Education and Income Inequality in Latin American Countries

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Abstract

It is a common theory that education levels and inequality are highly correlated. In layman's terms, as access to education increases, the earning potential of the poor also increases. Therefore, the poverty gap shrinks. However, when access to education is limited, there is a greater disparity between the earning potential of the rich and that of the poor, thereby expanding the poverty gap. The following paper examines and compares the education levels and income inequality across 14 Latin American countries. These countries experience "persistent" and "pervasive" inequality impacting all aspects of life (de Ferranti et al., 2004). Inequality will be represented by the Gini coefficient, which represents the degree to which income distributions of households within an economy vary from perfectly equal distribution. The models also include measures of enrollment and expenditure per student in primary, secondary, and tertiary schools, as well as employment rates and the income held by the highest 20% of the population.

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1.0 INTRODUCTION

Intuitively, increased access to education will lead to a more equitable distribution of income across a nation. Higher education attainment creates more skilled workers who demand higher wages. Thus, if the education level of the rich is held constant, the poverty gap is reduced. However, if access to education is constrained, the poverty gap can widen, thus increasing income inequality. Roberts (2002) identified eight of such barriers when studying access to tertiary education in the Commonwealth Caribbean, including: space, cost (development, delivery and travel), population size and economies of scale, technology, attitude of producers and consumers, the structure of opportunity and gender. Therefore, one can infer that education equality and income equality are positively correlated.

The following paper seeks to clarify the correlation between education and income inequality. It differs from the existing literature on the subject in two key ways. First, this study focuses on 14 Latin American countries, including some Caribbean Islands. Few research studies have examined this region. Still, it varies from the previous body of literature on education and inequality in Latin America in its narrow focus. This study targets literacy rates, enrollments and expenditures at different education levels, income held by the lowest, highest and third 20% of the population, and percentage of employment in agriculture, industry and services as the relevant factors determining income inequality, measured by the Gini coefficient.

This study is guided by three main sources. First, De Ferranti et al. (2004) have provided a strong background for the causes of inequality in Latin American and the trends currently found in the region. The authors have conducted extensive research, funded by the World Bank, providing rich insights on the issue. Furthermore, De Ferranti et al.'s study is now eight years old. Thus, this paper is timelier than the current research. In addition, the model used in this paper is derived from two studies. One examined 117 countries using data from five year intervals over the period from 1960 to 1995 (Checchi, 2001). Factors replicated from this model include enrollment in primary, secondary and tertiary schools. The second paper focused on education and inequality and economic growth in Indonesia from 1996-2005 (Digdowiseis, 2009). Aspects borrowed from this model are share of income held by the top, 20% of the population, as well as

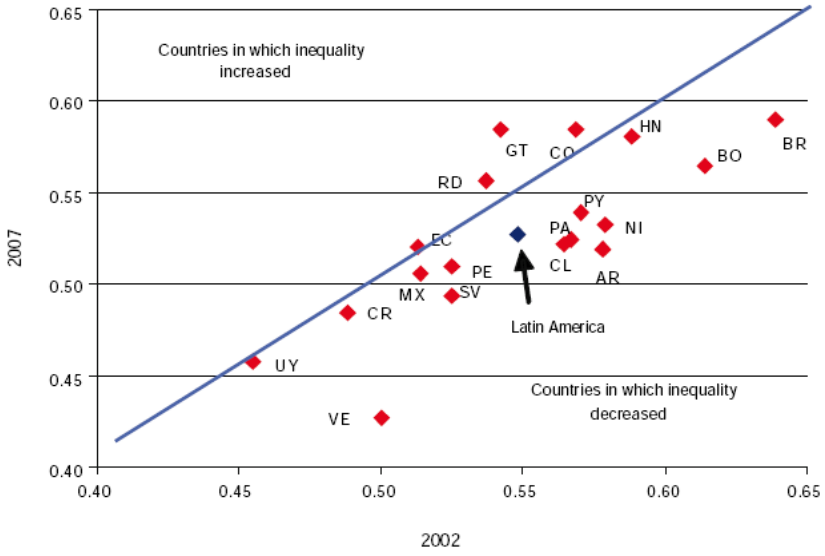
public expenditure on education.

The remainder of this paper is organized as follows: Section 2.0 depicts general trends in income inequality and education in Latin American countries. Section 3.0 discusses the current literature on the subject. The empirical model is illustrated in Section 4.0. Section 5.0 describes the data and methodology. The empirical results are discussed in Section 6.0. Conclusions are found in Section 7.0.

2.0 TREND

Figure 1 below depicts the change in the Gini Coefficient for 18 Latin American countries between 2002 and 2007. Inequality has increased for nations above the blue line and it has decreased for those below the blue line. The majority of these nations fall below this line, signifying that inequality declined during that period. Overall, the income inequality for Latin America has decreased, as indicated by the blue diamond label Latin America. However, most of the countries still possess Gini Coefficients between 0.45 and 0.60. Therefore, further advancements must be made in order to strive for perfect equality – or a Gini Coefficient of 0.

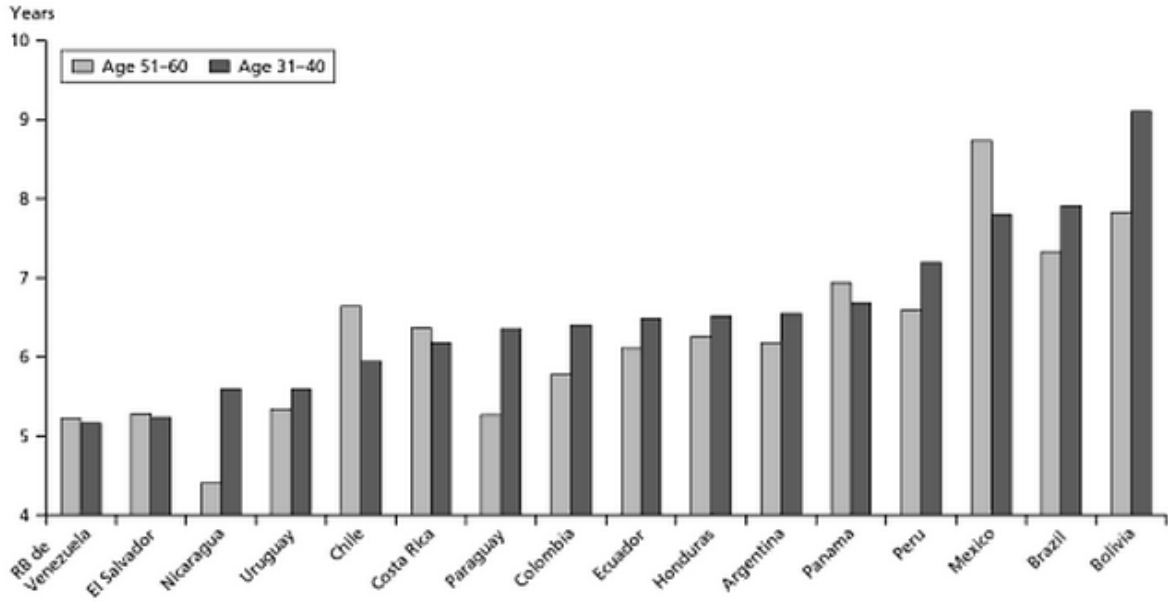
Figure 1: Changes in the Gini Coefficient in 18 Latin American Countries between 2002 and 2007



Source: Green, D. (2009, March 19). Want to Reduce Inequality? Look at Latin America! *From Poverty to Power.* Retrieved March 19, 2012, from http://www.oxfamblogs.org/fp2p/?p=197.

Figure 2 below displays the differences in average years of education for individuals in the lowest and highest quintiles for 16 Latin American Countries for individuals between 31 and 40 and 51 and 60. Thus, for countries the where the lighter grey bar is taller than the darker grey bar – Venezuela, El Salvador, Chile, Costa Rica, Panama, and Mexico – one can infer that this discrepancy is shrinking, as it is smaller in the younger generation. However, for countries with a larger dark grey bar – Nicaragua, Uruguay, Paraguay, Columbia, Ecuador, Honduras, Argentina, Peru, Brazil and Bolivia – the difference in education between the top and bottom quintiles is growing.

Figure 2: Differences in Averages Years of Education in 2000



Source: De Ferranti, D.; Ferreira, F. H. G.; Perry, G.; & Walton, M. (2004) *Inequality in Latin America: Breaking with History?* Washington, DC: The World Bank.

Figure 3 below compares four indicators of inequality across ten Latin American countries, as well as the United States and Italy. By reviewing this table, one can determine that inequality in these countries, especially Brazil, Guatemala, Columbia and Chile, is much higher than in the United States, and higher still when compared with Italy.

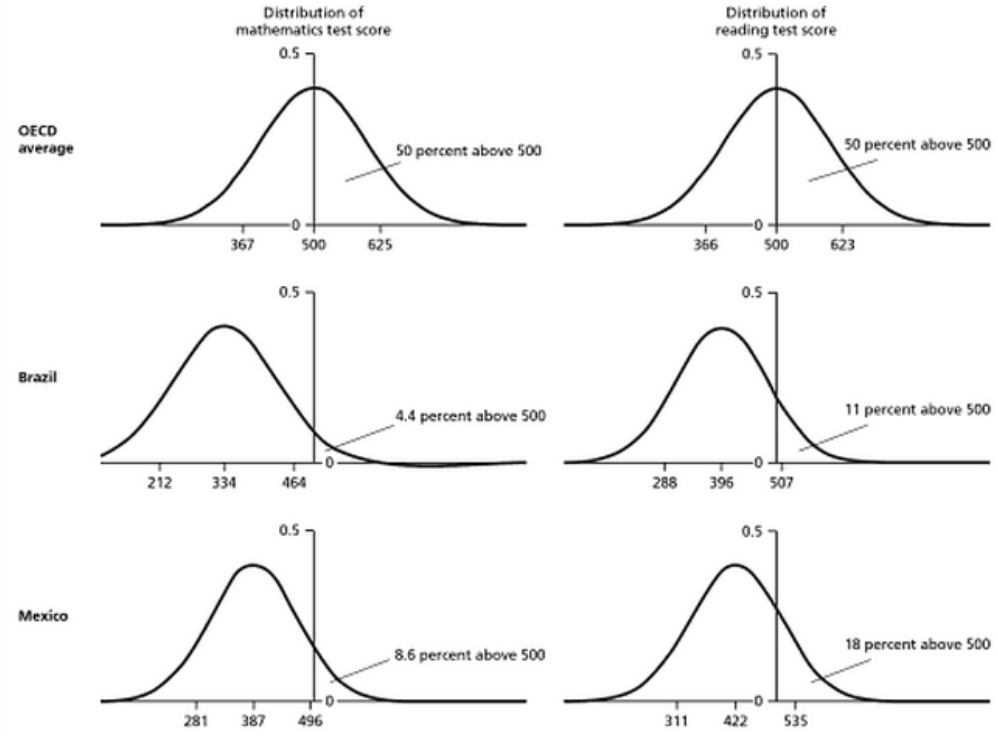
Figure 3: Inequality Indicators – Latin America v. US and Italy

	Gini coefficient	Share of top 10 percent in total income (percent)	Share of bottom 20 percent in total income (percent)	Ratio of incomes of 10th to 1st decile
Brazil (2001)	59.0	47.2	2.6	54.4
Guatemala (2000)	58.3	46.8	2.4	63.3
Colombia (1999)	57.6	46.5	2.7	57.8
Chile (2000)	57.1	47.0	3.4	40.6
Mexico (2000)	54.6	43.1	3.1	45.0
Argentina (2000)	52.2	38.9	3.1	39.1
Jamaica (1999)	52.0	40.1	3.4	36.5
Dominican Republic (1997)	49.7	38.6	4.0	28.4
Costa Rica (2000)	46.5	34.8	4.2	25.1
Uruguay (2000)	44.6	33.5	4.8	18.9
United States (1997)	40.8	30.5	5.2	16.9
Italy (1998)	36.0	27.4	6.0	14.4

Source: De Ferranti, D.; Ferreira, F. H. G.; Perry, G.; & Walton, M. (2004) *Inequality in Latin America: Breaking with History?* Washington, DC: The World Bank.

Figure 4 below illustrates the normal distribution of mathematics and reading test scores for Brazil and Mexico as compared to the OECD Averages. When comparing these numbers, it becomes clear that education in Mexico and Brazil is lacking. Whereas 50% of students factored into the OECD average fell above the 500 mark for mathematics, only 4.6% of Brazilian students and 8.6% of Mexican students achieved this score or above. Similarly, for the OECD average, 50% fell above 500 for reading, while only 11% and 18% of Brazilian and Mexican students did so, respectively.

Figure 4: OECD Average Test Scores Compared with Mexico and Brazil



Source: De Ferranti, D.; Ferreira, F. H. G.; Perry, G.; & Walton, M. (2004) *Inequality in Latin America: Breaking with History?* Washington, DC: The World Bank.

3.0 LITERATURE REVIEW

As stated in the introduction, one can intuitively understand that a positive relationship exists between income inequality and education inequality. Still, the relationship between education and inequality has been debated quite a bit between economists. Digdowiseio (2009) presents a variety of these views. First, he states that some economists have deemed education levels and income inequality positively correlated as land inequality shares this relationship with both factors. Other economists have argued that the link between income inequality and access to education is depicted with the Kuznet's inverted-U curve, as more equitable distribution of income coupled with increased attainment of higher education decrease income inequality. Still more have declared that there is a direct relationship between income inequality and gross-secondary school enrollment and public expenditure on education (Digdowiseio, 2009).

De Ferranti et al. (2004) declare that inequality in Latin American countries is extremely "extensive." In fact, the Latin American country with the highest income equality still does not reach the equality levels of any country in the Organization for Economic Cooperation and Development (OECD) or of any Eastern European nation (De Ferranti et al., 2004). Specifically, survey results show that the wealthiest 10% of the population accounts for 40%-47% of total income in Latin American countries, whereas only 2-4% of total income can be attributed to the lowest 20% of the population (De Ferranti, 2004). Comparatively, the wealthiest 10% earn 31% of total income in the United States and 27% of total income in Italy. These authors also state that this issue is both "pervasive" and "resilient." Income inequality is "pervasive" in Latin American countries because it impacts so many aspects of daily life, from access to health care, public services, education and credit to the influence of "political voice." Finally, this inequality is rooted in "exclusionary institutions" dating back to colonial times, thus creating "resilient" inequality.

The negative impacts of inequality creep into other aspects of the economy. For instance, inequality delays overall development. These authors argue that unequal access to education "limits personal contributions to society of some of the most talented individuals," (De Ferranti et al. 2004). Furthermore, limited access to credit decreases the amount of profitable investment projects within the country as a whole. In addition, high inequality is positively correlated with increased violence and crime rates. Also, inequality within society fuels negative public opinions and is seen as unethical, as birth position highly limits one's opportunities and education levels.

One relevant study focused on education and inequality in Brazil during the period of 1982-1998 (Blom et al., 2001). These authors found that, "the wage gap between skilled workers and unskilled workers his widening because the demand for highly skilled workers has vastly outpaced the supply," (Blom et al., 2001). This phenomenon is caused by industries relocating to Brazil – and other developing countries – as they are comparatively less capital intensive than industrial nations. As companies have high demand for inexpesive, yet educated, workers, it has become, "increasingly attractive to obtain a university degree," (Blom et al., 2001). Along with this, they note the increasing returns of education. That is, as an individual gains more years of education, the return from one additional year is augmented as well. Finally, this study

determined that education was a significant determinant of wages – and thus income inequality – in Brazil, as illustrated by the 814% discrepancy between the monthly earnings of a college graduate and a worker without a degree.

In support of the above mentioned Brazilian study, increasing access to education has been touted as a superior method for reducing inequality. Individuals learn new skill and acquire assets through education. Furthermore, the spillover effect enhances overall social welfare. Thus, equitably distributing opportunities is a key function in reducing inequality, according to Fan et al. (2001). These authors claim that this tactic, unlike a redistribution of current assets, will avoid making any party worse off (Fan et al., 2001). Ultimately, Fan et al. (2001), recommend an approach to increase access to education that takes the concerns of both supply and demand sides into account, in order to create "win-win polic[ies]."

While the above mentioned authors give a history of income inequality in Latin American nations, as well as giving an overview of the current outlook of their inequality, their main focus is to look to the future in solving the inequality problem. In order to do so, De Ferranti et al. (2004) propose three major reforms: equalizing access to education, property rights, and other assets, improving market institutions by, "building institutions and rules to reduce the risk of crisis and to make the distributions of losses less unequal when crises do occur," and, finally, increasing redistribution of income efforts.

4.0 EMPIRICAL MODEL

The basic models used in this study borrow variables from the papers of Checchi (2001) and Digdowiseis (2009) as discussed in the introduction. The additional factor of the literacy rate was added to test for significance. In order to obtain the most significant results, two regressions were run in E-Views. The first model explores enrollment at the primary, secondary and tertiary levels, while the second focuses on public expenditure per student at each of these levels of education. Both models include the employment rate and the percentage of income held by the top 20% of the population in order to control for omitted variable bias.

4.1 Model 1

$$GINI_{it} = \eta_1 \delta_{1it} + \eta_2 \delta_{2it} + \ldots\ldots \eta_{14} \delta_{14it} + \beta_1 EnPri + \beta_2 EnSec + \beta_3 EnTer + \beta_4 IncHigh + \beta_5 Emp + \phi' X_{it} + \mu_{it}$$

4.2 Model 2

$$GINI_{it} = \eta_1 \delta_{1it} + \eta_2 \delta_{2it} + \ldots\ldots \eta_{14} \delta_{14it} + \beta_1 ExpPri + \beta_2 ExpSec + \beta_3 ExpTer + \beta_4 IncHigh + \beta_5 Emp + \phi' X_{it} + \mu_{it}$$

Where $GINI_{it}$ is the Gini coefficient in country i=1, …., N, year t = 1, …., T(i).
EnPri, EnSec and EnTer represent enrollment in primary, secondary and tertiary schools, respectively. In addition, IncHigh denotes the percentage of total income held by the top 20% in the country. ExpPri, ExpSec and ExpTer stand for expenditure per student in primary, secondary and tertiary schools. Finally, Emp is the employment rate.

The additional symbols represent variables specific to the country specific fixed effects associated with regressions of panel data. δ_{jit} is the country specific dummy variable, η_i is the country effect, and μ_{it} is a classical disturbance term.

5.0 DATA & METHODOLOGY

5.1 Data

This study uses annual panel data across 14 Latin American countries. The data was obtained from the World dataBank – World Development Indicators (WDI) & Global Development Finance (GDF) – for the period spanning 2001 to 2010. A table depicting the independent variables targeted and their expected signs can be found in Appendix A.

5.2 Methodology

Two separate regressions were tested in order to determine the effects of enrollment and expenditure per student, and to test them against each other. The program E-Views was used to run the regression using panel options. Fixed effects for the individual countries were accounted for in the regressions.

5.3 Limitations

While the data and results reflect the relationship between inequality and education in these 14 Latin American countries, data availability limited the thoroughness of this study. The relevant data was simply not available for many of the Latin American countries, Caribbean Islands in particular. A more complete analysis would include statistics from all 42 Latin American countries, rather than generalizing the results from 14 nations to the entire region. Furthermore, this study gives a summary of the current correlation between education and inequality. An investigation over a longer period of time would yield long term trends on the topic.

6.0 EMPIRICAL RESULTS

The main focus of this study was to establish the determinants of income inequality in Latin American countries, with respect to education indicators. The results of the three regressions can be found in Table 1 below.

Table 1: Regression Results – Coefficients and t-Statistics

Variable	Model 1	Model 2
EnPri	-0.041025* (-1.695562)	
EnSec	-0.042251** (-1.956531)	
EnTer	-0.034989 (-1.590723)	
IncHigh	0.093727*** (3.558562)	0.127839*** (3.494899)
EMP	-0.455493*** (-6.139992)	-0.498918*** (-7.110117)
ExpPri		-0.139183* (-1.644332)
ExpSec		0.065864** (2.354584)
ExpTer		0.089519 (0.959382)
C	81.19538 (17.16336)	74.52815 (13.38695)

Note: ***, ** and * indicates variables at the 1%, 5% and 10% significance respectively

Model 1 seeks to determine the effects of enrollment in primary, secondary and tertiary schools on income inequality. The percent of total income held by the highest 20% of the population and overall employment rates were included in each model to standardize the comparisons. Of the

five variables in Model 1, four were found to be statistically significant: enrollment in primary schools was found to be significant at 10% and enrollment in secondary schools was significant at 5%. Finally, income held by the highest 20% of the population and the employment rate were found to be significant at 1%.Coefficients for all of the variables resulted with the correct expected signs, with everything but income held by the highest 20% having a negative correlation with inequality. The adjusted R^2 of 0.949080 indicates that 94.9080% of the variation in the dependent variable (GINI) was caused by changes in the independent variables. Finally, the probability of the F-statistic is 0 (F-statistic= 124.1183); thus, the overall model is statistically significant.

Rather than studying enrollment, Model 2 looks at the impact of expenditure per student at the primary, secondary and tertiary level. Again, the percent of total income held by the highest 20% of the population and the employment rates were included for comparison purposes. Of these factors, four were found to be significant. Income held by the highest 20% and the employement rates were significant at 1%, while expenditure per secondary student was significant at 5% and expenditure per primary school student was found to be significant at 10%. However, with this model, two variables, ExpSec and ExpTer, had positive coefficients when it was expected that increases in expenditure would put downward pressure on inequality. Thus, omitted-varaible bias may have taken place. Another possible explanation is that there is a higher expenditure per student, but lower enrollment in some countries. In this case, inequality would in fact increase as only the early potential of those few students enrolled would increase, widening the gap between the educated and the uneducated. The adjusted R^2 of 0.936831 shows that 93.6831% of the variance in the GINI coefficient can be attributed to changes in the independent variables. Ultimately, the 0 probability of the F-statistic (F-statistic = 110.3744), demonstrates the model's complete statistical significance.

7.0 CONCLUSION

This paper contributes to the working knowledge of the correlation between income inequality and education. Overall, the zero probabilities of the F-statistics indicate that both models are statistically sound. Thus, changes in the Gini coefficient can be attributed to educational factors. Furthermore, as expected, the percentage of income held by both the highest 20% of the

population of each country and the employment rates have been shown to be extremely significant. Finally, though not included in the models above, previous regressions run with literacy rates included showed that this was not a significant factor. From this conclusion, one can estimate that high literacy rates level the playing field for all individuals, and turn to other measures of education for meaningful results.

Ultimately, the results of these regressions can guide countries, especially Latin American countries, which strive for income equality. First, as one would expect, should the share of income held by the highest 20% decrease, the Gini coefficient would drop, thus bringing the country closer to income equality. However, the sign of the variables ExpSec and ExpTer were also found to positive in the second regression, when they were expected to have a positive sign. These results could indicate that there was a omitted-variable bias or there could be a correlation between enrollment and expenditure that was not captured in this study. In the future, researchers may run these variables together to test this hypothesis. Still, results began to become skewed as more variables were included, causing the signs of the coefficients to be reversed. This issue is proposed to be caused by the redundancy of variables, such as income held by the highest and lowest 20% of the population. In order to test these theories, further research must be conducted, both spanning further back in the countries included in the study, and adding the remainder of Latin American Countries, as well as including additional variables.

In addition, countries seeking to reduce income inequality should take steps to increase enrollment at all levels of education. Education should be made more accessible. In order to achieve this access, public expenditure on education, another variable found to be statistically significant, must be increased. This objective can be achieved at the lower education level by building more primary schools in rural areas, allowing more children to attend. In addition, expenditures could also provide more teachers or teaching materials, thereby improving the quality of primary education. Spending can also be increased at the tertiary level. Building public colleges and universities and allowing for more educational grants will ensure that enrollment in tertiary schools increases.

Appendix A: Variables and Expected Sign

Variable	Abbreviation	Description of Variable	Expected Sign	Rationale
Expenditure per student, Primary (% of GDP per Capita)	ExpPri	Amount spent on each primary school student as expressed in GDP per Capita	(-)	Higher spending on education leads to better education. In turn, individuals are able to take advantage of increased opportunities, lowering the Gini Coefficient
Expenditure per student, Secondary (% of GDP per Capita)	ExpSec	Amount spent on each secondary school student as expressed in GDP per Capita	(-)	Again, greater expenditure leads to improved education and equality.
Expenditure per student, Tertiary (% of GDP per Capita)	ExpTer	Amount spent on each tertiary school student as expressed in GDP per Capita	(-)	Again, greater expenditure leads to improved education and equality.
Employment Rate	Emp	Percentage of the population that is employed.	(-)	As the employment rate increases, more individuals are earning an income, working towards closing the poverty gap.
School enrollment, Preprimary (% gross)	EnPri	Percentage of eligible students enrolled in preprimary school	(-)	As enrollment increases, more individuals become educated, thus increasing their earning potential

School Enrollment, Secondary (% gross)	EnSec	Percentage of eligible students enrolled in secondary school	(-)	As enrollment increases, more individuals become educated, thus increasing their earning potential
School Enrollment, Tertiary (% gross)	EnTer	Percentage of eligible students enrolled in tertiary school	(-)	As enrollment increases, more individuals become educated, thus increasing their earning potential
Income Share held by Highest 20%	IncHigh	Percentage of total income held by the richest 20% of the population	(+)	The greater amount of income held by the highest 20%, the larger the poverty gap.

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