

**Latin American Laboratory for Assessment of the Quality
of Education - LLECE**

**Education inequality in Latin
America and the Caribbean: A
socioeconomic gradients analysis**

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Motivation

- **Socioeconomic Status is correlated with many key social indicators: income, education, health,...**
- **How can we best model this relationship?... the more specific the level of analysis the better the understanding we could get.**
- **This presentation is an attempt to do that for the education sector.**

Objective

Analyze the relationship between students' achievement in mathematics and reading and their socioeconomic and cultural status in the case of Latin American and Caribbean primary school students that were assessed by the SERCE study (OREALC/UNESCO Santiago [2008]).

Outline

- 1. Student Achievement and Socioeconomic and Cultural Status**
- 2. Socioeconomic Gradients as an assessment framework**
- 3. Estimation and Results**
- 4. Advantages and Limitations**
- 5. Concluding remarks**

1. Student Achievement and Socioeconomic Status Measures

➤ Both measures come from SERCE.

- **Second Regional Comparative and Explanatory Study. OREALC/UNESCO Santiago, 2008.**
- **Learning acquired by Latin American and Caribbean primary school students. Third and sixth grades during 2005 /2006. Areas of mathematics, reading and natural science.**
- **Questionnaires to students, teachers, principals, and parents.**
- **Details can be found at OREALC/UNESCO Santiago, 2009a and Costilla, 2008.**

Participants



1. Measures of the Student Achievement and Socioeconomic Status

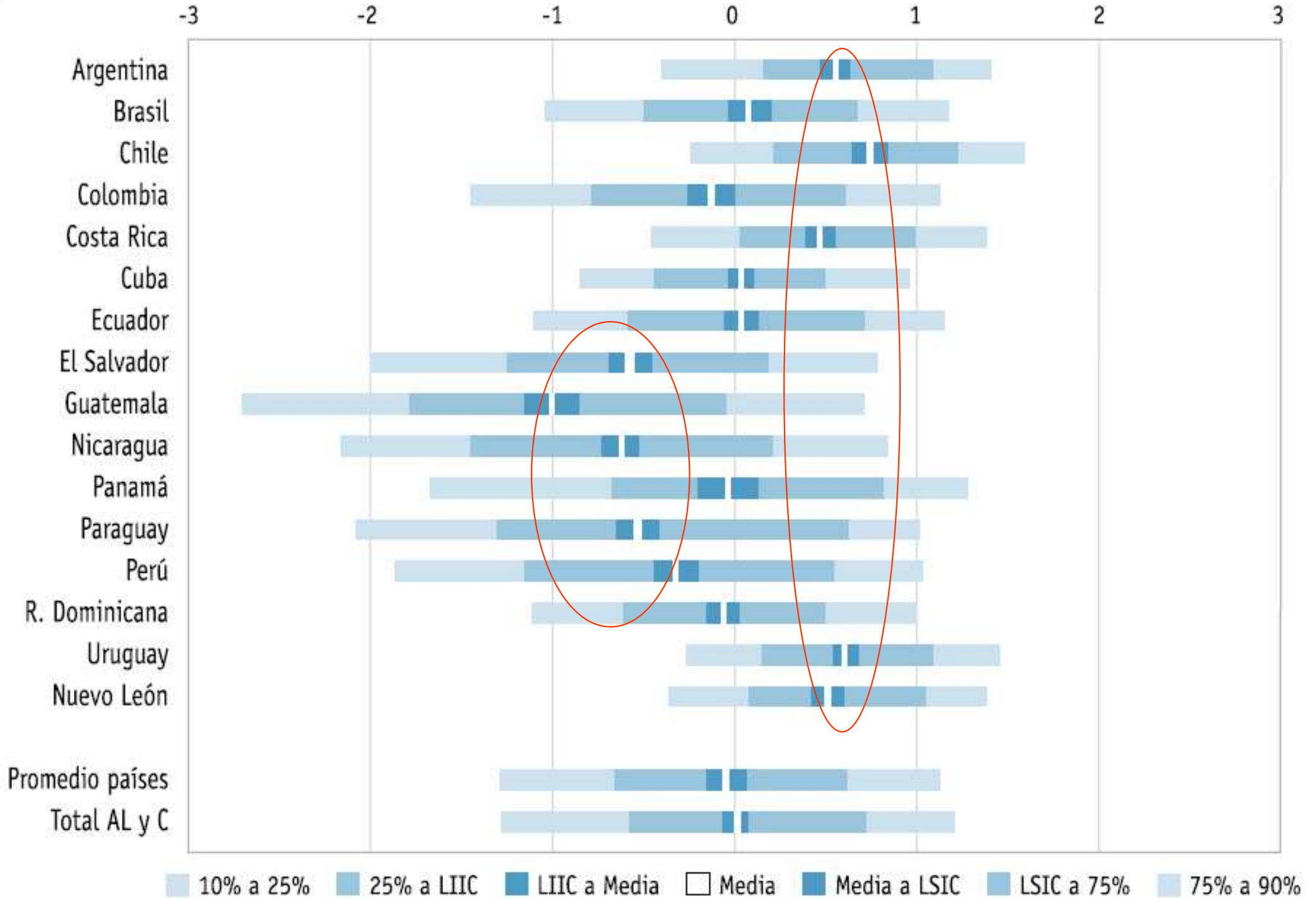
➤ Student achievement.

- Use of Item response theory.
- Centered on a scale with a mean of 500 and a standard deviation of 100, at regional level.
- Performance ranges from level 1 (low) to level 4 (high).

➤ Socioeconomic Status.

- The questionnaires are used to construct it.
- Index of socioeconomic and cultural status, ISEC.
- Comprises student variables:
 - Parents education
 - Mother tongue
 - Access to books and other education facilities at home
 - Home's floor building material

ISEC Distribution (all Serce students)



2. Socioeconomic Gradients as an assessment framework

- **A socioeconomic gradient describes the relationship between a social outcome and socioeconomic status for individuals in a specific jurisdiction, such as a school, a province or state, or a country (Willms, 2003).**
- **Implemented as a linear regression of the student achievement on the ISEC for each area and grade evaluated.**

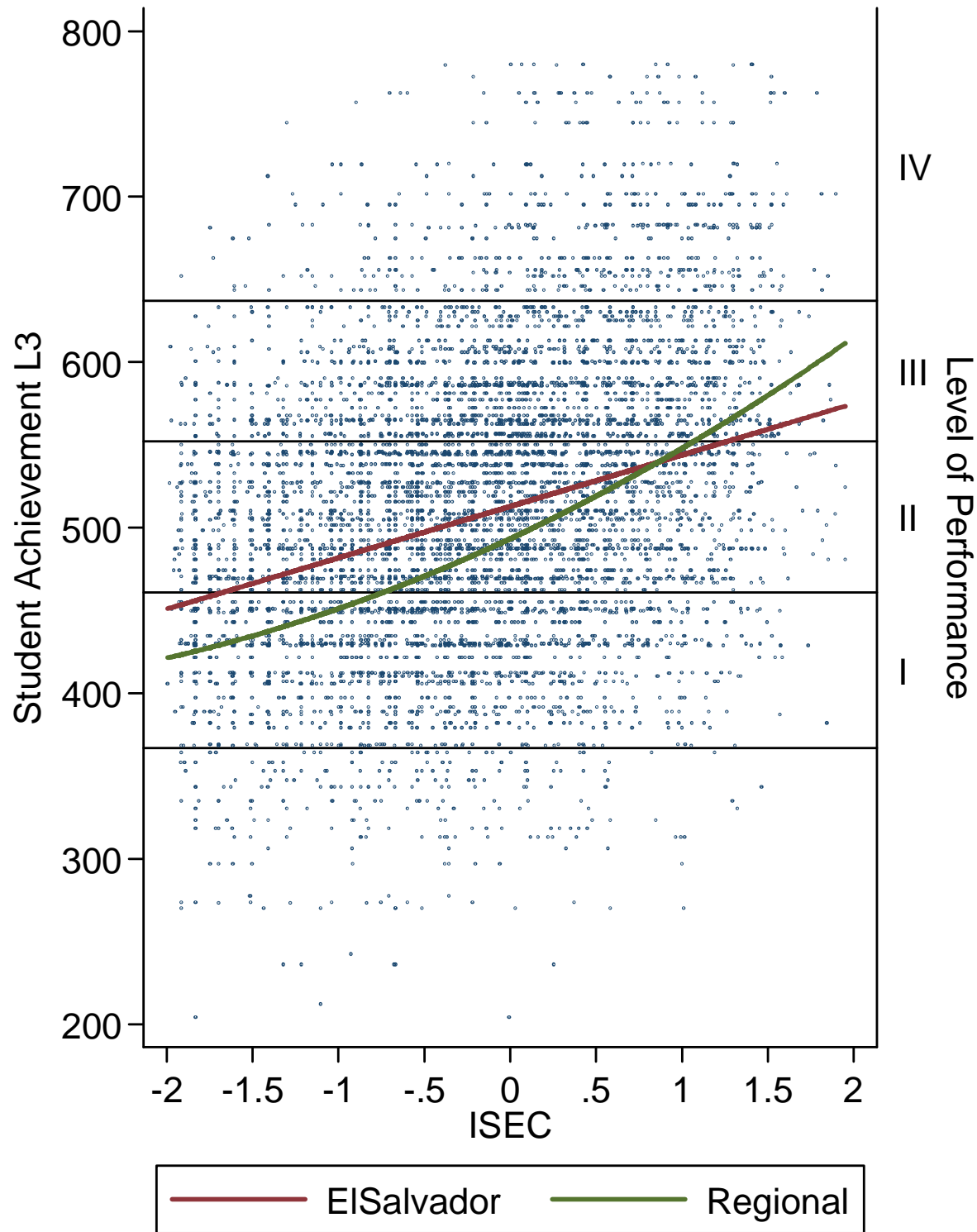
$$y_{ij} = a_{ij} + b_{ij}x_{ij} + e_{ij}$$

Where:

y_{ij} : *Student Achievement area "i" and grade "j".*

x_{ij} : *ISEC area "i" and grade "j".*

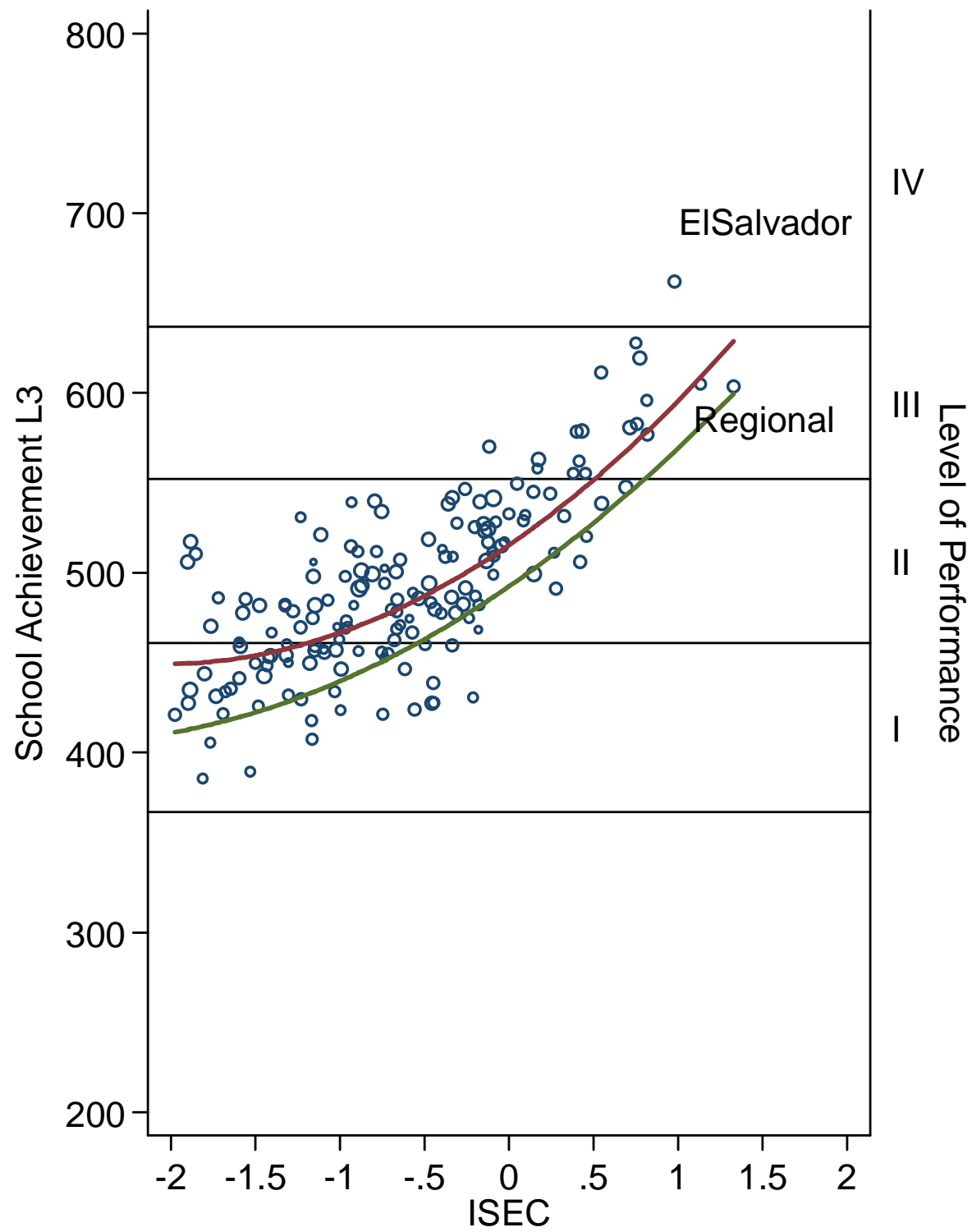
e_{ij} : *Error term area "i" and grade "j".*



2. Socioeconomic Gradients as an assessment framework

- **Comprises three components: level, slope and strength.**
 - **Level: expected score on the outcome measure for a person with an average ISEC (*a*).**
 - **Slope: extent of inequality attributable to ISEC (*b*).**
 - **Strength: Proportion of the variance on the outcome that is explained by ISEC (R^2 of the relation).**

- **At the school level, this relationship is called School Profile**
 - **Relationship between the mean performance and ISEC of the school .**
 - **It provides information about this relationship between schools.**



3. Estimation and Results

- **Survey data.**
- **Estimation:**
 - **Linear regression of student achievement on ISEC that includes quadratic term when significant.**
 - **Gradients drawn for p5-p95**
- **Automation using Stata.**

3. Estimation and Results

➤ Survey Data

Declare dataset as a survey data.

```
. svydes
```

```
Survey: Describing stage 1 sampling units
```

```
    pweight: pesoestudian  
           VCE: linearized  
Single unit: missing  
Strata 1: admrur  
        SU 1: llavepaiscentro  
        FPC 1: <zero>
```

Stratum	#Units	#Obs	#Obs per Unit		
			min	mean	max
1	1053	57471	1	54.6	316
2	411	14679	2	35.7	208
3	1230	19892	2	16.2	188
3	2694	92042	1	34.2	316

3. Results

➤ **Estimation:**

Gradients for Peru in Mathematics 3rd grade.

```
. svy: reg puntaje_m3 isec if isec >= p5 & isec <= p95
(running regress on estimation sample)
```

Survey: Linear regression

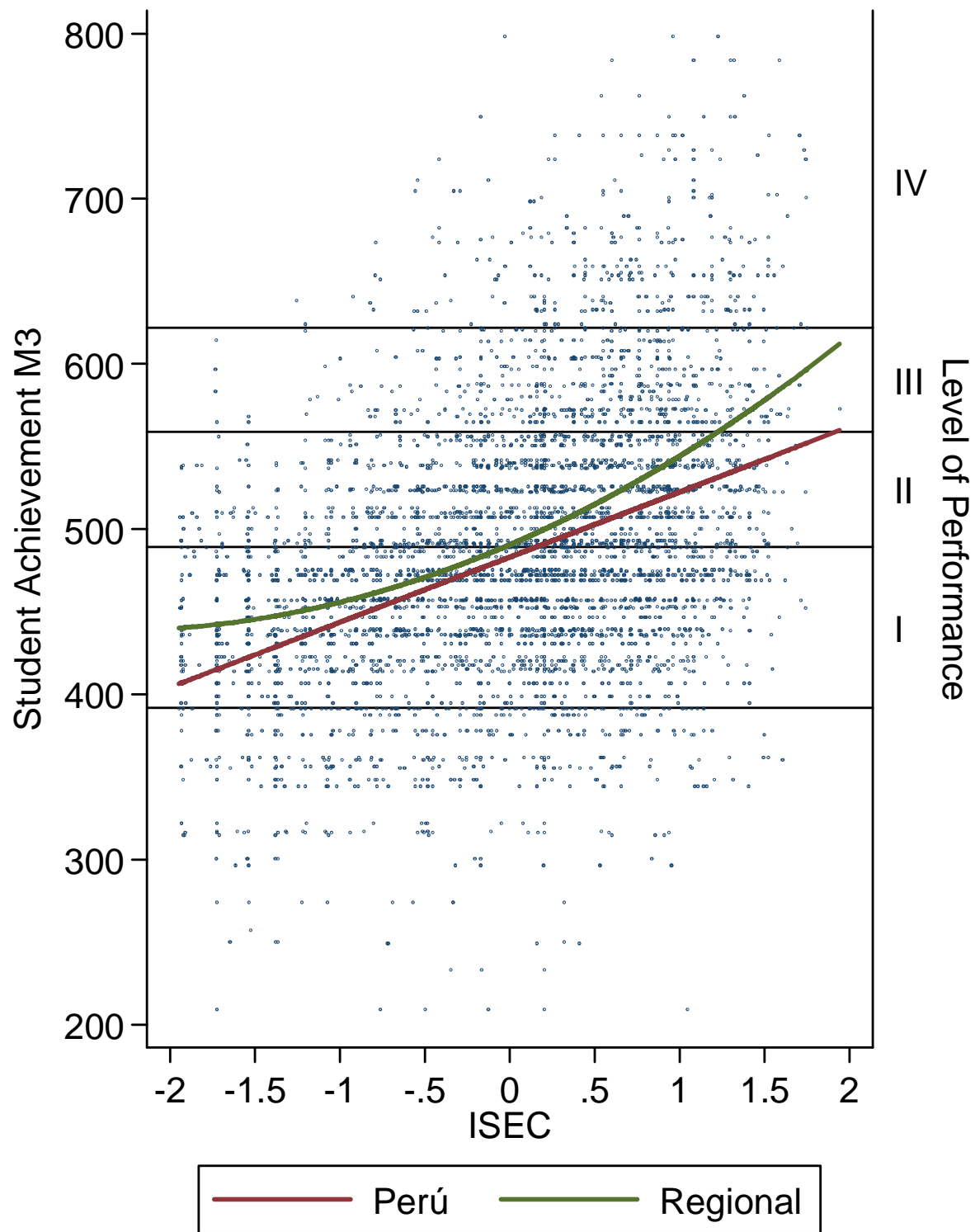
Number of strata	=	3	Number of obs	=	4350
Number of PSUs	=	154	Population size	=	617558.78
			Design df	=	151
			F(1, 151)	=	219.33
			Prob > F	=	0.0000
			R-squared	=	0.1657

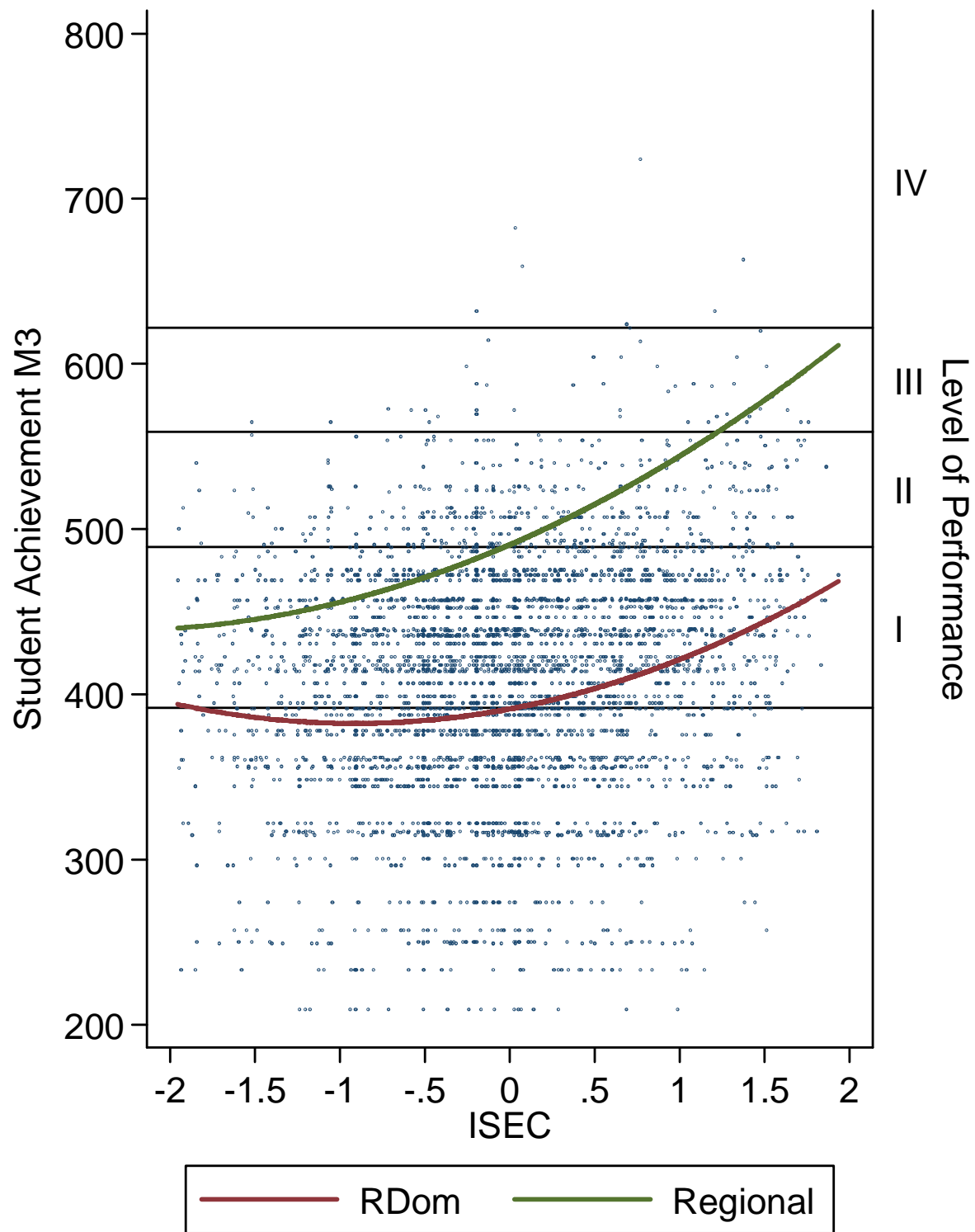
puntaje_m3	Coef.	Linearized Std. Err.	t	P> t	[95% Conf. Interval]	
isec	37.29738	2.518428	14.81	0.000	32.32147	42.27328
_cons	487.2929	3.407629	143.00	0.000	480.5602	494.0257

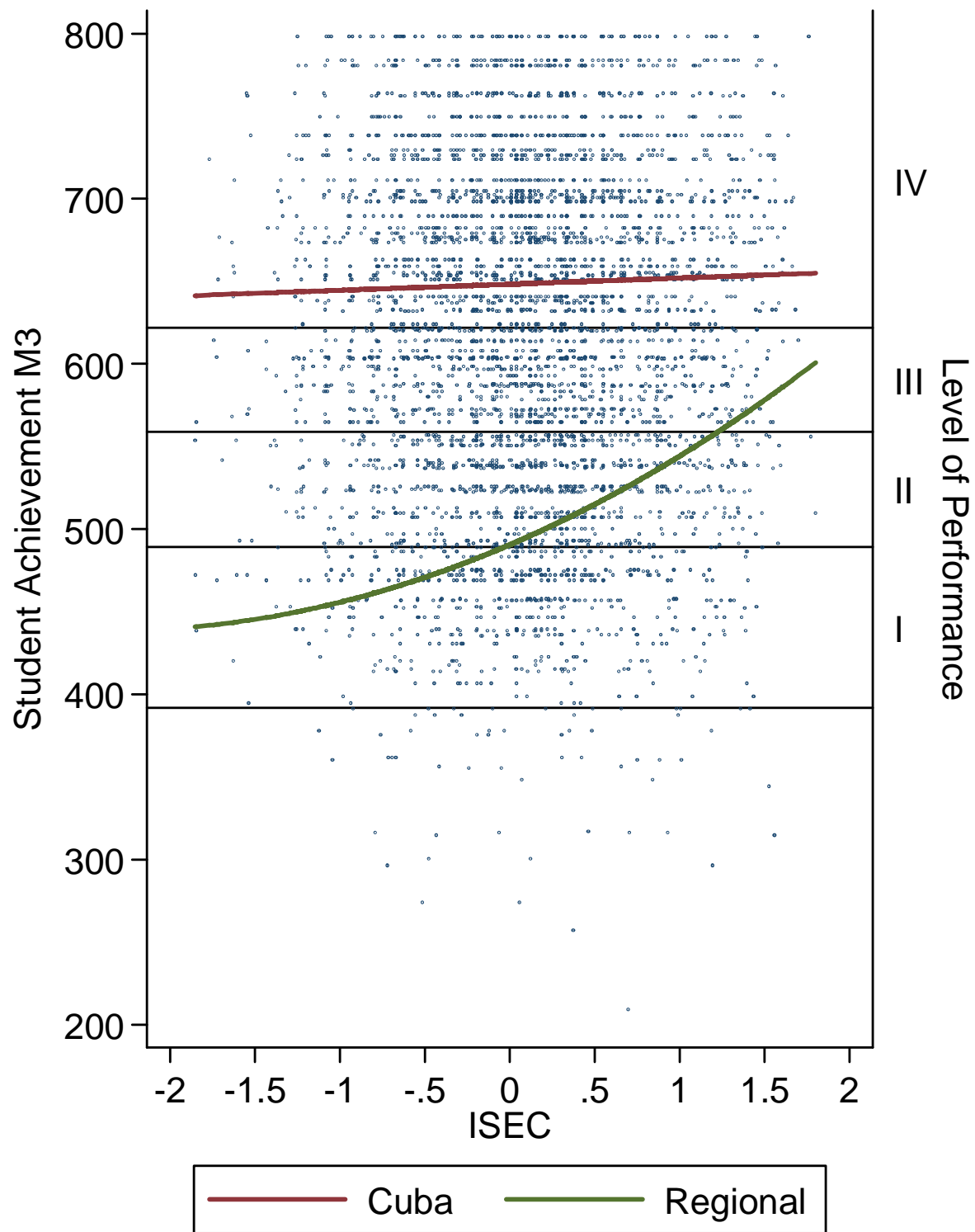
3. Results

➤ Automation using Stata.

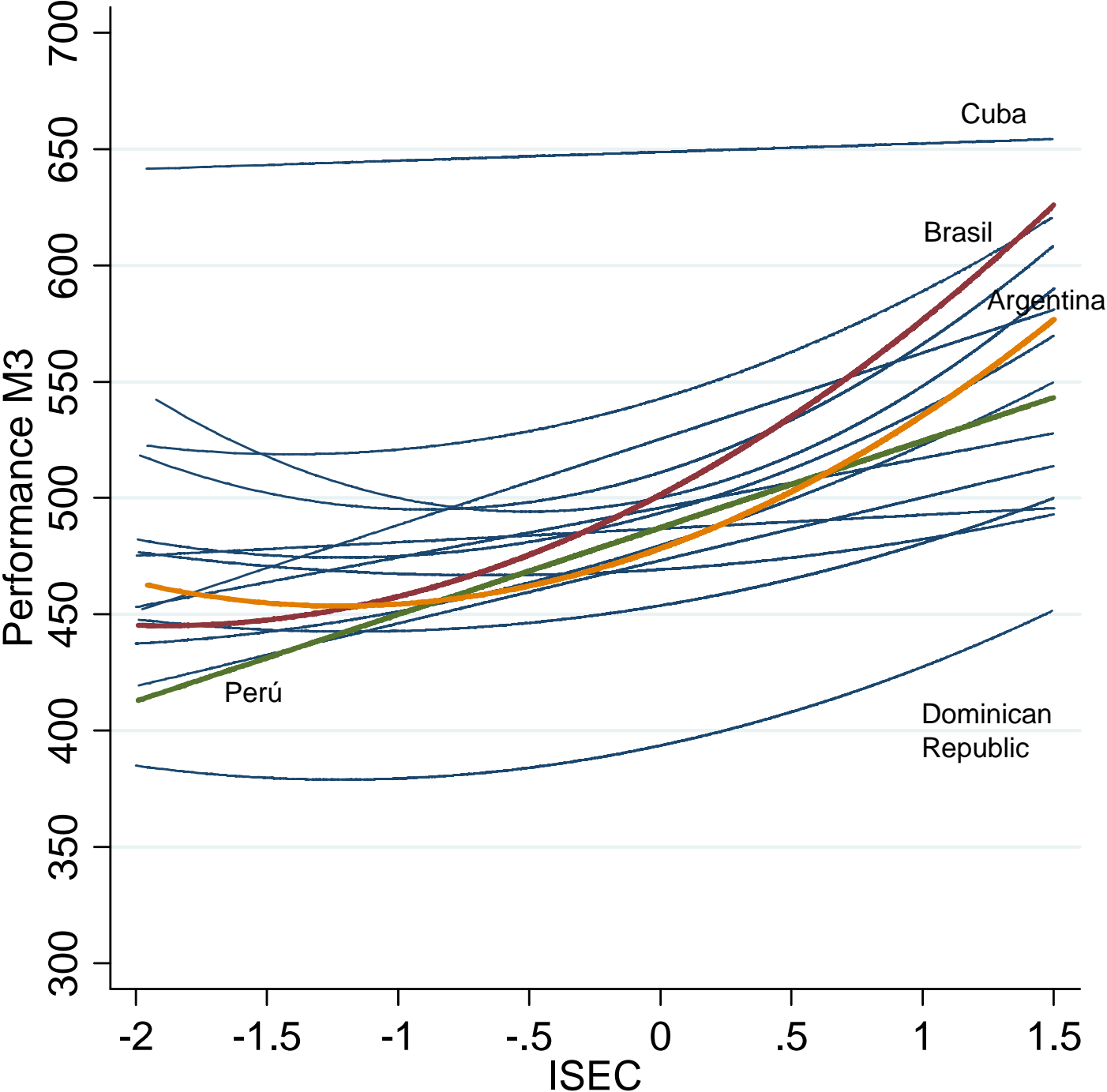
```
local cov1 isec
local cov2 isec isec2
levelsof(pais_num), local(paises)
foreach p of local paises {
    di "*** `: label (pais_num) `p' ***"
    preserve
    keep if pais_num == `p'
    sum isec [weight=pesoestudian], detail
    scalar p5 = r(p5)
    scalar p95 = r(p95)
    gen sample_`pais' = ( isec >= p5_`pais' & isec <= p95_`pais' )
    svyset [pweight = pesoestudian], strata(admrur) psu(llavepaiscentro)
    forvalues i=1/2 {
        svy: reg puntaje_m3 `cov`i' if sample_`p' == 1
        est store `p'_`i'
    }
    restore
}
```







Gradients



3. Results

- **In all countries there is a compositional effect associated with the mean ISEC of the school.**
 - **Slope of ISEC at the school level is always significant**

- **Considerable variation of the strength of the relationship among countries both at the student and school level.**
 - **Different degrees of success in reducing the disparities associated with socioeconomic and cultural status.**

 - **Countries where performance, both student and school level, resembles socioeconomic status and cultural status.**
 - **Brasil, Argentina, Peru vs Cuba.**

 - **Countries with general low level of Achievement**
 - **Paraguay, Nicaragua, and Dominican Republic.**

4. Advantages and Limitations

Pros:

- **Look at the school system as a whole. “Visual” indicator of an aggregate relation.**
- **Allows comparison of results between countries along the whole range of ISEC.**

Cons:

- **Socioeconomic Gradients and School profiles are only the first step.**
 - **Detailed analysis of ISEC components needed.**
 - **Multilevel Analysis of factors associated to learning. OREALC/UNESCO Santiago, 2009b.**

5. Concluding remarks

- **A socioeconomic gradient describes the relationship between a social outcome and socioeconomic status for individuals in a specific jurisdiction, such as a school, a province or state, or a country (Willms, 2003).**
- **Within this framework, it is analyzed the relationship between student achievement and their socioeconomic and cultural status for the case of Latin American and Caribbean primary school students that were assessed by SERCE (OREALC/UNESCO Santiago, 2008).**
- **It is shown that there is a considerable variation of the strength of this relationship among countries, suggesting different degrees of success in reducing the disparities associated with socioeconomic and cultural status.**

References

- Willms (2003), Ten hypotheses about socioeconomic gradients and community differences in children's developmental outcomes.
- OREALC/UNESCO Santiago (2009a). Reporte Técnico SERCE.
- OREALC/UNESCO Santiago (2009b). Reporte de Factores Asociados SERCE. (Forthcoming).
- OREALC/UNESCO Santiago (2008), Student achievement in Latin America and the Caribbean. Results of the Second Regional Comparative and Explanatory Study (SERCE).
- Costilla (2008). Using Stata to assess the achievement of Latin American students in Mathematics, Reading and Science. 2008 Fall North American Stata Users Group meeting