	8.28	0.5521	0.3819	-0.0141	635.89
[a] Public transportation and related goods & services	13.06	0.5521	0.6536	0.0133	-598.18
Furniture and equipment	2.2	0.5521	0.6055	0.0012	-52.91
Clothing and footwear	7.5	0.5521	0.5182	-0.0025	114.64
Recreation, entertainment and sports	5.14	0.5521	0.6885	0.007	-316.14
Communications and network services	4.56	0.5521	0.4608	-0.0042	187.98
[a] Education	14.84	0.5521	0.5718	0.0029	-131.99
[c] Health care & related	29.14	0.5521	0.4947	-0.0167	754.27
Insurance, professional & public services	5.35	0.5521	0.7188	0.009	-402.56
Total	**100**	**0.5521**	**0. 5498**	**-0.0023**	**100.0**

Notes: [a] zero rated. For soft-drinks and sweetened beverages general rate is applied; some expenses on transportation, such as flights or car rentals are taxed at the general rate as well as spending on fuel, gasoline and diesel; private and public education VAT is exempted when tuition is paid but other private educational expenses are taxed at the general rate.

[b] Alcoholic beverages include those purchased at the store and those consumed in a licensed establishment, as well as those products used in home brewing of alcoholic beverages.

[c] From this group just medicines are zero rated.

Source: Author's elaboration using ENIGH, 2012.

5. Conclusions

This paper focuses on the study of the redistributive effect and progressivity of the tax-benefit system in Mexico. Even if the economic efficiency requires more free markets, these may induce a serious distributive failure. As a remedy to this, the regulator or the government

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imposes in general a series of distributive corrections through the fiscal system and the benefits programs. This will ensure some equity and an acceptable level of social welfare. However, even if these redistributive mechanisms are helpful to correct the market failures, they are in general complex and can encompass some distributive imperfections. The need of synthetizing and analysing social efficiency of the tax/benefit system, justifies, inter alia, the corrections to be undertaken. In this paper, we try to shed a light on the Mexican tax-benefit system by using a rich and nationally representative database for the year of 2012. Mainly, we start by studying the progressivity of the tax/benefit system. Further, we propose a simple method of decomposition of progressivity indices in order to show the contribution of the different sources of tax or of benefit to the total progressivity.

In order to show the extent of horizontal inequality and how the latter affects the vertical equity of the tax/benefit system, the DJA model was applied for the first time to the Mexican case. Next, we summarize the main findings of our research:

- In general, the tax/benefit system is progressive and reduces the Atkinson-Gini inequality by about 5.68 points. Benefit programs exhibit more progressivity relatively to taxes. This may be explained by the efficient targeting of poor and the higher sensitivity of progressivity indices to the income changes in the bottom part of the distribution. When social transfers are applied, the tax/benefit system for the low income contributors becomes more progressive, but part of the problems is linked to coverage.

- Results of the DJA model show that the benefit *Oportunidades* contributes the most to VE. It shows also the existence of a relatively high level of horizontal inequality where the HI reduces the VE by about 25%. This can be explained by some imperfections in targeting the poor, or also, in the structure of the tax system when reranking is about 15%. Reducing the HI component will improve the social efficiency of the tax/benefit system, and this, without any additional need of funds. This aspect must be studied in future research to understand the effects from the current fiscal reforms in the country.

- The decomposition of progressivity indices shows that some indirect taxes contribute significantly to lighten the progressivity of VAT. The results identify also the sources of VAT that render nil the progressivity of this tax: health-care and housing expenditures, as well as communication services, clothing and footwear. Of course, this is related with the pattern of distribution of consumption of the different taxed goods.

- Some of the benefits target less the poor group and may justify the need of restructuring such programs in order to make them more efficient and less expensive for the government. This is the case for scholarships with the highest standard deviation as well as the benefits for the elderly and Procampo.

For future research we report the need to find out fiscal redistributive reforms on both direct and indirect taxes which will serve to simultaneously increase revenues and redistribute better the income, so more resources could be allocated in the most progressive programs of transfers to strengthen government public services with more coverage and social welfare.

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Appendix

Table A1. Per capita means of benefits and poverty headcount for Mexican provinces, 2012.

Provinces	Scholarships	Oportunidades	Procampo	Elderly	PAL	Empleo	Others	Poverty/a
Aguascalientes	8.6	14.4	2.5	8.7	0.3	1.3	0.0	0.508
Baja California	1.9	4.4	0.0	10.1	0.0	0.0	0.0	0.343
B. Calif Sur	8.4	12.8	0.0	11.4	1.0	0.6	9.0	0.306
Campeche	6.5	41.6	17.3	27.5	0.7	1.8	4.1	0.491
Coahuila	4.4	12.5	1.1	6.9	0.5	0.9	0.5	0.495
Collima	55.9	11.8	7.3	13.0	0.3	0.0	22.4	0.435
Chiapas	2.9	94.5	30.9	26.9	0.5	0.0	33.9	0.797
Chihuahua	7.8	11.9	45.5	26.4	2.3	0.2	0.7	0.526
Distrito Federal	12.9	1.5	0.0	57.1	0.1	0.0	15.6	0.278
Durango	7.7	22.8	30.0	15.4	0.3	0.2	3.5	0.633
Guanajuato	5.9	27.2	8.4	16.4	0.1	0.0	0.0	0.531
Guerrero	2.7	67.1	6.3	29.5	0.3	0.1	2.9	0.700
Hidalgo	5.6	50.2	12.2	34.9	0.9	1.7	0.8	0.670
Jalisco	29.8	13.7	3.9	17.9	0.5	0.0	1.4	0.522
Edo de Mex	4.0	13.7	2.6	8.5	0.6	0.0	0.1	0.546
Michoacán	5.3	35.6	2.9	22.2	1.9	1.1	0.0	0.589
Morelos	5.0	28.7	7.4	27.3	1.5	0.0	2.6	0.545
Nayarit	6.7	27.1	15.6	36.2	0.0	2.9	10.4	0.475
Nuevo León	5.8	5.5	0.0	17.6	0.0	0.6	6.5	0.266
Oaxaca	1.6	77.1	7.4	45.5	2.9	0.0	4.7	0.779
Puebla	1.6	48.3	10.5	16.2	0.4	0.0	0.3	0.658
Queretaro	42.3	23.3	6.5	18.9	0.0	0.3	2.3	0.435
Quintana Roo	4.7	16.9	2.0	7.9	0.4	0.0	0.0	0.360
San Luis Potosi	4.3	55.5	32.6	30.4	0.3	0.0	1.0	0.596
Sinaloa	11.5	34.3	13.9	25.8	0.3	0.2	2.4	0.487
Sonora	13.9	16.6	3.1	22.5	0.0	0.0	0.8	0.403
Tabasco	10.8	52.3	2.3	15.2	4.5	0.5	5.5	0.557
Tamaulipas	8.7	12.5	44.3	13.9	0.2	0.4	0.8	0.418
Tlaxcala	11.5	29.8	8.9	17.4	1.5	2.2	0.8	0.716
Veracruz	3.0	46.6	8.7	15.2	0.0	1.1	1.3	0.601
Yucatan	1.0	39.6	17.7	23.6	0.2	0.2	5.1	0.588
Zacatecas	8.5	44.0	33.0	29.9	0.2	3.7	3.5	0.625
Mexico	**8.3**	**28.9**	**10.1**	**22.1**	**0.6**	**0.4**	**4.2**	**0.525**

Notes: *a Total poverty using CONEVAL wellbeing threshold.*
Source: Author's elaboration using ENIGH, 2012.