

Educational Inequality in Nuevo Leon and Oaxaca, Mexico, 2008 and 2010: The Basis of an Uncertain Future for These Societies

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Abstract Education in society especially in Mexico, seems to be a powerful instrument of intergenerational social mobility to produce individuals with “capabilities and functions” [1] allowing them to obtain a greater well-being. “Education as schooling”, in the first instance, improves the individuals living conditions, since this is a path to a better way of living and a privileged way to achieve a higher economic and social position within a society” [2]. However, education’s purpose is not only to be thought as schooling for economic well-being, but also as an element of cultural integration and general well-being within a society. Based on that, we have studied the educational inequality in two states in Mexico during the years 2008 and 2010. To this end, we have incorporated into a model of multi-dimensional logistic regression, and index of educational inequality. This index, consist of three focal variables: educational backwardness, access to technologies of information and communication, and family education spending. These variables allowed us to quantify more accurately this form of inequality. The observed results are worrisome, even more because; this derives other inequalities for the families of these societies, including reducing opportunities for better employment, and thus provoking lower standards in health, housing, nourishment, and social participation among others. Educational inequality is, therefore, another factor that originates poverty in the society.

Keywords Education, Inequality, Index of Educational Inequality

1. Introduction

The idea of social inequality relates with the concept that we have towards equality. For Sen [1] inequality can come from two perspectives:

Equality can be measured and judged from the inherent

heterogeneity of humans and the pluralism of variables.

Inequality or lack of social equality can take human beings to situations where the difference between the variables of evaluation are considered severe, or even, extreme severe in some cases. In those cases poverty appears as a reflection of social inequality.

Poverty can be observed through different lenses. Historically from the 1940’s, poverty was measured based on the income. This approach was based on the welfare economy. In this case, the evaluation of inequality was based in the income, the wealth and the profit (economic approach).

Another approach comes from the capital. This approach mentions “it reproduces in a circle where the great exploitation of the active work force accentuates the tendency for generating a crescent mass of semi employed workers or an inactive work force. This phenomenon becomes a pressure factor that the capital uses to obtain more results from the active work force... the working population enhance the torments of poverty and misery on some other part of the population. The luck of some is strictly linked between each other” [3]. With this factor the capacity of the global and local capital creates a surplus of population (with a part-time job or without a job) and misery. Poverty comes from the lack of economic development and as a result of the before mentioned event. Current poverty, especially social inequality, it is not the result of an immature capitalism but the consequence of the maturity of a specific capitalism; the dependent one [3].

The leading and strategic role that the state assumes in the subjects that involves the policies and social welfare, has not created conditions to develop the standards in the population, on the contrary, it has allowed the rise of new forms of social inequality. Unfortunately, the new forms of inequality do not match or diminish the previous ones. This new forms of inequality maximise the previous ones generating new challenges in this field. While other types of inequality – social, economic and political participation- not only appears

to be deepening, but also acquiring a new physiognomy in the context of structural changes that characterize Mexico.

“Mexico, in Latin America, is one of the countries with the highest levels of social inequality”[4]. This inequality is defined by several variables that evaluate this subject (Sen [1], López C. y Ortíz J. [5]). Equality compares some specific conditions of an individual (income, wealth, education, internet access, happiness, freedom, employment, rights or needs) with others. This form of evaluation and measurement of equality is in function of the variable or variables, aspect or aspects that has been employed to do this evaluation. This evaluation involves income equality, equality in wealth and in happiness, opportunity of education or any chosen characteristic to be evaluated. However, searching for equality in one specific aspect produces some inequality on other aspects. In this context, this research pretends to show a multidimensional measurement of inequality that present some states in Mexico, in the years 2008 and 2010, highlighting the educational approach. This measurement explains and evaluates social inequality in a better way, and above all, the current educational inequality, proposing a desirable future for these societies.

2. Materials and Methods

In the last trimester of 2008, the National Council for the Evaluation of Social Development Policy (CONEVAL) elaborated a new multidimensional model of measurement of poverty for Mexico. This Model considered 5 proposals elaborated in 2007 and the comments and suggestions of Sabina Alkire [6], James Foster [7] and David Gordon [8]. This new model, that has been extended to improve the measurement of the educational dimension, is consistent with the theoretical and methodical elements proposed by David Gordon [8] and Satya R. Chakravarty [9]. These two authors employed on their respective models unit weights for all the focal variables employed. In other words, the average ratio that a person can have in terms of poverty, and that is why is considered to be poor, can be associated with a number between zero and one. Zero appears when there is any lack within the measurement and one where there is lack in all the parameters used in the measurement.

CONEVAL [10-19] generates a multidimensional model of poverty with two theoretical approaches: the welfare approach and the rights approach. The first comprises the analysis of the unsatisfied basic needs, the assets and the capabilities indicated by Amartya Sen [20]. Sen indicates that in the generation of any method to measure poverty there are two types of decisions, one refers to the identification of the ones who suffers poverty -those ones that are the targets of the social programs- and the other one that, as a synthetic form, builds a adding measurement, and index, of the social inequality to be observed. In the second one, the measurement is associated to the existence of the fundamental individual rights, inalienable, irreplaceable and

interdependent. For that reason, social inequality (poverty) is from this perspective a denial of the human rights. Based on these approaches CONEVAL [10] establish that “one person is poor (socially unequal) if this person lacks from welfare and rights”. With these elements CONEVAL establish the current definition of multidimensional poverty – multidimensional social inequality- for Mexico.

“A human being is in a multidimensional poverty situation when he/she does not have at least one right to accomplish social development, and if his/her income is insufficient to acquire the goods and services to satisfy his/her needs” CONEVAL [10]. This definition allows CONEVAL to select relevant dimensions to measure and evaluate social inequality. The first dimension measures economic welfare. This one is measured through the ordinary income per capita. This indicator identifies the population which income is enough to acquire the goods and needs to satisfy its needs. The second one is the one associated to the social rights that comprise education, health, social security, nourishment and housing with its services that quantify directly the social lack of every dimension. The last measurement identifies the population with at least one social lack in the indicators related with economic welfare. The adding measure is called the social deprivation index.

2.1. The Model

The model of CONEVAL [10-19] is a logistic regression model built to quantify two relevant subjects in the measurement and evaluation of social inequality: the economic welfare and the subject associated to the social rights. The indicators are:

2.1.1. Income Indicator

“Consider some monetary and non-monetary fluxes that does not risk or diminish the housing stock. Consider the frequency of transfers and eliminate the ones that are not recurrent. Do not include the estimation of the rent. Consider the scale economies and the equivalent scales within housing” CONEVAL [10, 17,19]

2.1.2. Lack Indicator of Educational lag

The constitution of this indicator employs the following variables: age of a person, year of birth, school insistency and educational level of the members within a house CONEVAL [10].

2.1.3. Lack Indicator of Access for Health Services

This indicator considers that a person is found in a shortage of access for the health services if the person does not have with an ascription or rights to receive health services from a private or public institution like the Seguro Popular, or from another governmental institution that provides social security (IMSS, ISSSTE, PEMEX, Army or Marine) CONEVAL [10].

2.1.4. Lack Indicator of Access for Social Security

The access to social security depends on the subset of conditions that needs to accomplish the members of each home, especially the ones that contribute or enjoy the benefits of having contributed during their laboured life.

Members of each household that do not accomplish with this condition can have social security access by family relationship defined by the Social Security Law (LSS) or another mechanism provided by it, for example, the voluntary inscription to the IMSS and the inscription for an Afore (Retirement found administrator) CONEVAL [10].

2.1.5. Lack Indicator of Quality and Housing

This indicator is calculated based of four variables: prevailing flooring materials, prevailing ceiling materials, wall materials and housing occupation density (Overcrowding index) CONEVAL [10].

2.1.6. Lack Indicator for Access of the Basic Housing Services

Based on the criteria proposed by the National Housing Commission (CONAVI), the model calculates the index with four focal variables. This model determines the lack of basic housing services: water access, drainage service, electric service and cooking fuel service CONEVAL [10].

2.1.7. Lack Indicator for Access to Food

This indicator incorporate the rights to nourishment as a part of the individual guarantees established in the Constitution of the United States of Mexico (CPEUM) [21]. It is also established in the article fourth that children have the right to satisfy their need of nourishment.

This indicator is determined by the distinction between the houses that has under aged population and the houses that does not have under aged population. The variable used to define the food access is the food security CONEVAL [10,15].

2.2. Work Methodology

The basic model comprises seven focal variables employed by the CONEVAL plus two, to broadly evaluate and measure educational inequality. These two new variables are: the use of technologies of information and communication (ITC) for schooling and non-schooling education (permanent during the lives of the individuals of a society (Delors J. et. al. [22])) and the proportion of expenses that represent for a family this permanent education. Both variables have not been considered under this approach in Mexico. Gordon [8] considered an extended model to measure poverty in Mexico, the use of the ITC as a “privation of communication services (no phone, internet or any other connection)” and as a “privation of information (no radio, television or computer)”.

This model consider household as the unit of analysis.

The model determines the percentage of households that are under the level of poverty on each dimension. Based on Sen’s proposal, in the model, “operations represent different things that a person values doing or being and it can go from the simplest things – the hope of life, the index of literacy in adults or the use of public goods- to more complex things such as social participation or the feeling of having dignity” [9]. At the same time, it defines a human capacity set as the set of vectors of alternate functions that a person can chose from a provided set of resources. The standard of life of a human being is determined by the given set of opportunities. Social inequality emerges due the lack of resources to accomplish a minimum level of life. “A more general approach supposes that the threshold or level of subsistence should be specified to each dimension. These levels as Sen indicates are the “minimum acceptable” in the different dimensions and a direct method to identify the poor or the unequal is to verify if a person has these accepted minimum levels. “A person would be considered poor in one dimension, for example education, if the quantity that poses does not reach a minimum acceptable” [9].

In Mexico, the educational threshold represents a nine-year education (According to the constitution everyone in Mexico should have this education) until 2012 and a twelve-year education starting at 2030 due to a reform in the constitution.

This logistic regression model has been amplified with the variables before mentioned. The logic regression is a statistical procedure that extends the idea of multiple linear regression where the dependable variable (Y), such as social inequality, is binary; it takes values: Zero (0) when there is no inequality and one (1) when there is inequality. Hair et al. [23] indicates that this procedure predicts directly the probability that an event occurs, when the levels of the variable reach the lowest they approach to zero, while when they grow they approach to one without exceeding it.

In the model p is the probability that an individual belongs to a part of the population that presents social inequality. This probability is measured by (1):

$$p = \frac{1}{1 + e^{-z}} \tag{1}$$

In the formula e is the base of the neperian logarithms ($e=2.718281828..$) and Z is a linear combination that expressed focal variables X_i ($i = 1, 2, ..7$) that allows to measure social inequality , expressed as (2):

$$Z = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 \tag{2}$$

where

$\beta_0, \beta_1, \beta_2, \beta_3, \dots, \beta_7$ are unknown parameters that the model calculates, and the variables of the proposed model are defined as:

X_1 = lack indicator for income inequality,

X_2 = **lack indicator for educational inequality**, it comprises: educational lag, use of ITC as a tool for

permanent educational training (X_{2A}) and the proportion of expenditure for education (X_{2B}),

X_3 = quality indicator for household spaces (rooms overcrowding), floors, walls and roof,

X_4 = basic services indicator in the household (water, electricity and sewer system),

X_5 = access to social security indicator,

X_6 = access to health services indicator,

X_7 = lack of food access indicator,

The proposed model calculates the probability that the person i (Family) belongs to a second subpopulation that presents some type of social inequality (poverty). Mathematically, this calculation is expressed as a model of logistic regression (3):

$$p_i = \frac{1}{1 + e^{-(\beta_0 + \beta_1 X_{i1} + \beta_2 X_{i2} + \beta_3 X_{i3} + \beta_4 X_{i4} + \beta_5 X_{i5} + \beta_6 X_{i6} + \beta_7 X_{i7})}} \quad (3)$$

If $p_i \geq 0.5$ the person is classified in the second group (this group presents inequality), if not the person belongs to the first group (where there is not inequality).

The variables to measure inequality consider the following characteristics.

2.2.1. Educational Lag

Educational lag is defined as the average breach in the household between compulsory education and real education (It is measure with article 3° of constitution [21] and articles 2°, 3° and 4° of General Law of Education (LGE); the population has to have 9 years of education until 2012, and 12 years from the people who were born in that year CONEVAL [10]). This is the only variable employed in the CONEVAL model to measure educational access. The proposed model includes this measure and adds two more. The proposed model generates a more complete tool to measure educational inequality.

This variable considers all house members that have 6 years or more education. The normative threshold of schooling (years of schooling (AE^*)) is defined as ($i - 5$), where i represents the age of a person, these values goes from $i = 6, 7, 8 \dots, 14$. For example, a six year old child has $AE^*(6-5) = 1$ year of schooling. A fourteen year old young should have $AE^*(14-5) = 9$ years of schooling. This school limit of basic education changed in 2012 –for those which born in that year - to ($i-5$), for $i = 6, 7, 8, \dots, 17$).

AE represents years of real schooling of a household member. Educational lag (X_{21}) for the members of a household in this age range is defined as:

$$X_{21} = \begin{cases} \frac{AE^* - 1 - AE}{AE^* - 1}, & si AE < AE^* \\ 0, & si AE \geq AE^* - 1 \end{cases}$$

$AE^* = 9$, if the person has age between 15 and 29. The educational lag would be:

$$X_{21} = \begin{cases} \frac{9 - AE}{9}, & si AE < 9 \\ 0, & si AE \geq 9 \end{cases}$$

For people that has 30 years or more the threshold value would be $AE^* = 6$, and the educational would be:

$$X_{21} = \begin{cases} \frac{6 - AE}{6}, & si AE < 6 \\ 0, & si AE \geq 6 \end{cases}$$

2.2.2. Employment of TIC as a Continuing Education

A big debate is developed referring to the link between information technologies and education. Tedesco [24] said that this link can be observed in two different but inclusive social currents.

The first one refers to digital inclusion, fundamental element in one society that based its actual and future development on information. The second one in its pedagogical use is considered as a didactic resource or as a mechanism. For that reason it is a focal variable that can be observed in terms of access and usability since it is associated with the economic income, educational level, gender and race. Tedesco [24] proposes to incorporate the use of the ITC on education in the systemic educational policy to reduce inequality, to break social determinism in the learning results, and promote teaching-learning process oriented to the objective “learn to learn”.

However, it can be observed that the rhythm of expansion of the use of technologies of information is more accelerated in the highest sectors of society. It can be observed that in the medium and lower sectors this use is decreased due to the lack of infrastructure for connectivity and severe unequal economic conditions in Mexico. Based on that, the proposed model considers, to measure educational formation and extracurricular permanent schooling (X_{22j}), with technologies of information and communication, the following inclusive and formation permanent variables.

2.2.3. Household Phone Line Service

$$X_{22a} = \begin{cases} 1, & without an access \\ 0, & with access \end{cases}$$

Internet Access at Home

$$X_{22b} = \begin{cases} 1, & without an access \\ 0, & with access \end{cases}$$

The home has a computer

$$X_{22c} = \begin{cases} 1, & No \\ 0, & Yes \end{cases}$$

The home has a printer

$$X_{22d} = \begin{cases} 1, No \\ 0, Yes \end{cases}$$

The continuous educational training variable (X_{22}) with the ITC are defined as the arithmetical average of the values X_{22j} where $j = a, b, c, d$. Mathematically it can be expressed as (4):

$$X_{22} = \frac{1}{4} \sum_{j=1}^4 X_{22j} \tag{4}$$

For the model $X_{22} \in [0,1]$. If $X_{22}=0$, the household does not present use of tic inequality. If $X_{22} > 0$, the household is considered unequal (poor). High values in this variable indicate that a higher level of educational inequality for technologies of information and communication is presented, for example $X_{22}=0.75$. If $X_{22}=1$ the household presents inequality in all the elements that the tic comprises.

2.2.4. Educational Household Expenditure

Household expenditure in education includes "all the expenses by all the family members on the tuition fees, materials, uniforms, school transportation and other expenses referred to the education of people, including those with different capacities. It also considers cultural expenses, sport and recreational activities expenses, this can be considered as a usual expense or a sporadic expense.

Expenditure comprises several items that goes from the acquisition of encyclopaedias, books and newspapers to the expenses involved in recreational activities such as going to the cinema or bars, vacations and parties, amongst others" INEGI [25].

The expenditure subcomponent is one of the ten subcomponents that are measured on the interview about the household expenditure. There is a total common per capita income ($Ictpc$) for each person that belongs to a household and the educational expenditure for each member of the household (Ge). The proportion of the educational expenditure is expressed as $Pge = Ge/Ictpc$. There is not a variable in this educational threshold for rural or urban areas. The proposed model considered a 5% of the total household expenditure as a minimum expense for schooling and non-schooling education. This expense will allow to acquire the compulsory basic education established in the Mexican constitution -preschool, elementary school, middle high school until 2012 and high school from 2012 (for the people born in this year and onwards) and a permanent education through life, for all the members that constitute a

household, and also for culture, sport and recreational activities. Members of a household that do not have access to a compulsory basic education, to a non-schooling education, culture, sports and recreational activities due to expenditure if the proportion of the educational expense (Pge) (5) is less of 5%.

$$Pge = \frac{Ge}{Ictpc} \tag{5}$$

$$= \begin{cases} 1, si Pge < 0.05 \\ 0, si Pge \geq 0.05 \end{cases}$$

This means that if $X_{23} = 1$, the person or persons that are members of a household do not expend the minimum resources in this dimension; the tendency is that educational inequality will appear. It can be individual or familiar due a lack of expense in education. It is probable that this proportion of the expenditure is use in other dimensions (health, nourishment, housing, or another).

2.2.5. Educational Inequality Indicator (IDE)

Based on these subcomponents, educational inequality is measured by an indicator we denominated as educational inequality indicator (IDE) (6). This indicator comprises the components of educational lag, use of the tic for continuous education and the proportion of expenditure for education. This indicator is defined as the average arithmetical value X_{2j} , where $j = 1, 2, 3$. Mathematically it can be expressed as:

$$IDE = X_2 = \frac{1}{3} \sum_{j=1}^3 X_{2j} \tag{6}$$

For the model $X_2 \in [0,1]$. A household with $X_2 = 0$ does not have educational inequality in each of the members. If $X_2 > 0$, the household is considered socially unequal (poor) in the educational dimension. Higher values in this variable, for example $X_2=0.67$ indicate a higher level of educational inequality.

2.3. Model Results for the Educational Dimension for Nuevo Leon and Oaxaca during 2008 and 2010 [26-36]

A high inequality was presented in the educational dimension between the two states.

In relationship with the subcomponent for educational lag in 2008 and 2010, the Northern state (Nuevo León) presents less educational lag; one out of ten habitants while in Oaxaca three out of ten habitants present educational lag (Table 1).

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Table 1. Inequality in education

Concept	Nuevo León				Oaxaca			
	2008		2010		2008		2010	
	people	%	people	%	people	%	people	%
Population with educational backwardness	654,571	14.9	614,196	13.2	1,129,102	30.7	1,151,994	30.3
Population with computer	1,672,618	38.1	1,829,825	39.3	513,549	14.0	551,684	14.5
Population with Internet	1,360,923	31.0	1,480,622	31.8	341,935	9.3	435,240	11.4
Population with landline	3,186,260	72.5	3,464,096	74.4	924,105	25.1	1,108,275	29.2
Availability of goods (households)								
Computer	433,321	38.1	467,986	39.3	122,274	13.9	134,557	14.4
Internet	352,571	31.0	378,676	31.8	81,413	9.3	106,156	11.4
Landline	825,456	72.6	885,958	74.4	220,025	25.0	270,311	28.9

Sources: Prepared with model results.

Pobreza y rezago social 2008 y 2010, Nuevo León, CONEVAL.

Pobreza y rezago social 2008 y 2010, Oaxaca, CONEVAL.

Perspectiva estadística Nuevo León, marzo 2013, INEGI.

Perspectiva estadística Oaxaca, junio 2013, INEGI.

Anuario de Estadísticas por Entidad Federativa 2011, INEGI.

Table 2. Indicator of educational inequality

Concept	Nuevo León				Oaxaca			
	2008		2010		2008		2010	
	people	%	people	%	people	%	people	%
Population with educational inequality	2,921,408	66.5	2,731,311	58.7	2,956,996	80.4	3,140,421	82.6
	households				households			
Educational inequality	756,841		698,545		707,415		771,602	

Sources: Prepared with model results.

ENIGH 2008 y 2010, INEGI.

In relationship with the subcomponent of the educational expenditure the results show that habitants in Nuevo León, 2.9% in 2008 and 6.7% in 2010, dedicated at least 5% of the household income to education while in Oaxaca this expenditure was 13.1% in 2008 and 8.6% in 2010. Apparently in Oaxaca there is more conscious that there has to be more investment in this concept (it can be observed a higher expense, 10.2 percentage points and 1.7 percentage points, more). However, in both states to spend in all the activities related to education (schooling, non-schooling education and recreational activities) from all the household members was not a priority, it neither represented a good investment. For both states, to assign economic resources in education represented a spending rather than as an investment.

Educational inequality, as a result for the arithmetical average of these variables (educational lag, use of the TIC and to spend a proportion of the income to education) showed that it reached Nuevo León in 66.5% in 2008 and 58.7% in 2010 (Table 2). Inequality appeared 2008 in almost seven out of ten households and in 2010 it appeared in almost six out of ten households. The decrease between these two years is almost 8 percentage points (7.8%) and is not relevant since it can be observed that only 34% and 41% of the population does not have educational inequality.

Oaxaca showed worrying figures. More than 80% of the population in the state presented this inequality condition in both years. It can be observed that this condition did not decrease, on the contrary it grew between these years (2.2 percentage points). This means that in Oaxaca, educational

inequality increased in two years in more than 180,000 persons (more than 60,000 households).

3. Conclusions

It can be concluded from the results in this measurement that both states, presented internally high levels of educational inequality; if we only analyse this problem with the official variable (educational backwardness) this inequality was between one and three out of ten people; but including the three proposed variables we observed that between six and eight out of ten people presented educational inequality. Nuevo Leon had more than 400 000 people with less education inequality in 2010 than Oaxaca. This observation might be worst for the years after this study. When comparing figures between states, Oaxaca presented 20% more population with this type of inequity compared with Nuevo León. Public educational policies applied in its moment did not ease this inequality, as it is indicated by Tilly [37], its persistence in these societies in the years 2008 and 2010.

Likewise it was observed that the use of TIC was very limited. In 2010, three out of ten people in Nuevo Leon had access to Internet; and only one out of ten people in Oaxaca. The decline of this inequality through the use of these technologies was distant. Even today there is no clear public policy to bring the Internet to more people in Mexico.

Finally, in relation to the variable spending on education (5% of income as a minimum), economic conditions appear to worsen, so an increase in this variable seems impossible.

As can be seen, educational inequality measurement seems to be more accurate with the inclusion of the two variables proposed. In general, this inequality studied, we estimate it will have an increase in the years after the study and that there are no indications that this will have a decrease to future in Mexico.

4. About Multidimensional Inequality

Results thrown from the multidimensional model confirm the observed inequalities within each state and between them in each of the before mentioned dimensions.

It can be observed in Nuevo León, between the years 2008 and 2010, an increase of four percentage points (3.8%) in the non-unequal population -the one that does not suffer any type of inequality in any dimension. However, for 2010, the percentage of population that presents inequality in at least one dimension increased to 40.9%. Population in poverty, the one that presents inequality in more than three dimensions, increased 21.2%, representing 986,000 people.

For Oaxaca this numbers, as in any other studied dimensions, worrying. From 2008 to 2010, non-unequal population decreased 0.1% (from 9.4% to 9.3%), instead of increasing. In 2010, 23.4% of the population presented inequality in at least one dimension. From 2008 to 2010, the

population in poverty conditions increased 5.3% (from 62% to 67.3%). This means that in the latest analysed year, more than 2,500,000 habitants were multidimensional poor.

The multidimensional inequality in these states does not seem to diminish, on the contrary its behaviour indicates for the future a greater social inequality in these societies.

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