Replication: Using Maimonides' Rule to Estimate the Effect of Class Size on Student Achievement

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Abstract

This study explores the impact of class size on educational outcomes using Maimonides' rule as an instrument and applying Regression Discontinuity Design.

Introduction

The purpose of this report is to establish a causal relationship between lower class size and increased academic performance for the subjects of Math and Reading. For context, Maimonides' rule states that a class size should have an upper limit of 40 students.

Literature Review

Many existing studies support the idea of lowering class sizes to increase student performance. Gene Glass and Mary Lee Smith conclude that smaller class size is better in a popular Meta-Analysis research paper. Gaps in the research could be potential omitted variables that influence student test scores.

Methodology

Test score data for this study came from a national testing program in Israeli elementary schools in June of 1991. Descriptive statistics were generated, an OLS was performed, as well as a 2SLS. RDD comes into play when introducing Maimonides' rule, which creates a discontinuity in the relationship between enrollment and class size at enrollment multiples of 40.

Findings

This study employed a Fuzzy RDD, and the associated table from the 2SLS for Fifth graders is below:

TABLE IV
2SLS Estimates for 1991 (Fifth Graders)

	Reading comprehension						Math					
	Full sample				+/− 5 Discontinuity sample		Full sample				+/− 5 Discontinuity sample	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Mean score (s.d.)	74.4 (7.7)				74.5 (8.2)		67.3 (9.6)				67.0 (10.2)	
Regressors												
Class size	−.158 (.040)	−.275 (.066)	−.260 (.081)	−.186 (.104)	−.410 (.113)	−.582 (.181)	−.013 (.056)	−.230 (.092)	−.261 (.113)	−.202 (.131)	−.185 (.151)	−.443 (.236)
Percent disadvantaged	−.372 (.014)	−.369 (.014)	−.369 (.013)		−.477 (.037)	−.461 (.037)	−.355 (.019)	−.350 (.019)	−.350 (.019)		−.459 (.049)	−.435 (.049)
Enrollment		.022 (.009)	.012 (.026)			.053 (.028)		.041 (.012)	.062 (.037)			.079 (.036)
Enrollment squared/100			.005 (.011)						−.010 (.016)			
Piecewise linear trend				.136 (.032)						.193 (.040)		
Root MSE	6.15	6.23	6.22	7.71	6.79	7.15	8.34	8.40	8.42	9.49	8.79	9.10
N		2019		1961	471			2018		1960	471	

The unit of observation is the average score in the class. Standard errors are reported in parentheses. Standard errors were corrected for within-school correlation between classes. All estimates use I_c as an instrument for class size.

Figure: 2SLS Table

Discussion

It was found that the effects were greatest for Math and Reading scores of Fifth graders, with smaller effects for the Reading scores of Fourth graders. Effects on the Math scores of Fourth graders were found to not be significant. This is mostly consistent with existing literature supporting the notion that decreased class size improves student performance.

Conclusions

The key findings of this study have important real world applications. This study, along with others, supports the conclusion that smaller class size is better for student performance. These findings can be applied to policy changes on the maximum number of students allowed in a class.

Appendix

The following shows the equations for the 2SLS:

$$n_{sc} = X'_s\pi_0 + f_{sc}\pi_1 + \xi_{sc}$$

Figure: Stage 1 of 2SLS

$$y_{isc} = X'_s\beta + n_{sc}\alpha + \mu_c + \eta_s + \epsilon_{isc}$$

Figure: Stage 2 of 2SLS