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Mexico: Poverty estimates 2000-2002
Test of hypothesis

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Summary

Hypothesis testing was made on the poverty estimates developed for the period 2000-2002 by the **Mexico's Technical Committee on Poverty Measurement**, for three defined concepts of poverty: *food*, *capacities and patrimony poverty*, including the three geographic levels: *national*, *urban* and *rural*. For this purpose, the **National Income and Expenditure Household Surveys (ENIGHs)**, conducted in those years by the National Institute of Statistics, Geography and Informatics (INEGI) were used. The test outcomes show that both at national level and for the rural area, the proportion of the population in *food poverty* condition was lower in the year 2002 in relation to the two previous years, but this was not the case for the urban area. A similar situation was observed for *capacities poverty* in the three geographic levels; whereas for the *patrimony poverty* there was no statistical evidence that it has fallen during the period of reference.

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Introduction

Social government programs require to be periodically evaluated first, in order to measure their impact on target population and second to guarantee their continuity, or being the case, to take care of the adjustments and modifications required.

Particularly, it is feasible to evaluate poverty alleviation programs every two years through the information provided by the *National Income and Expenditure Households Survey* (ENIGH).

When undertaking the evaluation of such programs, it is usual for social policy makers to consider the following question:

Are action programs against poverty and social policies adopted in this period better than those pertaining to the previous one? In other words: Is the *rate of poor people in 2002 lower than in the year 2000? A*nswering this question, involves the consideration of certain characteristics of the information source.

Results obtained come from probabilistic random samples and not from the total population. Therefore, it is necessary to conduct tests of statistical significance, mainly when the differences are so small that rise a doubt about its veracity, since they could be apparent and could be explained by random fluctuations (incidental variations), that is to say, that accidentally the sample was "loaded" towards the non-poor households or vice versa, which is an intrinsic characteristic to any random sample.

Thus, the objective of this paper is to prove if the reduction of poverty in the period 2000-2002 is relevant for the three concepts adopted by the **Mexico's Technical Committee on *Poverty Measurement*:** *namely food, capacities and patrimony poverty*, and for the three geographic areas: *national, urban and rural.*

Exposition of hypothesis

Null hypothesis:

There is no significative difference in the proportion of poor population between 2000 and 2002.

Versus

Alternative hypothesis:

Significative difference in the proportion of poor population in the period 2000-2002 exists.

If it is denoted as:

H_0 = null hypothesis.
H_a = alternative hypothesis.
P_{2000} = proportion of year 2000 poor population.
P_{2002} = proportion of year 2002 poor population.

Then symbolically we want to prove:

$$H_0: P_{2000} = P_{2002}$$
Vs.
$$H_a: P_{2000} ? P_{2002}$$

This will be conducted for the three geographic levels (national, urban and rural); three poverty classifications (food, capacities and patrimony) and two categories (households and people), giving a total of 18 statistical hypothesis tests.

Test statistic

Set

$$p_{2000} = \frac{q_{2000}}{n_{2000}} \qquad y \qquad p_{2002} = \frac{q_{2002}}{n_{2002}}$$

Applying the Central Limit Theorem to "large" size samples and being a two tails test where p_{2000} and p_{2002} come from independent random samples, then

$$Z = \frac{p_{2000} - p_{2002}}{\sqrt{s^2_{p_{2000}} + s^2_{p_{2002}}}}$$

has an asymptotic standard normal distribution.

Where:

p_{2000} = proportion of poor people estimated from ENIGH-2000 sample

p_{2002} = proportion of poor people estimated from ENIGH-2002 sample

q_{2000} = number of poor people obtained through ENIGH-2000

q_{2002} = number of poor people obtained through ENIGH-2002

$s^2_{p_{2000}}$ =square standard error considering the complex design of ENIGH-2000 sample

$s^2_{p_{2002}}$ =square standard error considering the complex design of ENIGH-2002 sample

Analysis of results

The following Table 1 shows the 18 combination results for the previously mentioned statistical tests.

MEXICO: Hypothesis testing on differences in the proportion of poors in the years 2000 and 2002, by geographic scope and poverty classification Table 1

SCOPE/CLASSIFICATION CATEGORY	PROPORTION / YEAR		2000-2002 VARIATION	CASES HAVING THE FEATURE		STANDARD ERROR		Z VALUE	SIGNIFICANCE LEVEL OBSERVED â (TWO TAILED) (%)
	p_{2000}	p_{2002}		q_{2000}	q_{2002}	s_{2000}	s_{2002}		
National									
Food poverty									
Households	0.186	0.158	0.028	4,370,075	3,899,371	0.00723	0.00851	2.508	1.215
Population	0.242	0.203	0.039	23,665,635	20,575,000	0.00944	0.00940	2.928	0.342
Capacities poverty									
Households	0.253	0.211	0.042	5,950,765	5,192,812	0.00808	0.00954	3.361	0.078
Population	0.319	0.265	0.054	31,126,655	26,905,093	0.01004	0.01032	3.751	0.018
Patrimony poverty									
Households	0.459	0.441	0.018	10,769,504	10,876,387	0.01036	0.01196	1.138	25.521
Population	0.537	0.517	0.020	52,479,846	52,459,986	0.01089	0.01093	1.296	19.494
Urban									
Food poverty									
Households	0.098	0.085	0.013	1,464,305	1,337,724	0.00739	0.00579	1.385	16.600
Population	0.126	0.114	0.012	7,478,137	7,210,489	0.00967	0.00778	0.967	33.360
Capacities poverty									
Households	0.162	0.122	0.040	2,422,268	1,909,483	0.00947	0.00689	3.417	0.063
Population	0.202	0.160	0.042	12,038,695	10,070,015	0.01162	0.00882	2.879	0.399
Patrimony poverty									
Households	0.374	0.354	0.020	5,589,169	5,538,924	0.01351	0.01017	1.182	23.702
Population	0.438	0.420	0.018	26,017,494	26,518,971	0.01480	0.01133	0.966	33.426
Rural									
Food poverty									
Households	0.341	0.285	0.056	2,905,770	2,561,647	0.01567	0.02109	2.131	3.308
Population	0.424	0.348	0.076	16,187,498	13,364,511	0.01908	0.02058	2.708	0.677
Capacities poverty									
Households	0.414	0.365	0.049	3,528,497	3,283,329	0.01626	0.02336	1.722	8.514
Population	0.500	0.438	0.062	19,087,960	16,835,078	0.01927	0.02183	2.129	3.324
Patrimony poverty									
Households	0.607	0.594	0.013	5,180,335	5,337,463	0.01651	0.02925	0.387	69.869
Population	0.693	0.675	0.018	26,462,352	25,941,015	0.01501	0.02237	0.668	50.394

Source: Own calculation based on the National Income and Expenditure Households Survey (ENIGH), conducted in those years by the National Institute of Statistics, Geography and Informatics (INEGI), and on the methodology proposed by the Mexico's Technical Committee on Poverty Measurement.

Srandard errors were calculated by the Dirección de Estadísticas de Corto Plazo de la Dirección General de Estadística, INEGI.

The Last Conglomerated method was used in combination with Taylor's Series method, since it was a complex design of sampling.

Population at localities with less than 15 000 inhabitants was considered as rural population.

Food Poverty: Households whose income by person was less than that considered as necessary to cover food needs.

Capacities Poverty: Households whose income by person was less than that considered as necessary to cover food needs (defined same as in the previous group), plus the income required to assume expenditures in education and health.

Patrimony Poverty: Households whose income by person was less than that considered as necessary to cover food needs and basic consumption in health, education, clothing, footwear, housing and public transportation.

As Showed in Table 1, some differences in the proportion of poor people are significative, whereas some others present an opposite situation according to the significance level observed, that is, the minimum probability of rejecting the null hypothesis, yet being true. Now, the results by geographic extent are analyzed:

National

Decreasing in the proportion of households and poor people from 2000 to 2002, as much for food poverty as for that relative to capacities development is highly significative, therefore they cannot only be explained by accidental variations.

On the contrary, the difference of 2 percentage points for the population, and nearly the same numerical value for households is not a reliable proof to state that development of patrimony poverty in 2002 is lower than in 2000.

Urban

Decreasing in the proportion of households and poor people in the year 2002 in relation with the two previous years, as much for food poverty as for patrimony development is not significative, reason why the registered differences could be explained by accidental variations.

Whereas for capacities poverty, the difference of more than 4 percentage points for households and population is highly significative, indicating with it that the development of capacities poverty in 2002 is indeed smaller than in the year 2000.

Rural

Decreasing in the proportion of households with food poverty in the period considered is *significative*, and it is *highly significative* in regard to people; reason why it cannot only be explained by accidental variations. Concerning to the decreasing in the capacities poverty for people in more than 6 percentage points and for households in close to

5 points, there was empirical evidence to state that the differences shown are real.

However, in regard to patrimony poverty, the difference of 1.3 and 1.8 percentage points respectively shown for households and people, could probably be explained due to random fluctuations.

This situation is summarized in Table 2, when considering a level of global significance of α=5% (except for rural households in condition of capacities poverty where a major risk is assumed).

MEXICO: Hypothesis test results Table 2

GEOGRAPHIC SCOPE	FOOD POVERTY		CAPACITIES POVERTY		PATRIMONY POVERTY	
	H	P	H	P	H	P
National	Y	Y	Y	Y	N	N
Urban	N	N	Y	Y	N	N
Rural	Y	Y	Y	Y	N	N

H = Households
P = Population
Y = Yes, null hypothesis is rejected
N = No, null hypothesis is not rejected

In the following Table the confidence intervals (1- α = 90%) for the different concepts of poverty are presented, from where congruent conclusions with the previously derived ones are obtained.

MEXICO: Confidence intervals for the proportion of poor population by geographic scope and poverty classification Table 3

SCOPE / CLASSIFICATION / CATEGORY	PROPORTION/YEAR		2000-2002 VARIATION	STANDARD ERROR		CONFIDENCE INTERVAL AT 90%			
						ENIGH 2000		ENIGH 2002	
	p_{2000}	p_{2002}		s_{2000}	s_{2002}	LOWER LIMIT	UPPER LIMIT	LOWER LIMIT	UPPER LIMIT
National									
Food poverty									
Households	0.186	0.158	0.028	0.00723	0.00851	0.174181	0.197981	0.144197	0.172179
Population	0.242	0.203	0.039	0.00944	0.00940	0.226827	0.257869	0.187195	0.218135
Capacities poverty									
Households	0.253	0.211	0.042	0.00808	0.00954	0.240104	0.266672	0.194975	0.226345
Population	0.319	0.265	0.054	0.01004	0.01032	0.302242	0.335262	0.248035	0.281997
Patrimony poverty									
Households	0.459	0.441	0.018	0.01036	0.01196	0.441535	0.475613	0.421560	0.460900
Population	0.537	0.517	0.020	0.01089	0.01093	0.519504	0.555334	0.498750	0.534716
Urban									
Food poverty									
Households	0.098	0.085	0.013	0.00739	0.00579	0.085759	0.110069	0.075889	0.094927
Population	0.126	0.114	0.012	0.00967	0.00778	0.109878	0.141684	0.101510	0.127114
Capacities poverty									
Households	0.162	0.122	0.040	0.00947	0.00689	0.146400	0.177542	0.110587	0.133239
Population	0.202	0.160	0.042	0.01162	0.00882	0.183374	0.221604	0.145141	0.174151
Patrimony poverty									
Household	0.374	0.354	0.020	0.01351	0.01017	0.351504	0.395962	0.336904	0.370370
Population	0.438	0.420	0.018	0.01480	0.01133	0.413263	0.461957	0.401777	0.439067
Rural									
Food poverty									
Households	0.341	0.285	0.056	0.01567	0.02109	0.314887	0.366437	0.250324	0.319726
Population	0.424	0.348	0.076	0.01908	0.02058	0.392392	0.455166	0.313762	0.381484
Capacities poverty									
Households	0.414	0.365	0.049	0.01626	0.02336	0.386924	0.440412	0.326894	0.403754
Population	0.500	0.438	0.062	0.01927	0.02183	0.468008	0.531414	0.401987	0.473805
Patrimony poverty									
Households	0.607	0.594	0.013	0.01651	0.02925	0.580172	0.634474	0.545767	0.641993
Population	0.693	0.675	0.018	0.01501	0.02237	0.668084	0.717452	0.637956	0.711544

Source: Own calculation based on National Income and Expenditure Household Survey (ENIGH), conducted in those years by the National Institute of Statistics, Geography and Informatics (INEGI), and in the proposed metodology by the Mexico's Technical Committee on Poverty Measurement.

Standard errors were calculated by the Dirección de Estadísticas de Corto Plazo de la Dirección General de Estadística, INEGI.

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Patrimony Poverty: Households whose income by person was less than that considered as necessary to cover food needs and basic consumption in health, education, clothing, footwear, housing and public transportation.

Table 3 presents cases where the confidence intervals for 2000 are not superposed with that of 2002, reason why an ordering between the registered values of poverty in both years is possible. These data when analyzed also allow to conclude (under a controlled risk) that in effect there was a real decreasing in the poverty levels during the period 2000-2002.

Such situation occurs in the following cases:

National: Food poverty and development capacities poverty (households and people).

Urban: Development of capacities poverty (households and people).

Rural: Food poverty (people).

For the rest of households and poor people proportions an overlap in the corresponding confidence intervals is observed, which implies that in those cases there is no statistical evidence to affirm that in the year 2002 there was a poverty reduction.

Final considerations

Social programs to combat extreme poverty in urban zones are almost of recent application and do not have the same character and depth than those implemented in rural areas. Hence, the small reduction in poor households and people in the urban areas can be accidental. This is not the case for the rural zones.

Target population of health and educative programs (largely extended and taken care of by the three government levels in the national territory, both at urban and rural stages), is possibly deriving in an effective decreasing of poor households in terms of their development of capacities.

The decrease of households and poor population in patrimony is probably apparent. Social policy mainly oriented to combat extreme poverty, could not explain a decrease in patrimony poverty. The combination of other factors would be required, such as the economic policy and the improvement of performance indicators of the economy (employment, remunerations, etc.), which from 2000 to 2002 definitively did not show improvement signs.