Education Expenditures by State and Inequality in Mexico 2000-2014

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Abstract

Public expenditure has contributed to deep eningine quality and poverty in the way it is distributed across different educational levels and regions of Mexico. Public expenditure is the main instrument used by societies to promote education, especially in conditions of extreme inequality, as in the case of Mexico. The relationship between the orientations of public expenditure dedicated to the university level in comparison to the amount spent on primary education (tertiary tilt), is considered a key element of inequality reduction. This research studies the relationship of Gini index of enrollment in basic education, tertiary tilt and Gross Domestic product (GDP) with panel models and a long-run study of per capita GDP on expenditures in basic education, basic enrollment and GDP growth rate; thus identifying this relationship and its effects by State, this research will establish a proposal on the planning of public expenditure on education per level.

Keywords: Inequality, education, public expenditures in education, Gini index, linear regression model, panel data.

1. Introduction

Throughout its history, Mexico has suffered from high levels of poverty and inequality, a consequence of the serious delays that it has experienced in addressing the challenges in its educational sector and the limited ability of the federal and State governments to mitigate them. Therefore, it is important to conduct an analysis on expenditures in education and inequality. The country's educational system reflects high levels of inequality in how education is accessed as well as its quality. Education is a decisive factor in the development process, which strengthens economic and social progress, and promotes increase in the national income. For such an increase to occur, it is desirable that the population is properly formed and informed; it means that they have at least the primary and secondary education, and general scientific and technical knowledge.

In Mexico, after 1968, the public resources allocated to education were mainly directed to the middle upper and upper education. This trend continued even in the period of crisis and fiscal adjustment of 1983-1986, which was reflected in the share of primary education decreasing from 60 percent to 30 percent in the decades of the seventies and eighties; at the same time student enrollment grew from 9.7 to 16.5 million. The tendency towards higher education was reversed in 1988-1994 when public expenditure was significantly strengthened for primary education. Expenditures per student in higher education reached an average of 12 times expenditures per student in basic education during the years 1970-1976 and 1982-1988. However, in the last two decades, the difference continuously reduced to a factor less or than five times, the average for the Organization for Economic Cooperation and Development (OECD) countries being close to two.

The OECD establishes that for countries like Mexico, the annual investment in education must be eight percent of Gross Domestic Product (GDP), to reach the average level of education of OECD members. This research also aims to relate the hypothesis that places the market as a source of inequality and poverty expressed by Piketty (2015), which emphasizes that education is a fundamental part of government policies to halt and reverse social problems. Education has not only become a discriminating factor but one that deepens inequality, which is accentuated when high school and tertiary educational levels are more favored by public spending.

Lower expenditure on education at basic levels affects population centers that were born with economic and material disadvantages. Increased expenditure on higher education benefits the various population segments. Sylwester (2000) mentions that although public spending on education is positively associated with economic growth in the future, the actual effect on growth is negative. In another study, he used a set of countries which examined empirically whether more resources to education could positively affect income distribution, measured by the Gini index by country. According to his findings, public spending on education seems to be associated with a subsequent decrease in the level of inequality caused by income. The research findings suggest that more resources to education can be an alternative to reduce the level of income inequality in a country (Sylwester, 2002).

Therefore, it is necessary to develop a quantitative research that explains why inequality in the distribution of income per capita can be harmful for the accumulation or formation of human capital, analyzing the data obtained from the 32 Mexican States. This research is divided into four sections; literature review, data, empirical estimation and conclusions.

2. *Literature Review*

2.1 Inequality

There are three kinds of inequality, namely, inequality in income (salary or wage), inequality in wealth and the increase in rent and capital income. (Gasparini, Cicowies, & Sosa, 2012). Inequality is a widespread and persistent phenomenon that invades broad areas of society and not only its economic dimension (Gordillo, 2013). Other authors consider inequality as results of the stages of development, but when it is severe, cause an imbalance that prevents convergence of development (Bojórquez Serrano, Marceleño Flores and De Haro Mota, 2015).Inequality usually results from factors beyond an individual's control, because of families' initial endowments, disparities between capital and labor, and inequality of income (salaries).Inequality and redistribution are at the center of the political conflict (Piketty, 2015) because the political system has given its power to certain economic groups. Sometimes, inequality results in high crime rates, health problems, and lower levels of education, social cohesion, and life expectancy. Stiglitz (2012) emphasizes that it is the power of public policies alone that is capable of limiting the veracity of the market to concentrate more and more wealth.

The main ideologists of inequality, Piketty (2015) and Stiglitz (2012) reported that the causes of inequality and poverty are multi factorial; because they have economic, social, political, racial, and religious origins. Nevertheless, inequality was primarily created and reproduced on a large scale by the market, specifically for the labor market. Migration, education, and technology are important aspects that affect and will continue to affect labor markets in all economies of the world. The fact that a worker transits from one sector to another depends on many more factors than just the desire to keep oneself busy; such as the relocation of new jobs, or the demand for new skills and competencies. The difference between skilled and unskilled jobs persists in the labor market. Analyzing the trend of the Mexican labor market, it can be assumed that the skilled labor is destined for labor market in the export sector. The supply of unskilled labor faces a situation of discrimination in relation to skilled labor, because the latter has a better chance to be placed in the non-export sector. The result is that workers with less than 12 years of education are faced with the problems of precarious employment, underemployment, informality, and emigration.

Higher levels of qualification or training of workers correlate with increased economic productivity. According to the National Survey of Occupation and Employment (ENOE, 2013), in the set of skilled and unskilled workers, it appeared that the first segment, without schooling or at least 12 years of education, represented 83 percent of the total workforce. Year 1991, this percentage was 90.2 percent. Muñoz, Morales, and Alvarez (2007), indicate that an increase in the quality of education measured by their coverage is not related to a decrease in salaries inequality. Villegas and Lopez (2011) show that the socioeconomic status of students is significantly associated with their access to education, as well as educational quality. At the end, higher levels of schooling will result in better opportunities to move into employment.

2.2 Public expenditures in education

Currently, education is still conceived as a way to acquire, transfer, and enhance culture, as an ongoing process that contributes to the development of the individual and the transformation of society. Education seeks to take care of social conditions that allow the equitable distribution of material and cultural goods within a regime of freedom and to spread democracy in a way that permits coexistence allowing citizens to participate in decisions to improve their society (Salgado-Vega, Miranda & Quiroz 2011).Public expenditures in education depend on two main variables, the distribution of coverage at each educational level, and the allocation of expenditure between these levels. We can say that Mexico has established an important effort in the allocation of expenditure in education, which represents the third part of the average spending in OECD countries. The growing escalation of educational services has qualitatively changed the global distribution of public education expenditure, from being retroactive to moderately progressive.

However, it is below the average for Latin America, representing only a half of the actual expenditure in countries like Brazil and Argentina. According to the OECD, Mexico has improved its access to education at all levels of the education system. It has restructured policies and educational management processes in an effort to influence quality results. Thus, the average years of education in Mexico is 8.6 years (OECD, 2014).According to OECD, Mexico spends, on average, 15 percent of its GDP per capita on an elementary school student and 17 percent on one in high school, significantly below the average compared with the other OECD members that are at 23 and 26 percent, respectively. By providing fewer resources to basic education (primary and secondary), the possibility that more students escalate to middle and upper levels is limited. Even though the study of primary education is essential, it cannot be ignored because of the importance of higher education as the way of forming human capital. In this matter, Wolff (2015) found a positive and significant effect in spending on secondary education in both math scores and literature in PISA test. Spending on primary education is also a significant factor in explaining the PISA test at the high school level.

In Mexico, 19 percent of the adult population aged between 25 and 64 years has upper secondary education as its maximum degree of studies. The proportion of adults with higher education has grown since 2000. However, Mexico still has one of the lowest percentages of adults with this level of education within OECD countries. In graduate education, the annual expenditure per student remains at 46 percent of per capita GDP (OECD, 2014).

In synthesis, educational levels from basic to postgraduate education in Mexico show the following trends: from primary to secondary, a modest growth in relation to high school, college and graduate students, while a rapid growth very noticeable in the last three levels. Bornacelly (2013) describes that the technical and technological education has a rate higher than average education by 19.5 percent; their growth rate of return between 2007 and 2011 is higher than university education by 0.4 percent and this increases the probability of employment.

3. *Data*

3.1 Income in equality

One of the most serious aspects of inequality is income distribution. The Standardized World Income Inequality Database reports that Mexico is within 25 percent of countries with the highest levels of inequality in the world, and this problem has been increasing over time. Furthermore, high levels of inequality in educational attainment are also associated with greater income inequality (Rodriguez & Tselios, 2009).The Socio-Economic Database of Latin America and the Caribbean (SEDLAC) and the Income Distribution Database (OECD) state that between mid-nineties and 2010, income inequality in Mexico has declined.

However, the current inequality is greater than what happened in the eighties, owing to two contradictory events; although it has grown per capita income, it has also stagnated poverty rates in the country. This is because the growth is concentrated in the highest levels of the distribution (Oxfam, 2016).The databases of the National Survey of Income and Expenditure on Households (ENIGH) for years 1989-2014 were analyzed. This survey is conducted by the National Institute of Statistics, Geography, and Informatics (INEGI) on a biennial basis except 2005. For odd years where there is no data recorded, we proceeded to apply Newton's polynomial interpolation method of divided differences. Table 3.1.1 below presents the income distribution from 1990-2014.

Table: 3.1.1. Deciles income distribution

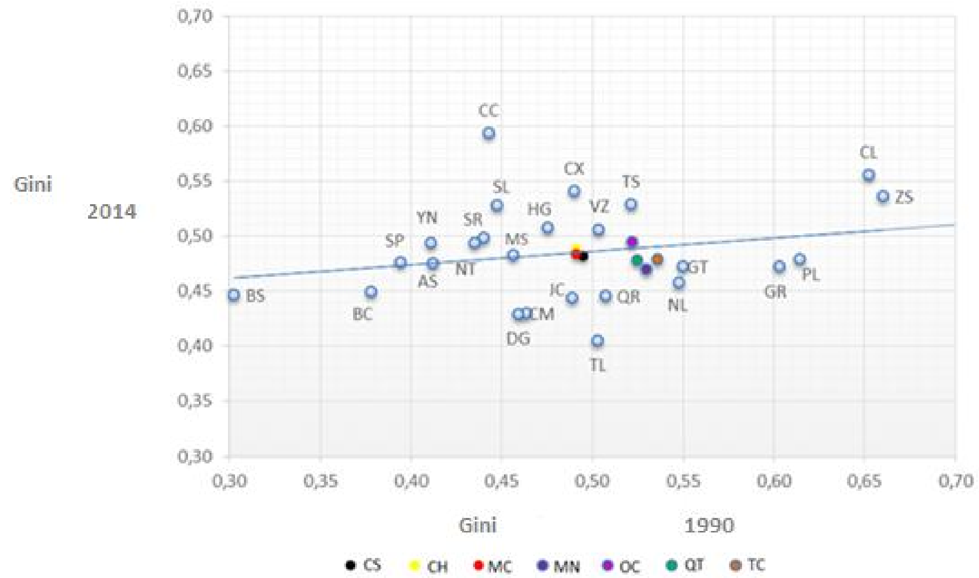
	I	II	III	IV	V	VI	VII	VIII	IX	X	income
1989	960	2,047	2,931	3,827	4,841	6,059	7,708	10,086	14,761	42,776	**9,557**
1990	1,024	2,304	3,378	4,418	5,416	6,807	8,715	11,658	16,939	44,059	**9,492**
1991	951	2,151	3,166	4,141	5,105	6,436	8,271	11,150	16,425	42,823	**8,702**
1992	875	1,949	2,853	3,713	4,682	5,917	7,622	10,298	15,457	41,745	**8,040**
1993	818	1,774	2,572	3,300	4,297	5,438	7,013	9,461	14,436	40,427	**7,537**
1994	848	1,786	2,560	3,381	4,319	5,466	7,044	9,465	14,553	41,504	**7,732**
1995	890	1,743	2,392	3,208	3,915	4,935	6,319	8,360	12,666	33,080	**7,099**
1996	794	1,621	2,287	2,992	3,769	4,748	6,086	8,089	12,142	32,769	**6,755**
1997	749	1,636	2,404	3,019	4,027	5,072	6,514	8,738	13,061	37,183	**7,527**
1998	748	1,696	2,553	3,382	4,317	5,437	6,979	9,413	14,055	41,003	**8,186**
1999	817	1,810	2,709	3,145	4,571	5,751	7,354	9,909	14,806	42,484	**8,489**
2000	993	2,046	2,960	3,867	4,925	6,185	7,852	10,500	15,712	42,431	**8,646**
2001	1,485	1,968	2,846	3,731	4,711	5,885	7,430	9,865	14,750	34,251	**6,911**
2002	1,448	2,029	2,877	3,719	4,640	5,768	7,304	9,678	14,345	35,097	**7,731**
2003	1,209	2,129	2,963	3,756	4,679	5,799	7,375	9,755	14,304	39,033	**9,260**
2004	1,000	2,204	3,051	3,884	4,828	5,983	7,608	10,017	14,561	42,069	**10,223**
2005	983	2,161	3,042	3,976	5,003	6,216	7,839	10,220	14,805	40,220	**9,394**
2006	1,162	2,425	3,327	4,239	5,265	6,516	8,171	10,766	16,070	41,600	**9,612**
2007	1,162	2,372	3,289	4,168	5,260	6,568	8,277	10,901	16,169	43,378	**10,075**
2008	1,074	2,187	3,103	4,035	5,091	6,419	8,148	10,686	15,537	43,676	**10,258**
2009	1,000	2,169	3,046	3,929	4,872	6,064	7,610	9,987	14,202	36,494	**9,051**
2010	973	2,125	2,989	3,833	4,792	5,932	7,483	9,844	14,117	35,497	**8,480**
2011	988	2,099	2,965	3,781	4,820	5,963	7,613	10,039	14,715	37,770	**8,376**
2012	1,023	2,089	2,951	3,859	4,849	6,007	7,746	10,225	15,277	40,248	**8,458**
2013	1,068	2,114	2,950	3,714	4,823	5,981	7,717	10,170	15,280	40,510	**8,549**
2014	1,116	2,194	2,977	3,749	4,712	5,833	7,408	9,712	14,325	36,607	**8,520**

Source: Own estimates from ENIGH

It is noted that in the lowest scale of the social pyramid (first three deciles), households in the countryside and small towns dominate. Although the average family comprises about six persons, they survive with small amounts of money to meet everyday expenses through domestic production. Middle-class households, ranked between the fourth and seventh decile, are located in towns with more than 2,500 inhabitants and on average consist of five persons. They have a small income and do not have a significant complement for production for their own consumption. The upper middle-class households, in the eighth and ninth deciles, live in urban areas; their income rises to a respectable amount and generally, they have only four persons per household. Finally, the upper-class households, last deciles, are small and are composed of three to four persons on average and accumulate higher income, which gives them a financially comfortable life. Although detailed analysis of the basic characteristics of the ENIGH lead to the conclusion that wealthy households were not represented in these surveys (Cortés & Leyva, 2005), they do serve as an indicator.

Salgado-Vega and Zepeda-Mercado (2012) explain why inequality in the distribution of income per capita can be harmful for the accumulation or formation of human capital. In a study on the 32 States of Mexico, Salgado-Vega and Rodriguez-Guerra (2012) used the Gini index to measure inequality in education in the different States of Mexico. They found out that when the average years of education in a State is low, a small part of the population completes all the years of schooling and also reported that there is a great educational inequality among the States in Mexico. This section provides a description of the behavior of per capita household monetary income and its distribution during the years 1990-2014. Eleven of the Mexican States: Campeche, Yucatan, Nayarit, Sonora, Sinaloa, Hidalgo, Mexico City, Veracruz, Tamaulipas, Coahuila and Zacatecas, show an increase in Gini index in the last 24 years. Aguascalientes, San Luis Potosi, Morelos, Chihuahua, and Oaxaca maintain their level of inequality. The rest of the States show a positive reduction, however small, in this index during 1990-2014.

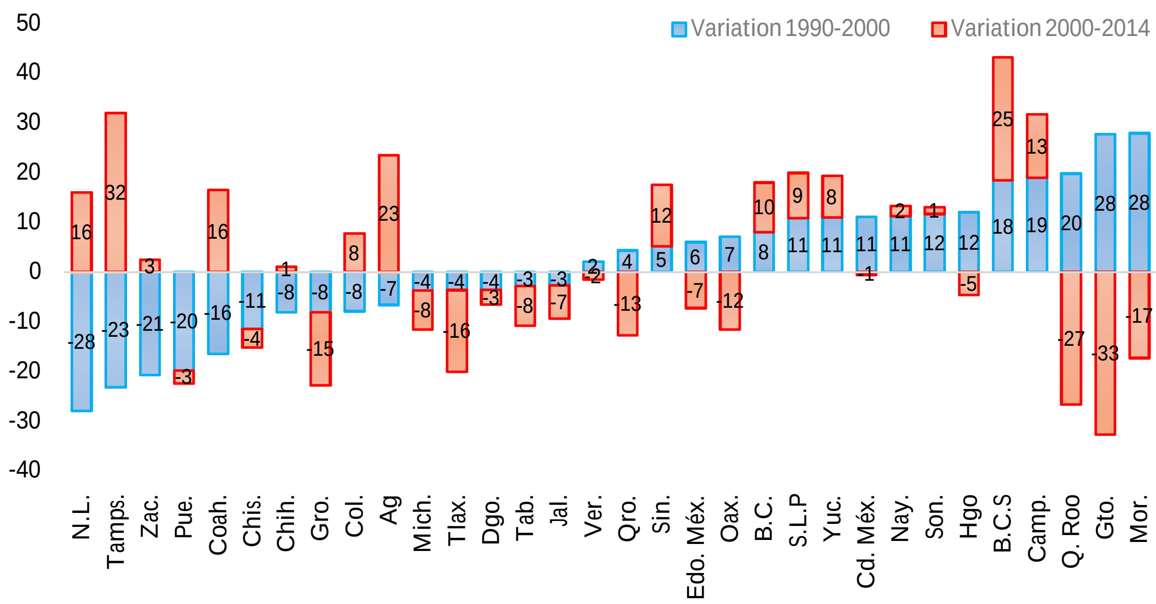
Graph 3.1.1 Gini index evolution



Source: Own estimates from ENIGH.

At the second level of analysis, it is important to note the variation in income inequality by States in Mexico. Graph 3.1.2 shows the States with the largest absolute decline in the Gini index between 1990 and 2014 arranged from left to right. This variation has two sub-periods: 1990-2000 and 2000-2014.

Graph 3.1.2 Variation in income distribution per State during the periods, 1990-2000, and 2000-2014.



Source: Own estimates from ENIGH.

3.2 Expenditure in education

This section shows the variables for estimation of panel data in table 3.2.1: total education expenditure by States at 2008 prices, the Gini index of the above section, *includes up* variable, primary enrollment and GDP for the years 2000-2014. The sources of information were Gini index income-expenditure surveys in Households (ENIGH) complemented with the estimations of part 3.1 and Gross Domestic Product (GDP) from INEGI, primary enrollment from Secretary of Public Education (SEP), Total education expenditures from National Institute for education evaluation (INEE).

Table 3.2.1 Summary of variables
Sample: 2000 2014, panel data

	Total education expenditure	Gini	Includes up	Primary enrollment	GDP
Mean	7.338074	48.96204	0.566386	424398.6	179962.5
Median	6.099585	48.88157	0.524039	331556.5	113129.7
Maximum	26.02905	70.26747	4.624222	1847391.	1470643.
Minimum	0.876066	34.31357	-3.613203	57034.00	13141.60
Std. Dev.	4.491551	4.816026	1.239969	348711.8	205372.4
Observations	480	480	480	480	480

Resources: Own estimates from SNIE, SEP and INEGI.

3.3. Long run data

The long-run GDP data was taken from Botello (2016), population from World Bank (2016) Banco Mundial, education expenditures and enrollment from SEP (2016), Calderon (2007), INEGI (2009) from historic statistics Calderon Hinojosa (2007), Money and coins in circulation (M2) from Banco de Mexico (2016). The estimation of long-runmodel was taken from 1950 to 2014, annual data was used for GDP growth rate, total education expenditures, M2/GDP, primary enrollment and GDP per capita as shown in table 3.3.1.

Table 3.3.1 Variables for long run, 1990-2014.

	GDP growth	EDUCATION EXPENDITURE	M2_PIB	ENROLLMENT	GDP PC
Mean	4.439344	176894.6	11.82678	16260863	75593.47
Median	4.4385	134596.3	0.038927	20101702	83044.54
Maximum	11.01	541109.8	73.13434	25939193	108850.9
Minimum	-5.759	4269.07	0.000799	3181979	36891.16
Std. Dev.	3.555235	167932.4	20.42039	7982364	23014.31
Observations	64	64	64	64	64

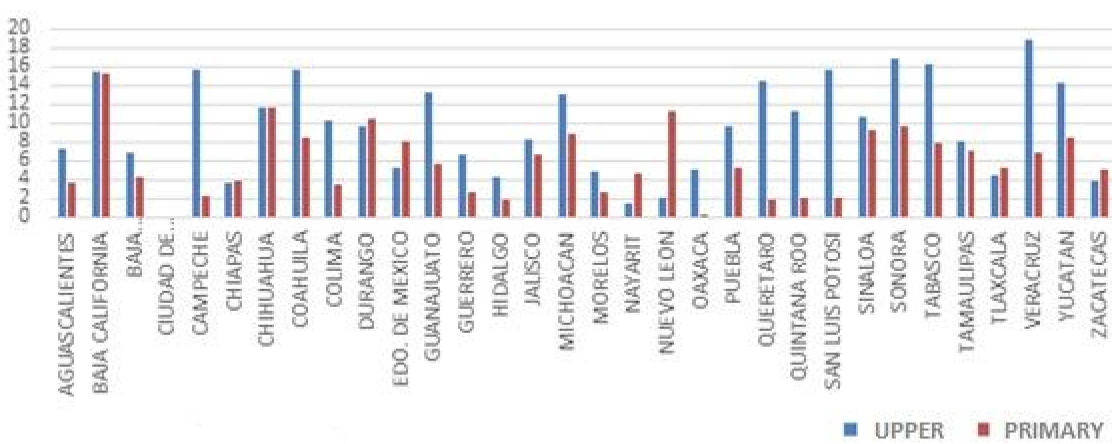
Source: Own estimates from INEGI

3.4. Tertiary tilt

Nowadays, most education systems in the developing world have a "Tertiary Tilt" or tendency towards higher education: educational public resources focus on students of upper education and not on those in primary education. Although primary enrollment rates have increased in many developing countries, expenditures in education have remained highly concentrated among students of the upper levels. Specifically in Mexico, governments have invested more in professional education compared to basic education.

Keller (2010) examines the individual effects of primary, secondary, and upper education on income distribution, finding that expenditures per student in primary education significantly improve income distribution globally—especially in less developed countries. Moreover, secondary education enrollment and its public expenditure, particularly in the developed countries, also have statistically significant effects. Graph 3.4.1 shows a regional breakdown of the expenditure for the 2000 decade, revealing a positive inclination of investments in upper education, even in relatively small numbers, rather than for primary education.

Graph: 3 .4. 1: Per capita expenditures in primary and upper education during the 2000 decade (Thousands of pesos, year 2008).



Source: Own estimates from SEP.

Tertiary tilts are occasionally taken as a natural reflection of the higher cost of education at upper levels (Judson, 1998). But the fact that college costs more to operate than a primary school does not mean that the inclination is inevitable. Governments that spend their main expenditure on university studies are devoting resources to only a group of students, a capital that could be used to provide high-quality primary education to a much larger number of individuals. In poor regions, on the other hand, a Tertiary tilt would benefit the wealthiest citizens. Wealthy families often have sufficient financial resources to pay for quality primary education, while the cost of upper education would decrease the finances for most of the elite families. Meanwhile, the situation goes the opposite way for poor families; they could hardly finance primary education and it could be impossible for them to pay for college education in the future.

How could these patterns influence cost among access to education and inequality? To answer the question, for every Mexican federal state, we measured the tendency of public expenditure on education through the assessment of expenditure for upper education—especially in college—against the expenditure on primary or basic education. The measurement of tilt in public expenditure in education is as follow:

Tertiary tilt in education expenditures: we capture it directly as expenditure per tertiary student as a proportion of primary school students.

$$\frac{Expenditureperst\sup_{i,t}}{Expenditureperstprim_{i,t}}$$

Where *Expenditure perstsup*$_{i,t}$ is the public expenditure per student in upper education in *i* State at *t* time. *Expenditure perstsprim*$_{i,t}$ is the public expenditure per student in basic education in State *I* at time *t*. We minimize the impact of states with quite high tendencies using the natural logarithm of this ratio:

$$Include\sup_{i,t} = ln\left(\frac{Expenditureperst\sup_{i,t}}{Expenditureperstprim_{i,t}}\right)$$

Our measurement focuses on the inequality between the resources allocated to tertiary education compared to ones of primary education, and the wedge that the tertiary tilt expenditure may be driving among those with higher purchasing power and income.

4. Empirical estimation

4.1 Panel estimation for 32 States

When we have data comprising time series and cross-sectional elements, such a dataset would be known as a panel of data or longitudinal data. A panel of data will embody information across both time and space. Importantly, a panel keeps the same individuals or objects—in this case, the 32 states of Mexico—and measures some quantity about them over time.

For the analysis of the data over time and space, there is a technique known as data panel, which aims to analyze the observation units over time, which can be defined as a panel data including a sample of individuals, households, companies or cities for a period of time (S.Pindyck & L. Rubinfeld, 2001). This methodology is a technical process that allows us to dynamically analyze the temporal dimension of the data, which enriches the study particularly during periods of major changes.

This methodology analyzed two aspects that are part of the unobservable heterogeneity: the specific and individual effects and temporary effects (Mayorga & Munoz, 2000).The information used consists of the coverage gross rate in primary education, *includes up*, and total expenditure as a proportion of GDP. It has a total of 465 educational and spending data: data *includes up* primary education and total expenditure located in a spatial context (state and year for 2000-2014).

To meet our goal, the next model was estimated to identify significant determinants of the model:

$$Y_{it} = \propto_{it} + X_{it}\beta_i + U_{it}$$

Where i = 1,2,…, n, Y_t = 1,…, T, and Y is the Gini index, *i* refers to the states (cross section),*t* is time, $\propto$is a vector intercept of n parameters, β is a vector of parameters K and X_{it} is the *i-th* observation at time *t* for the explanatory variables K. In this case, the total sample of observations in the model would be given by N * T.

$$U_{it} = \mu_i + \delta_t + \mathcal{E}_{it}$$

μ_i : Represents the unobservable effects that differ between units but not in time.
δ_t: No measurable effects that vary over time but not among the units.
$\mathcal{E}_{it}$: Refers to a purely random error term.

Three different models of panel data were estimated: the time fixed effects, cross-section fixed and random effects. The data were later compared with the evidence, until the best modeling specification was achieved (the results are presented in Table 4.1.1).Fixed-effects model proposes different intercept terms for each state and these intercepts are constant over time, with the relationships between the explanatory and explained variables assumed to be the same both cross-section ally and temporally.

In the random effects models (columns 4 and 5), the intercepts for each cross-sectional unit were assumed to arise from a common intercept α (which is the same for all cross-sectional units and over time), along with a random variable that varies cross-section ally but is constant over time. The term $\mathcal{E}_{it}$measures the random deviation of each state or entities intercept term from the global intercept term α. In estimating this model, it shows that the estimators $(\beta_0, \beta_1, \beta_2)$ are significant. Another way to model the individual characteristics of each state is through the fixed effects model (model 2 and 3). In this model, it is not assumed that the differences between states are random, but fixed, and therefore each intercept α_i must be estimated. The results show that all explanatory variables $(\beta_0, \beta_1, \beta_2)$ are significant; the goodness of fit is markedly increased (0.36).

Table: 4.1.1. Data panel models, dependent variable Gini index.

	Model 1	*Model 2*	*Model3*	*Model 4*	*Model 5*
	Constant coefficients	*Fixed effects*		*Random effects*	
		Cross section	*Time*	*Cross section*	*Time*
Enrollment prim	2.2475e-06***	2.6394e-05**	2.5138e-06***	2.7311e-06**	2.25607e-06***
	[7.64e-07]	[1.17e-05]	[7.93e-07]	[1.48e-06]	[7.61e-07]
Includes up	0.8465***	0.4060*	0.8471***	0.5054**	0.8461***
	[0.1775]	[0.2544]	[0.1793]	[0.2239]	[0.1766]
Eduexpenditure	0.06795	-0.0378	0.1068*	0.0156	0.0692
	[0.0518]	[0.7009]	[0.0590]	[0.0627]	[0.0518]
GDP	1.6241e-06	-7.1071e-07	1.2056e-06	2.6576e-07	1.61e-06
	[1.35e-06]	[2.35e-06]	[1.41e-06]	[1.93e-06]	[1.35e-06]
Constant	46.7377***	37.9361***	46.4145***	47.3540***	46.7268***
	[0.5478]	[4.9501]	[0.5976]	[0.9048]	0.5486
R^2	0.08714	0.3656	0.1242	0.019	0.0872
F	11.33	7.3131	3.6333	2.4004	11.3559
	(0.0000)	(0.0000)	(0.0000)	(0.0492)	(0.0000)
Durbin-Watson	0.6263	0.8667	0.5816	0.8269	0.6241
Brow-Forsythe[a]	(0.0697)	(0.4805)	(0.0697)	(0.1226)	(0.0649)
Autocorrelation	Yes	Yes	Yes	yes	yes
Verosimilitud[b]		(0.0000)	(0.1121)		
Hausman				(0.0933)	(0.0729)
Cross-sections	32	32	32	32	32
Observaciones	480	480	480	480	480

Standard errors in brackets, probability values in parentheses.

* Significant at 10

** Significant at 5%,

*** Significant to 1%.[a] Test for Equality of Variances of RESID [b] Redundant Fixed Effects-Likelihood Ratio

To test whether the fixed effects of states and time cannot be considered equal, the Redundant Fixed-Effects Likelihood Ratio was used. It is noted that for cross-sections, the p-value is less than 0.01, which leads us to affirm that the fixed effects of the states are different with 99 percent confidence at least. However, for time fixed effects, p-values greater than 0.05 were observed; these fixed effects of time are equal to almost 90 percent confidence; thus the time fixed effects are not different statistically.

To test whether the random affects model is suitable, the Hausman test for correlated random effects was used. In both cases (models 4 and 5) p-values greater than 0.05 were observed, leading us to accept the hypothesis that the individual effects are uncorrelated with the Gini index. Thus, random effects model could be suitable. The best-fitting model was the cross-section fixed-effects model; however, the model had problems of autocorrelation. We tried to correct them using autoregressive (AR) variables, but the results were not desirable; applying lagged variables showed that the level of individual significance, the value of the Durbin-Watson statistic and the coefficient of determination improved.

Therefore, the cross-section Model 2 corrected for autocorrelation was the one with the best statistically significant estimators for individual variables with a 99 percent confidence obtained; an R^2 of 0.385323, which although not a high value indicates that the model explains 38.5 percent of the total variation in the dependent variable, not shown in table 4.1.1. We can say that in terms of economic analysis, a positive and significant effect of enrollment at primary level (*enrollment prim*) is observed although all models have very small values, almost zero, indicating that it is not an important variable to modify the distribution of income or the Gini index.

On the other hand, the ratio of expenditure per student in higher education and primary or basic education (*includes up*) is the variable in all models that is statistically significant and the value of the parameter is greater than 0.5. This indicates that causing a change in the Gini index at midpoint by an increment of one in the ratio *includes up* increases the level of income inequality. This benefits students of higher education to the detriment of those in primary education.

Furthermore, the result of a positive and significant relationship between tertiary tilt (*includes up*) and the Gini index is striking. In this case, the positive effect generated is higher (0.5141) with regard to enrollment. This positive effect may be related to the fact that per capita spending on university education, when higher than per capita expenditures in basic or primary education, generates greater inequality. The GDP variable was not statistically significant in any model, meaning that it is not important to change the distribution of income. The fixed-effects model considers that there is a different constant term for each individual, cross-section and time effect, and assumes that the individual effects are independent of each other. Then, the fixed-effects model allows the investigation of inter temporal and/or cross-section variation through various independent terms (Greene, 2012).After validating the significance of the variables analyzed, we proceed to estimate the fixed effects of spatial units (States); in order to determine—over time—income inequality measured by the Gini index.
Therefore, the panel adjusted cross-section fixed effect is as follows:

$$Gini_{it} = 34.0968 + 0.00003 enrollmentprim(-1)_{it} + 0.5141 Includesup_{it} + \propto_N d_N + \sum_{K=1}^{K} \beta_k x_{kit} + u_{it} + \varepsilon_{it} \quad (1)$$

In matrix expresión:

$$Gini_{it} = \propto_i + \beta_i enrollmentprim_{it} + \beta_i incledusup_{it} + \varepsilon_{it} \quad (2)$$

It is observed that higher fixed effects are in Campeche, Nayarit and Queretaro, indicating that in these states the independent variables (*enrollment prim and Includesup*) in greater extent affect the dependent variable. To corroborate this, we proceed to apply these fixed effects to each state using equation (2), to observe what has been the behavior of the endogenous variable during the 14 years of study.

Table: 4.1.2 Cross-section fixed effects by State 2000-2014.

	State	Effect	35.15	State	Effect
1	Aguascalientes	7.8147	17	Morelos	5.2653
2	Baja California	0.6775	18	Nayarit	10.8189
3	Baja California Sur	6.8232	19	Nuevo León	-5.0650
4	Campeche	14.6753	20	Oaxaca	-1.1312
5	Chiapas	-2.7677	21	Puebla	-11.9015
6	Chihuahua	0.1620	22	Querétaro	9.7557
7	Ciudad de México	-14.5755	23	Quintana Roo	7.4765
8	Coahuila	0.1420	24	San Luis Potosí	2.9924
9	Colima	8.3477	25	Sinaloa	2.2837
10	Durango	7.7454	26	Sonora	4.8758
11	Edo. De México	-47.1129	27	Tabasco	7.2710
12	Guanajuato	-9.9655	28	Tamaulipas	0.7114
13	Guerrero	1.0052	29	Tlaxcala	3.6515
14	Hidalgo	7.4247	30	Veracruz	-14.3207
15	Jalisco	-14.6685	31	Yucatán	6.2285
16	Michoacán	-3.8990	32	Zacatecas	9.2592

Source: Own estimates in E views

4.2 Long-run estimation

The main objective of the regression is the determination of β_1, β_2 and β_3 estimated from the information contained in the observations that we have. (Ezequiel, 2013).Thus the simple regression mode is:

$$GDPpercapita_{i,t} = \alpha + \beta_1 enrollment_{i,t-10} + \beta_2 education\exp nditure_{i,t-10} + \beta_3 Z' + \eta_i + \varepsilon_{i,t} \quad (3)$$

Where Enrollment is the primary or basic enrollment; education expenditure is the total education expenditure and Z are other exogenous variables such as GDP growth rate and M2/GDP or the ratio between bills and coins in circulation along with short run savings and GDP. Sucarrat (2010) indicated the assumptions of a model of simple linear regression: Linearity in parameters—normality refers to one or what fits mean values (Herrera Herrera Acosta & Fontalvo, 2010); no autocorrelation—when distributions representing the error (the distance between the population and the sampling error) are not the same in mean and variance (Mahía, 2010); homosce causticity—if perfect regression coefficients of the variables x are indeterminate and their standard errors are infinite; absence of exact multi co linearity—if is less than perfect regression, coefficients have large standard errors, which means that the coefficients cannot be estimated with precision (Fernandez Montt, 2006).To reach the final model, regression equation (3) was subjected to the following tests.

Correlogram test: autocorrelation and partial correlation of order 2—thatwe check with Breusch-Godfrey test—showed very low probability, less than 0.05 and therefore the null hypothesis of no autocorrelation is rejected. Normality: rejecting the assumption of normality due to a presence of a Jarque-Bera test of 0.122657 (less than 5.99), and (greater than 0.05) high probability of 0.940514, the average is practically zero and kurtosis has a high value of 2.886510, indicating that the data are highly concentrated in the middle, being a very sharp curve. Heteroskedasticity: using the Breusch- Pagan-Godfrey test, which had probabilities higher than 0.05 in all variables, and the null hypothesis of homoscedasticity was rejected. Multicollinearity, VIF multicollinearity test was performed, which is a method for measuring the level of co linearity among the regressors; it showed how much of the variance of an estimated coefficient has been inflated due to co linearity with other repressors and we do not reject multi co linearity.

To correct the autocorrelation, an autoregressive model of order 1, AR (1), was added. Since there is the presence of heteroscedasticity in the model, the estimate by OLS is not optimal. Therefore, to correct this problem, we use the White Correction for heteroskedasticity. If you look closely, the probabilities of all the variables are below 0.05. This means that the correction was successful and in this case, the assumption of homoscedasticity is approved.

For purposes of multicollinearity, it was decided to omit the variable M2 / GDP from the model; because along with GDP growth, it showed the highest value. We check our results in the covariance matrix of the model and we observed appropriate values to accept the assumption of no multicollinearity.

In sum, the final model was as follows:

PIBPC = 36010.9577793 + 0.00186361608775*enrollment + 0.0484817340031*expenditure + 366.864217825*GDP growth + AR(1) =0.884563492716

Table 4.2.1 Regression results

Dependent variable: per capita GDP					
	C	enrollment	expenditure	GDP growth	AR(1)
Coefficients	36010.96	0.001864	0.048482	366.8642	0.884563
t-statistics	(4.801847)	(3.64776)	(4.035692)	(5.7603479	(10.91298)

Source: Own estimates in E views 9

The results of the model, at constant prices of 2008, indicate that enrollment in basic education is significant with a probability of 0.0006 and has a coefficient of 0.001864, i.e., for every one thousand new students enrolling to basic education (preschool, primary or secondary) per capita GDP will increase by $ 1.86. Meanwhile, the variable of total Federal Public expenditure on education is also significant with a probability of 0.0002; it has a coefficient of 0.048482, as the variable is expressed in millions of pesos, and this result means that for every million pesos that the federal government spends on public education, GDP will be affected positively by about five cents per capita.

GDP growth was favorable for the purpose of this research and was statistically significant with less than 0.05 probabilities and a coefficient of 366.8642; this is closely related to the dependent variable (GDP per capita).Thus a change of one percent of GDP growth should increase the GDP per capita by $366.86 pesos. These results are consistent with the actual conditions in which the expenditures are made, i.e., without considering changes in the quality of education, inefficiency of public spending, or significant changes in the distribution of income. This means that Mexico has room for economic policy in educational matters; our results indicate that structural changes are possible to reach and achieve higher goals and objectives in education and income, without additional spending.

5. Conclusions

In the panel regressions, we can say that in terms of economic analysis, a positive and significant effect of enrollment at the primary or basic level is observed, although in all models their values are very small, almost zero, and indicating that it is not an important variable to modify the distribution of income. On the other hand, the ratio of expenditure per student in higher education and primary or basic education is the variable that in all models is statistically significant and the value of the parameter is positive (>0.5), which indicates that causing a change the Gini index of a midpoint by an increment of one unit in the ratio of the variable *includes up*, thus increasing the level of income inequality. These results benefit students of higher education at the expense of those in primary education. These results proved one of the hypotheses of this research.

It was observed that higher fixed effects are in the states of Campeche, Nayarit and Queretaro, indicating that in these States, the variables of enrollment in basic education and the ratio of expenditure per student in higher education and basic education affect in greater amount the inequality of income through the Gini index, which proves that there is also inequality and different effects of these variables in the States of Mexico. One hypothesis of this research was that in Mexico, in recent years, higher levels of inequality respond to higher levels of income concentration, where the distribution of education spending has accentuated this process, as in the case of Campeche, Nayarit, and Queretaro. The above paragraph confirms this hypothesis. In the OLS model, it was possible to obtain a linear relationship between per capita GDP, which can be taken as a measure of inequality, and the exogenous variables, enrollment in basic education, total Federal Public expenditure on education and GDP growth.

It was observed that for every million pesos spent by the federal government in basic educational levels, per capita GDP will rise by $ 48.48. It was also found that access to education is a key factor to achieve a better per capita GDP, which in our model will increase by $ 1.86 pesos when student's enrollment increases by one unit in basic education.

Both total education expenditures and GDP growth are variables that affect GDP per capita; therefore, federal public expenditures must be raised to meet the needs of students, teachers, and schools. GDP growth turned out to have an impact of great magnitude in per capita GDP; as GDP growth increases by one unit, per capita GDP will increase by $ 366.84 pesos. Thus, identifying this relationship and its effects by State will establish a proposal on the planning of public expenditure on education and its amounts per level. The economic policy suggested by this research for States with greater inequality is that expenditures in basic education per student should grow at a higher rate than per capita university expenditures.

For the whole economy, the same policy can applied but at a slower pace. It is important to increase total education expenditure to meet the expenditures of OCDE countries for a better result in education and inequality.

To get a better per capita GDP again, Mexico needs more expenditure in basic education, increasing the student´s enrollment at all levels and to have an increase in GDP growth rate.

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