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Stata module for decomposition of progressivity measurements.

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Our goal

This presentation shows a new command called `dprogress.ado`.

Our goal with this `ado.file` is to analyze the progressivity for any continuous variable (total of taxes or transfers in our case) and to show how the different sources contribute to the total effect in redistribution using Stata.

An empirical case is shown for the current Mexican system in the Value Added Tax (VAT) scheme.

Theoretical approach

- We propose an analytical method to decompose the total progressivity of the total taxes and benefits by the contributions of different sources.

- Kakwani (1977) and Reynolds-Smolensky (1977) approaches are among the decomposable progressivity by sources.

- Kakwani index is equal twice the area between the Lorenz curve and the concentration curve (of a tax, or transfer).

- This is the difference between the concentration index of taxes and an inequality index such as the Gini index of gross incomes.

$$K_{T,B} = IC_{T,B} - I_X \qquad (1)$$

Tax Progressivity

- Using the Gini index of gross income I_X and the concentration curve of the tax T by C_T, the Kakwani index (*Tax-Redistributive* approach, (Duclos, 1993)) of progressivity is defined as follows:

$$TR_T = C_T - I_X \qquad (2)$$

- This index enables us to assess the level of progressivity in one simple value.

- This value ranges between (-2) –perfect regressivity- and (2) –perfect progressivity.
- By construction, the Kakwani index is based on the scheme of distribution of the tax (TR) to capture the extent of the progressivity.

Tax Decomposition of Progressivity

Let's assume 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:

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

- The contribution of a given tax T_k to total progressivity of T depends on its level of progressivity: $(C_{Tk} - G_X)$

- The contribution of a given tax to progressivity of total taxes depends on the importance of its share: $\frac{\mu_{Tk}}{\mu_T}$

Empirical application

- Using microdata from ENIGH 2012 we compute the next expression

$$X = N + T - P + SSC - B$$

- Where *X* is the gross income of all households
  N is the net income of all households
  T stands for total taxes (direct + indirect) paid by the households
  P are the pensions received by all the households
  CSS are the social security payments paid by the households
  B as the transfers received by the households

Empirical application: VAT case

- The ENIGH allows analysis of 726 products and generic services, from which 27 adds to VAT, at a rate general of 16%.
- We made a reclassification of 12 categories of VAT sources.
  - The food group considered is taxed in some goods as sweets, or pet food.
- We proceed to build the distribution for the 2012 survey, then we build an scenario using the 2012 database but applying the new tax rules in the year 2014.

Kakwani index for pre-fiscal and post fiscal reform, México 2014

Variables	Gini_X	Conc_N	KT/Bx100	std. Error
2012	0.5934	0. 5136	7.9879	0.0050
2014	0.5934	0. 5136	7.9777	0.0050
C(Ti, Bi)				
Total Taxes	0.5934	0. 6416	4.8241	0.0104
VAT 2014	0.5934	**0.5407**	5.2698	0.0135

Source: Author's elaboration using ENIGH 2012.

Sintaxis of dprogress (version 1.0)

Description:
To perform the decomposition of the Kakwani progressivity index by sources:

```
syntax varlist(min=1)[, HSize(varname) HGroup(varname) GROSSINC(varname) DSTE(int 1)
```

where

- `varlist` is a list of n variables that are the sources of the kakwani index
- `hsize` household size or variable that indicates the weight of household
- `hgroup` household groups, as in areas or households by region
- `grossinc` to indicate a variable of market income or gross income
- `dste` If option “1" is selected, it displays standar error.

Example

```
dprogress vat_1source vat_2source vat_3source, hsize(factor) grossinc(Xinc) dste(1)
```

Empirical application

example.do

example_eusmex14.wmv

Decomposition of the Kakwani progressivity index for VAT, by tax sources: Huesca & Araar (2014) Approach

Decomposition of the Kakwani progressivity index by tax sources: Araar (2013) Approach.
Household size : factor_hog

Sources	Income Share	Gini Index	Concentration Index	Absolute Contribution	Relative Contribution
Food and beverages	**3.08**	**0.5934**	**0.2569**	**-0.0104**	**19.66**
	0.14	0.0135	0.0115	0.0005	4.58
Alcohol and Tobacco	**1.89**	**0.5934**	**0.5757**	**-0.0003**	**0.63**
	0.15	0.0135	0.0339	0.0006	1.12
Restaurants & related services	**8.68**	**0.5934**	**0.6626**	**0.0060**	**-11.39**
	0.48	0.0135	0.0212	0.0022	6.07
Housing, including utilities	**10.32**	**0.5934**	**0.3461**	**-0.0255**	**48.45**
	0.33	0.0135	0.0170	0.0016	10.43
Transport	**16.70**	**0.5934**	**0.6423**	**0.0082**	**-15.48**
	0.63	0.0135	0.0207	0.0031	9.00
Furniture and equipment	**2.82**	**0.5934**	**0.5924**	**-0.0000**	**0.06**
	0.21	0.0135	0.0303	0.0009	1.70
Clothing and footwear	**9.19**	**0.5934**	**0.5373**	**-0.0052**	**9.80**
	0.67	0.0135	0.0406	0.0027	5.17
Recreation, entertainment	**6.99**	**0.5934**	**0.6554**	**0.0043**	**-8.22**
	0.34	0.0135	0.0233	0.0014	4.19
Communication	**5.33**	**0.5934**	**0.4462**	**-0.0078**	**14.88**
	0.20	0.0135	0.0186	0.0010	2.94
Education	**14.24**	**0.5934**	**0.5368**	**-0.0081**	**15.29**
	1.21	0.0135	0.0368	0.0050	8.48
Health care	**12.87**	**0.5934**	**0.4129**	**-0.0232**	**44.09**
	0.46	0.0135	0.0188	0.0022	8.68
Accommodation services	**7.89**	**0.5934**	**0.7121**	**0.0094**	**-17.76**
	0.89	0.0135	0.0421	0.0039	11.08
Total	**100.00**	**0.5934**	**-0.0527**	**-0.0527**	**100.00**
	0.00	0.0135	0.0136	0.0136	0.00

Conclusions

- The decomposition addressed here, can be applied to any decomposition of inequality by sources (of any continuous variable).

- This study is able to (normative) recommend to reduce the level of VAT on those products that end up with the more positive relative contribution, and to increase the level of the tax for those with the lowest value in relative participation.

- The results for VAT in groups with more regressive situation:
  - Health-care, housing and food and beverages expenditures.

- The groups with more progressive sources:
  - Accommodation services, Transport means, recreation and restaurants.

- The groups for Alcohol & tobacco, and Furniture & Equipment show neutral progressivity.

Basic references

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