Application of Interrupted Time Series to Investigate School Effects

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Common Scenario

- Interest in achievement growth following implementation of a new education initiative
- Desire to make comparisons with similar schools not implementing a program
- Student-level data from potential comparison schools is often difficult to obtain
- Aggregate school-level is commonly reported on state websites

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Primary Reference

Hallberg, K., Williams, R., Swanlund, A., & Eno, J. (2018). Short comparative interrupted time series using aggregate school-level data in education research. *Educational Researcher 47(5),* 295-306.

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Personalized Learning Program

- Four year project from 2014-15 to 2017-18
- 17 schools in 4 districts, grades PK-12
- Goal: Promote college and career readiness
- Main components: Project based learning, teacher collaboration, technology integration
- Support from trained instructional coaches
- *Does personalized learning (PL) impact student achievement?*

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Illustration

- Compare achievement prior to and after PL implementation for program schools
- Compare achievement growth between program and comparison schools
- SCDE website houses data from student assessments aggregated at the school level
- Fourth grade ELA to illustrate methods

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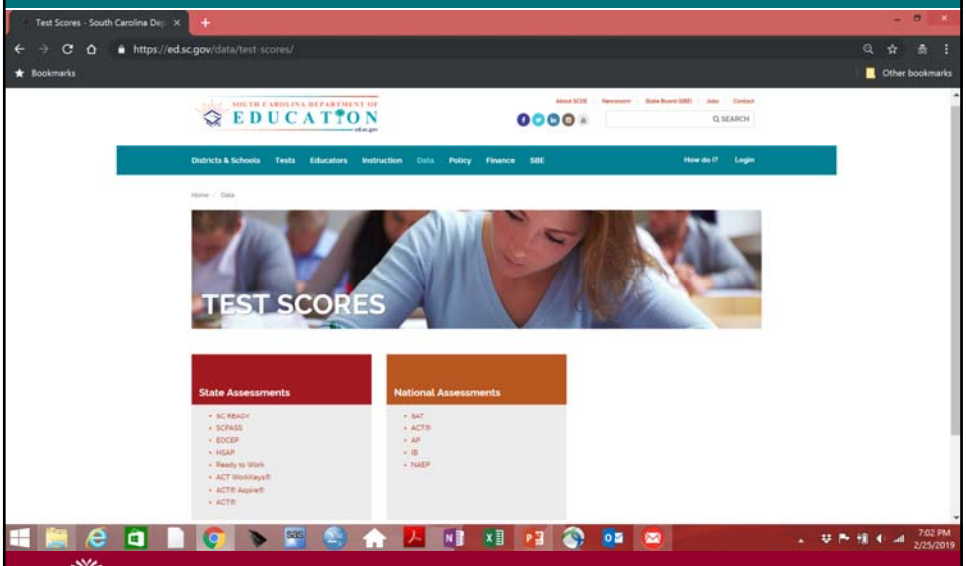
ed.sc.gov/data/test-scores



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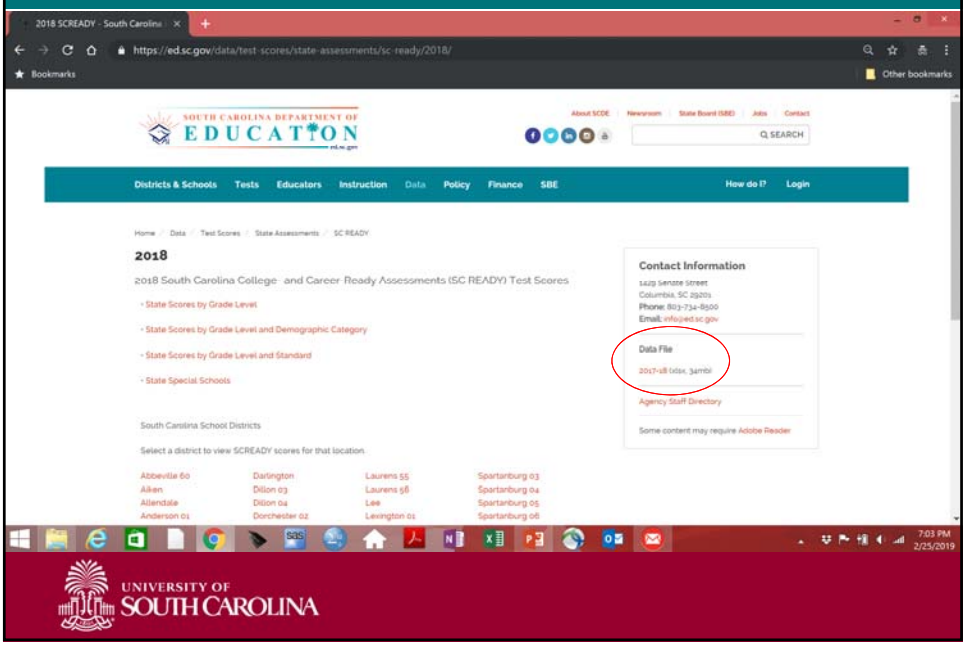
Able to Download Data Files



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Assessment Changes

- SC assessments for grades 3-8
  - SCPASS from 2009 to 2014
  - ASPIPE in 2015
  - SC READY from 2016 to 2018
- Standardized scores with respect to state for each year

$$Z = \frac{School\ mean\ - State\ mean}{State\ standard\ deviaion}$$

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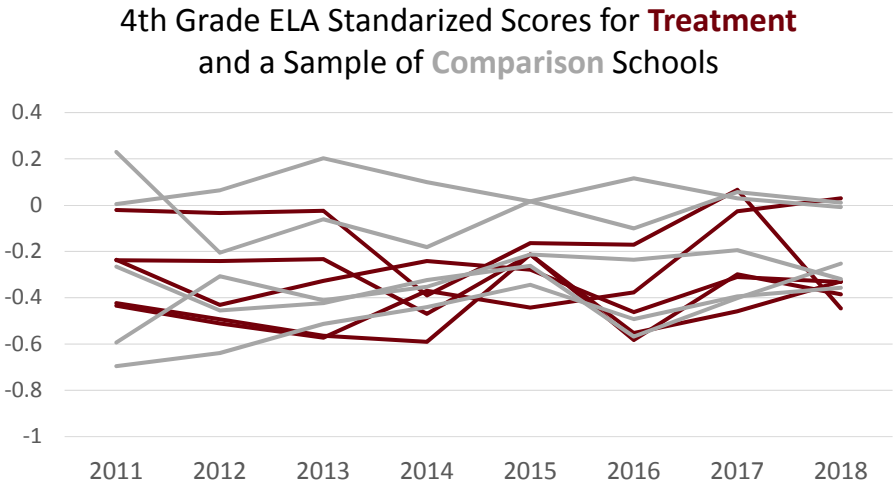

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Interrupted Times Series Models

- Baseline mean model

  Was there a change in the mean since project implementation?

- Baseline linear trend model

  Was there a change in the growth pattern since project implementation?

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Interrupted Times Series Models

- School mean as outcome of interest
- Time nested in schools
- Two level hierarchical models with time at level 1 and school at level 2
- School poverty index from 2014 included as covariate (year prior to program start)
- Comparison schools within program districts or from neighboring districts

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Time Variables

Time Point	Year	Time	Time Centered	Post Indicator
1	2011	-4	-3.5	0
2	2012	-3	-2.5	0
3	2013	-2	-1.5	0
4	2014	-1	-0.5	0
5	2015	0	0.5	1
6	2016	1	1.5	1
7	2017	2	2.5	1
8	2018	3	3.5	1

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Models with Treatment Schools Only

Baseline mean model

$$Y_{ij} = \beta_0 + \beta_1 Post + \beta_2 INDEX + v_j + u_{jt}$$

Baseline linear trend model

$$Y_{ij} = \beta_0 + \beta_1 Post + \beta_2 time_c + \beta_3 INDEX + v_j + u_{jt}$$

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Models with Comparison Schools

Baseline mean model

$$Y_{ij} = \beta_0 + \beta_1 Post + \beta_2 TRT + \beta_3 Post * TRT + \beta_4 INDEX + v_j + u_{jt}$$

Baseline linear trend model

$$Y_{ij} = \beta_0 + +\beta_1 Post + \beta_2 TRT + \beta_3 Post * TRT + \beta_4 time_c + \beta_5 time_c * TRT + \beta_6 INDEX + v_j + u_{jt}$$

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Results for Baseline Mean Model

Solution for Fixed Effects					
Effect	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
Intercept	1.1079	0.1592	35	6.96	<.0001
INDEX	-0.01607	0.002084	35	-7.71	<.0001
post	0.01433	0.02158	244	0.66	0.5074
TRT	0.06160	0.1229	35	0.50	0.6195
post*TRT	0.06996	0.05431	244	1.29	0.1990

Comparison schools consist of non-program schools in program or neighboring districts

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Results for Baseline Linear Trend Model

Solution for Fixed Effects					
Effect	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
Intercept	1.1027	0.1439	35	7.66	<.0001
INDEX	-0.01647	0.001854	35	-8.88	<.0001
time_c	-0.01455	0.009979	242	-1.46	0.1461
post	0.07391	0.04004	242	1.85	0.0661
TRT	0.04145	0.1260	35	0.33	0.7442
time_c*TRT	-0.01806	0.02548	242	-0.71	0.4791
post*TRT	0.1410	0.09926	242	1.42	0.1569

Comparison schools consist of non-program schools in program or neighboring districts

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Summary

- Able to estimate school level effects following program implementation and in contrast with a comparison group
- Process may be used for any project where implementation is at the school level
- Data obtained from public source is convenient and cost-effective
- Alternative ways to obtain comparison schools may be used

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Questions?

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