

Educational Test Scores and Education Spending: A Look Across States, 1992-2015

John Garen

Rex Bray

John H. Schnatter Institute for the Study of Free Enterprise

September 1, 2017

Caroline Hoxby, “Productivity in Education: . . .,” *Southern Economic Journal*, Oct. 2004

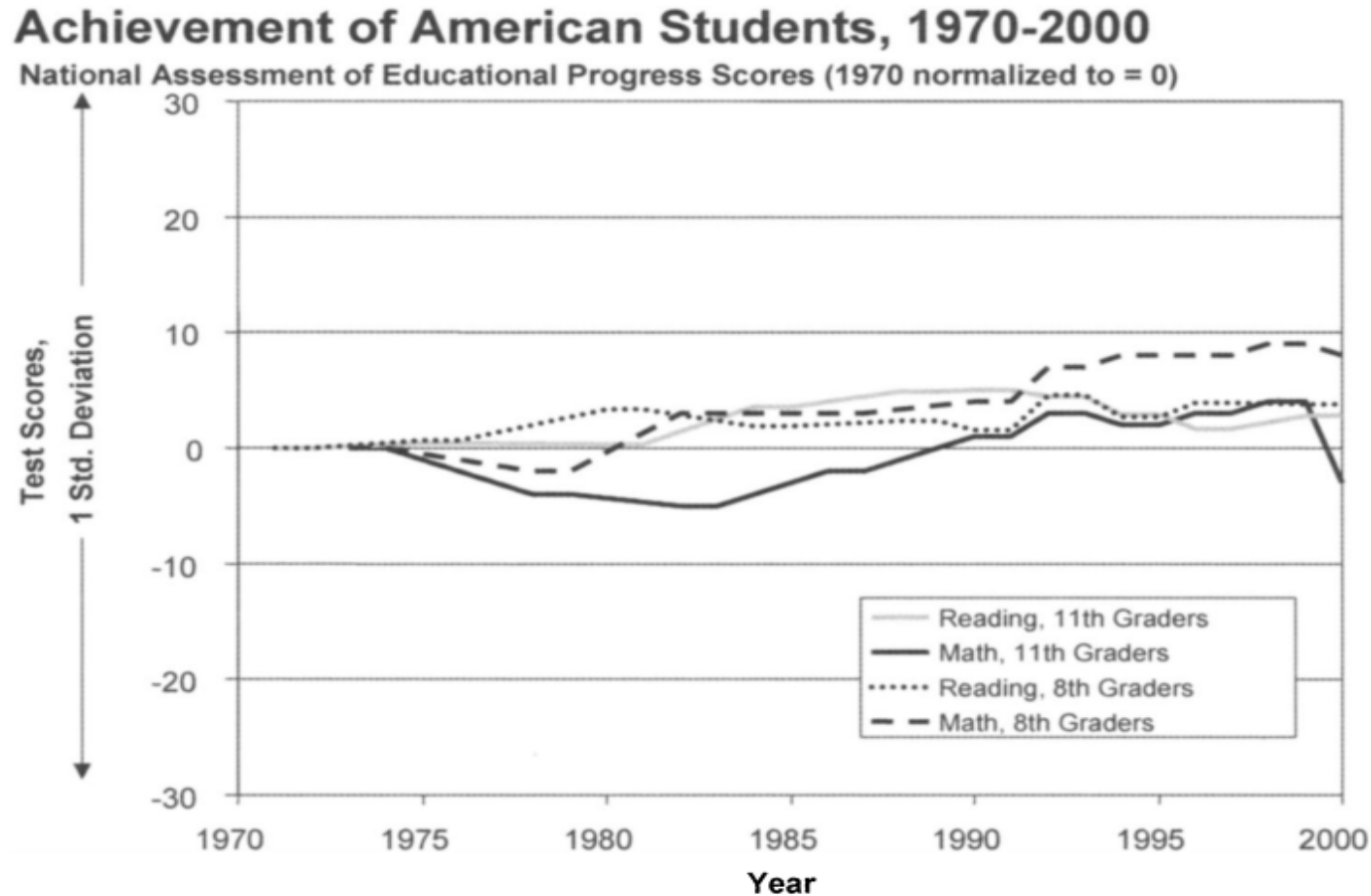


Figure 1. Achievement of American Students, 1970–2000 (National Assessment of Educational Progress Scores with 1970 normalized to zero). Source: Author’s calculations using U.S. Department of Education (2003e) data.

Real, Per Pupil Spending (2003\$)

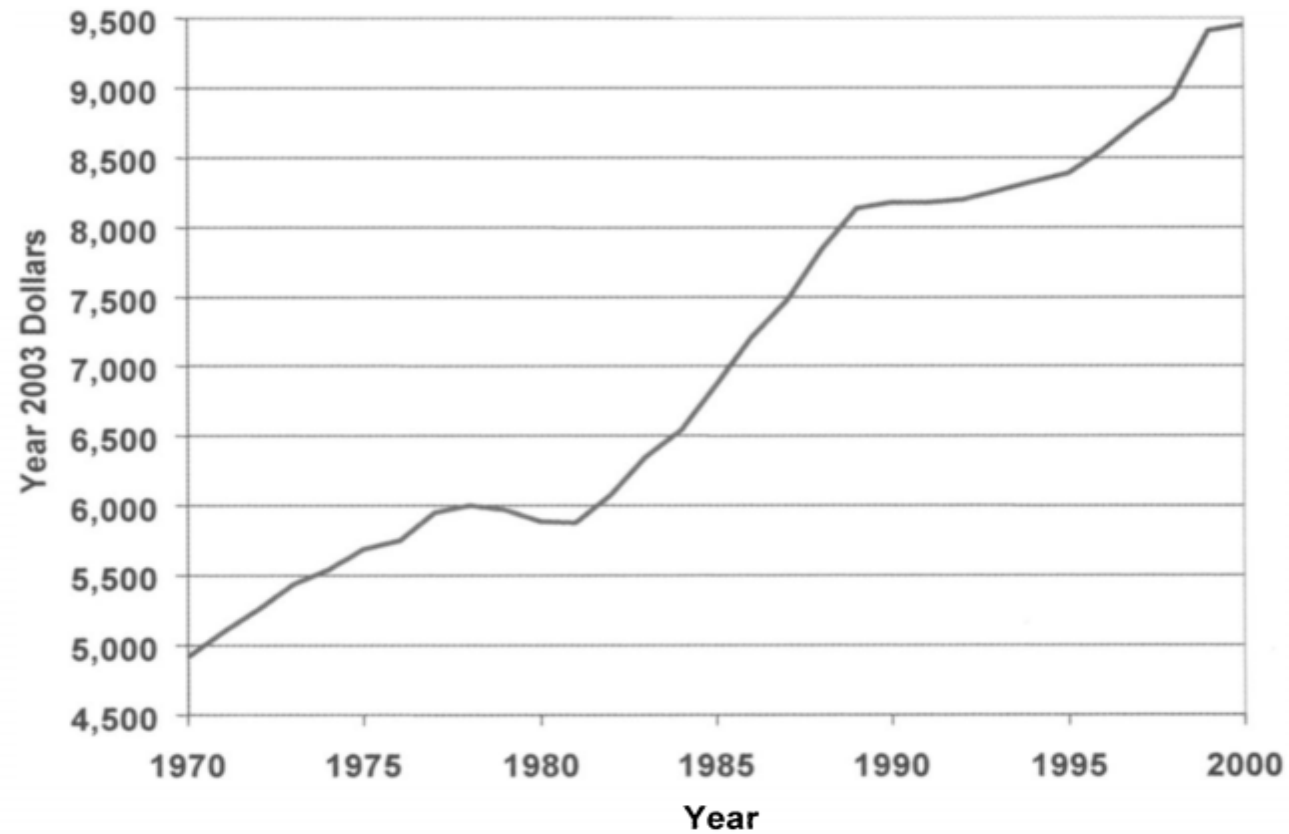


Figure 3. Average per-pupil spending in American public schools (year 2003 dollars, cost index is CPI). Source: Author's calculations using U.S. Department of Education (2004) and U.S. Department of Labor (2004) data.

NAEP Points per \$1,000

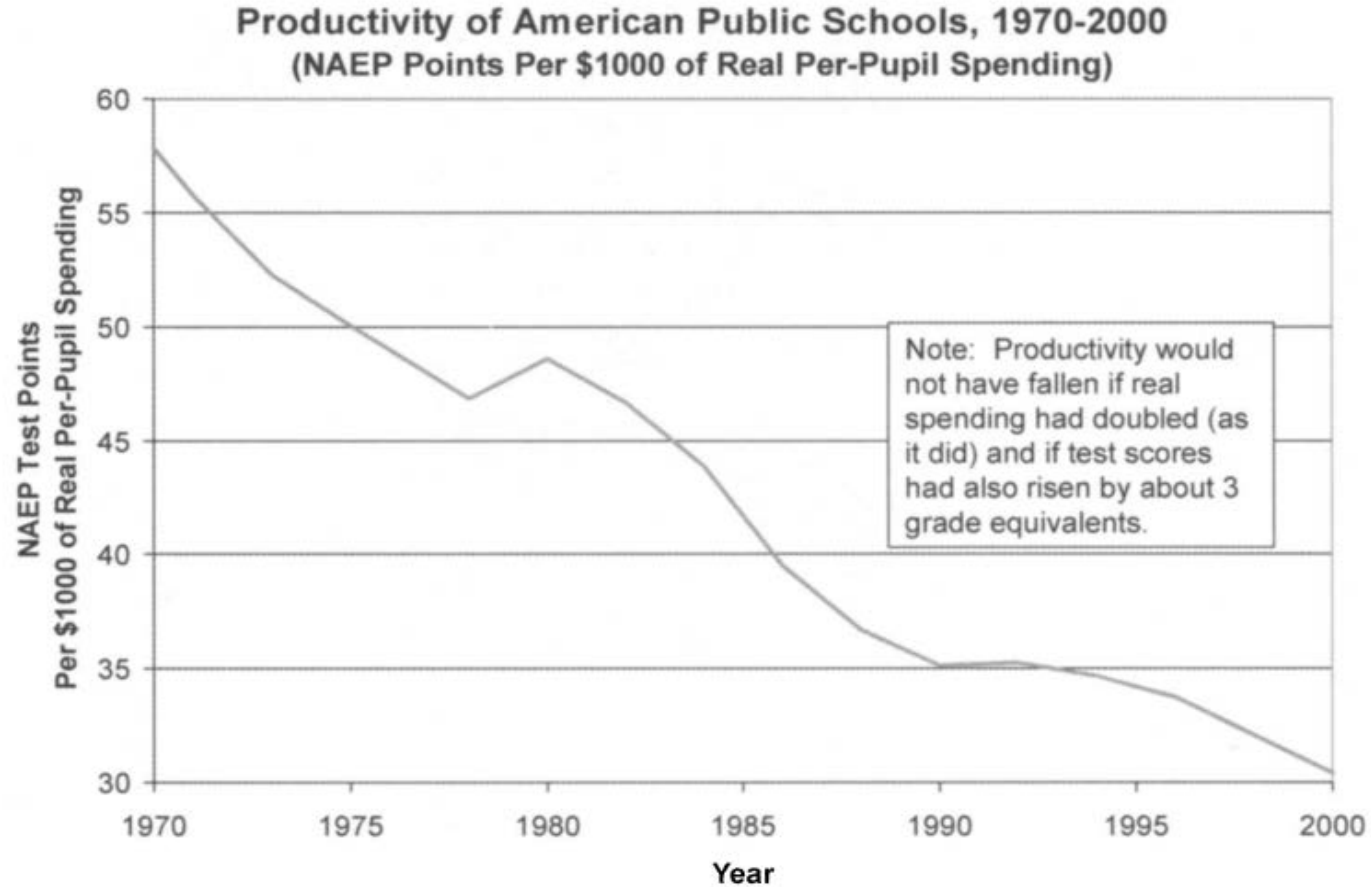


Figure 4. Productivity of American public schools, 1970–2000 (NAEP points per \$1000 of real per-pupil spending). Source: Author’s calculations using U.S. Department of Education (2003e, 2004) and U.S. Department of Labor (2004) data.

Hoxby's Concerns About Declining "Tiebout" Competition: How to Make School Funding Contingent on School Success?

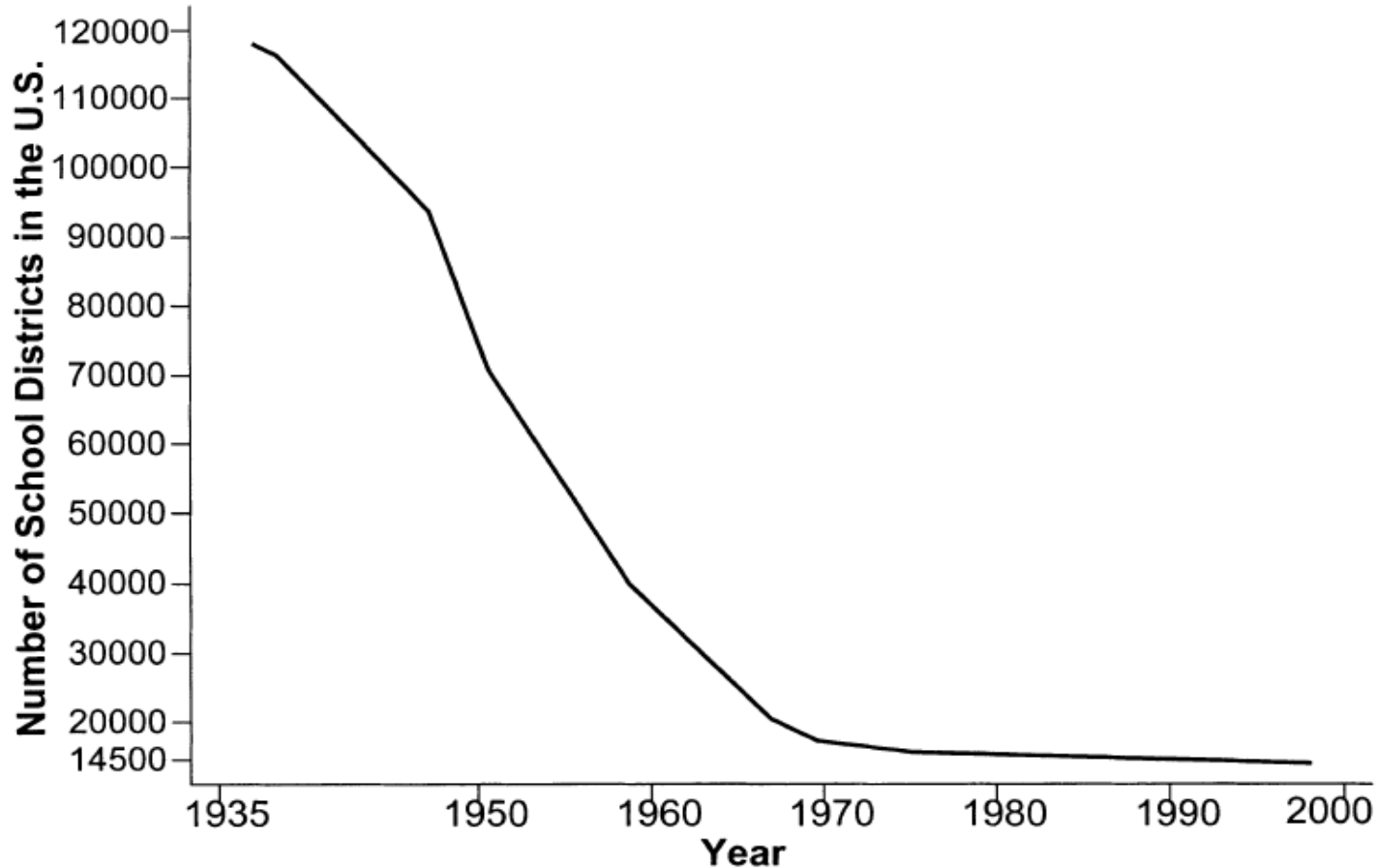


Figure 10. Number of School Districts in the United States. Source: Author's calculations using U.S. Department of Education (2003c) data.

Contributions of This Paper

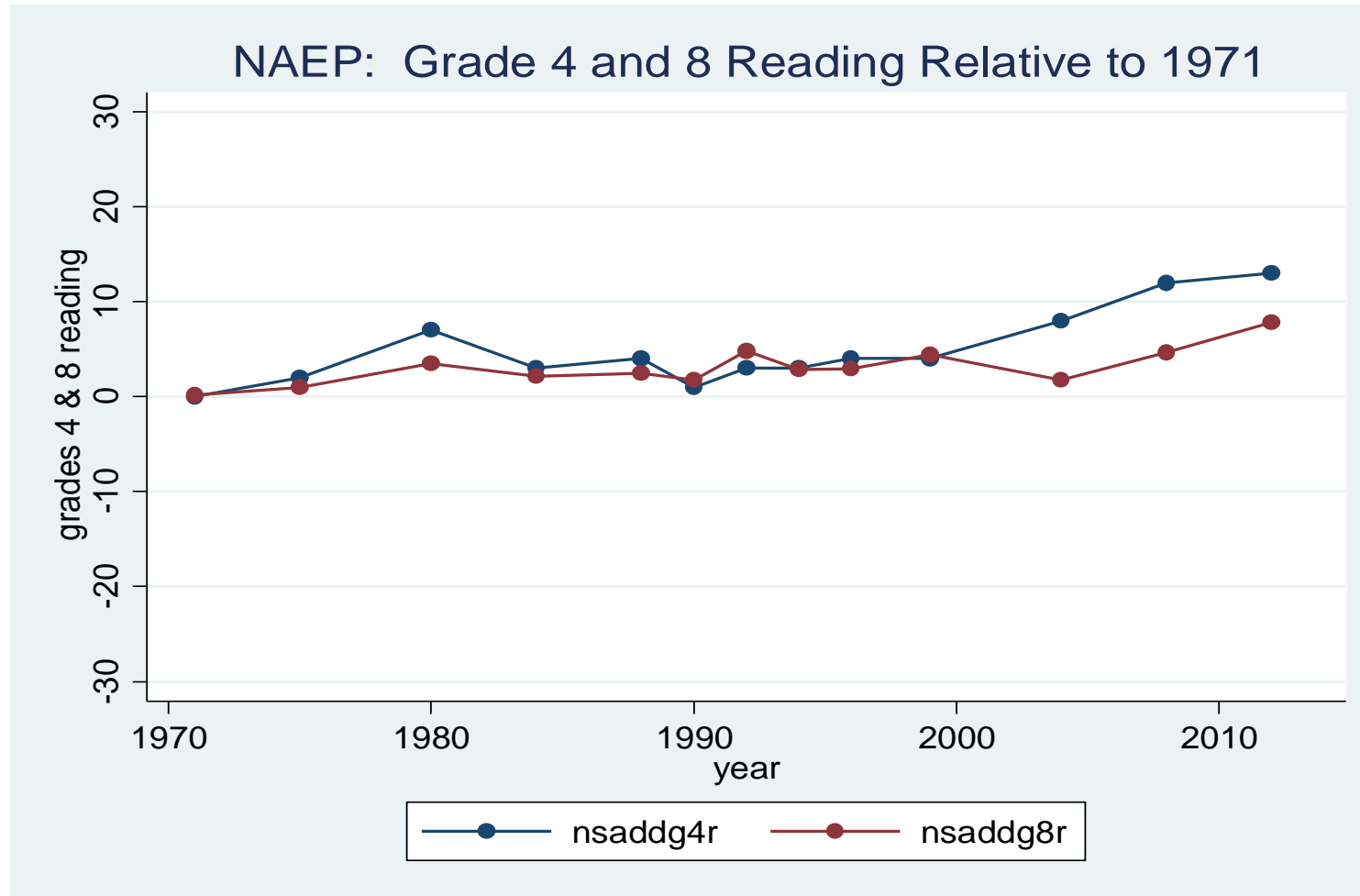
- Update national summary of performance through 2012.
- Examine the relationship of NAEP test scores and educational spending, over time and cross-states, 1992 -2015.
- States vary in test score progress, spending, and reform.

- Does the story change much from Hoxby (2004)?
- Is deeper and more fundamental reform called for?

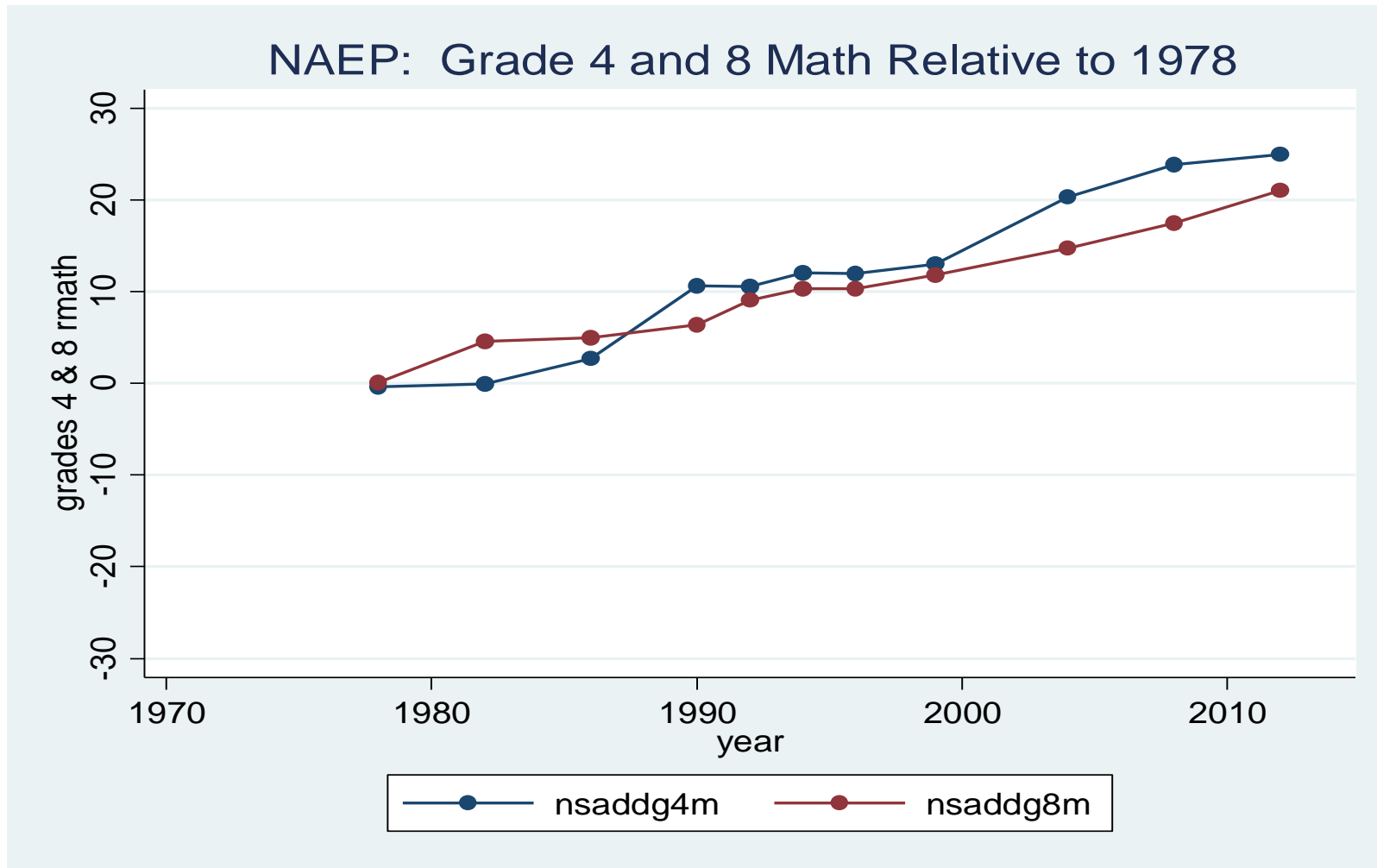
Various School Reforms in 1990s, 2000s

- Spending initiatives, e.g., Kentucky Education Reform Act of 1990.
 - School budget/teacher compensation plans. Tying school and/or teacher rewards to test scores.
 - Choice programs: No Child Left Behind, vouchers, charter schools, magnet schools, open enrollment
 - Some non-trivial changes, but not a major remake of schooling institutions. Only 5% of students are in charters.
-
- For a critique/assessment of aspects of the literature, see Garen, John, "Assessing the Literature on School Reform From an Entrepreneurship Perspective," *Journal of Entrepreneurship and Public Policy*, v. 5, n. 3, 2016.

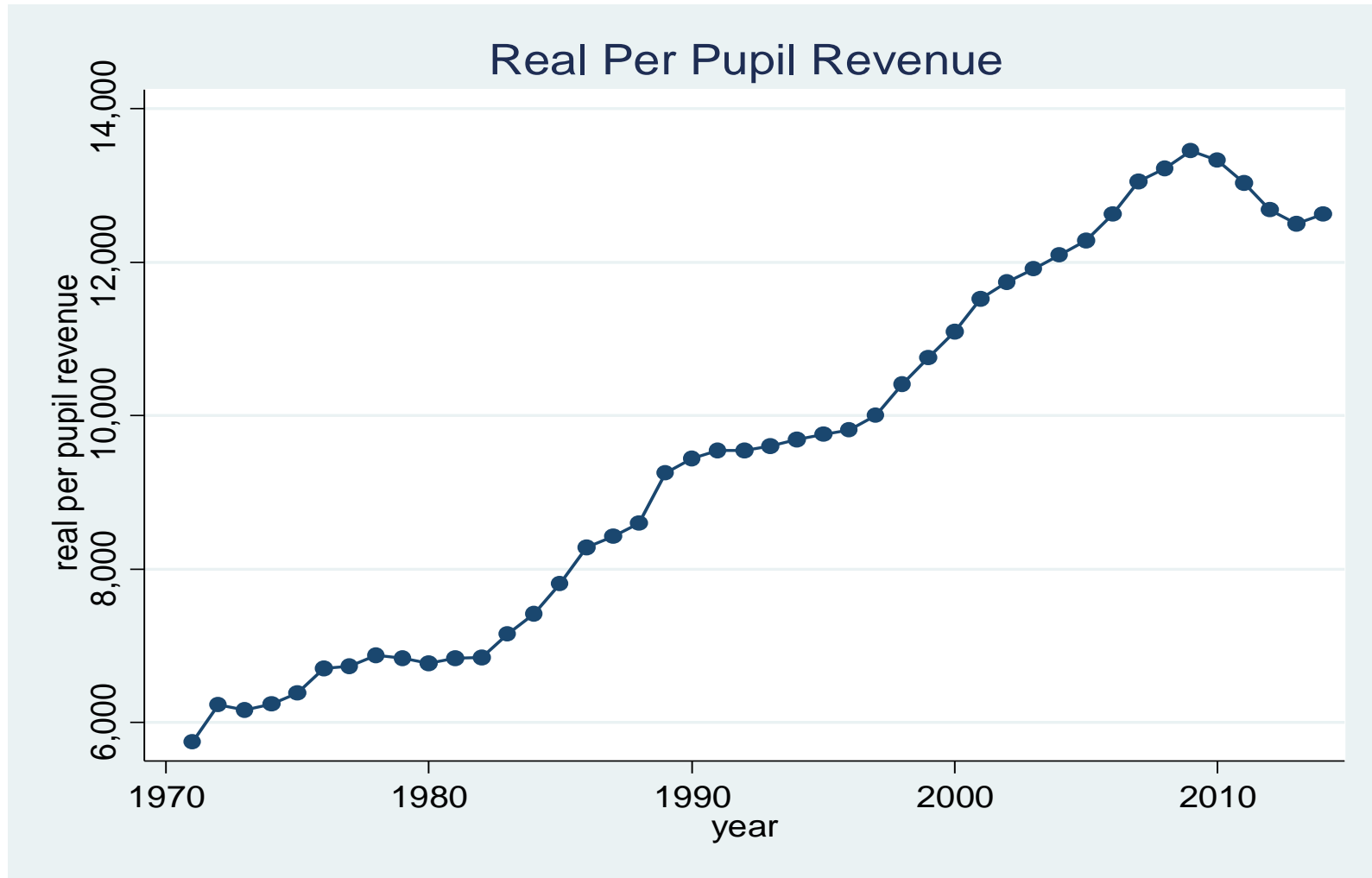
National Assessment of Educational Progress (NAEP) Test Score Updated Trends



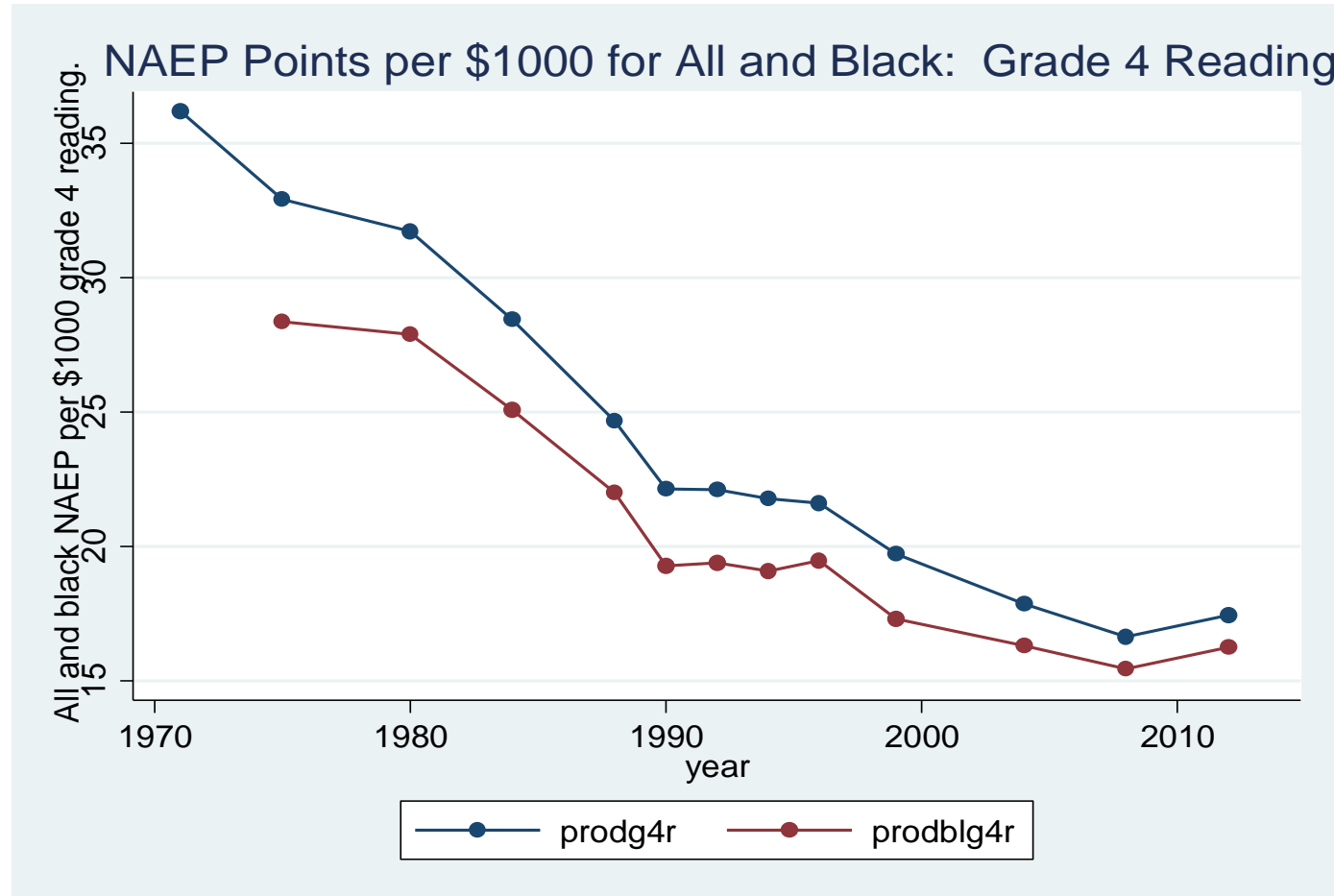
Updated National Trends, cont'd.



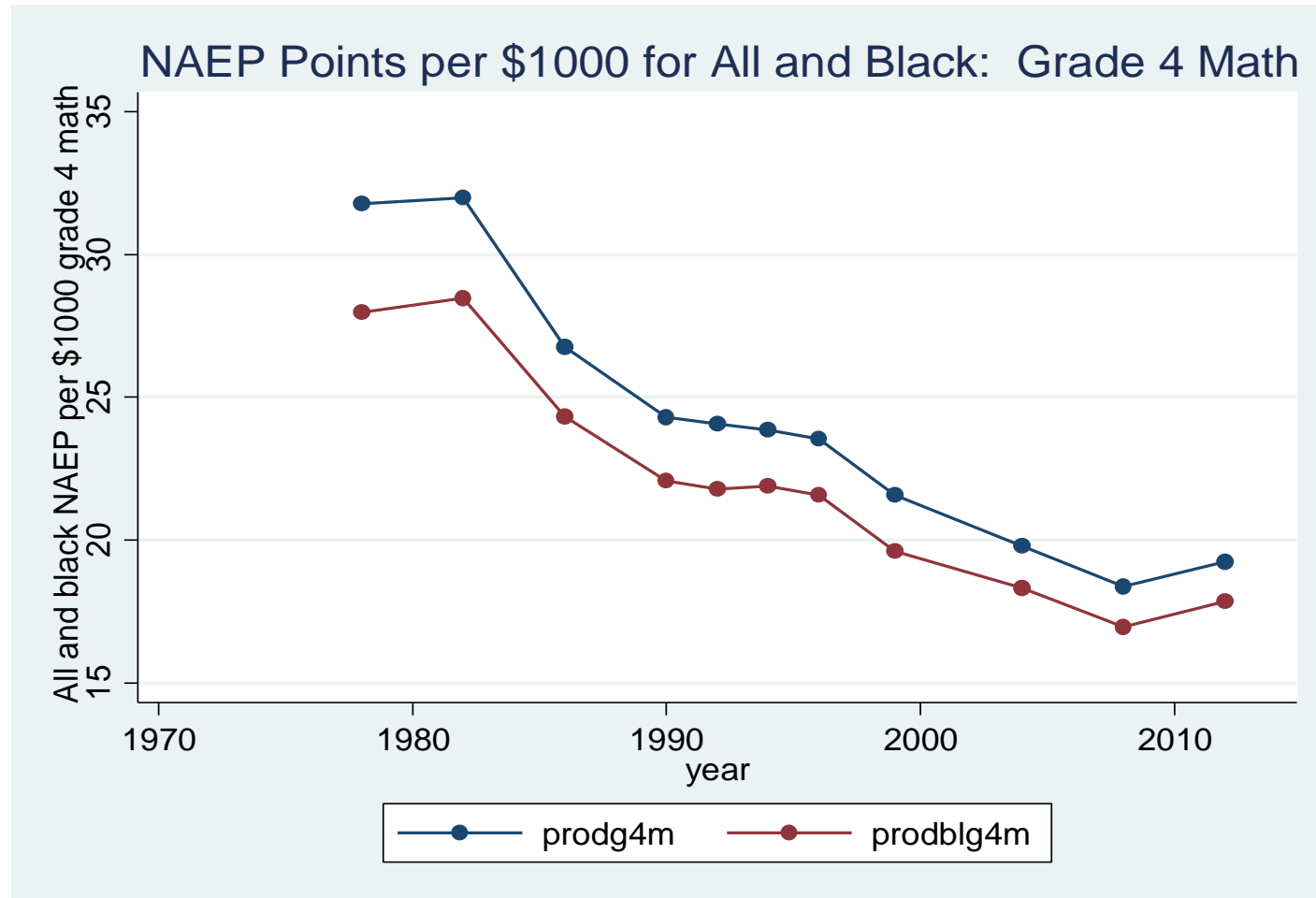
Real, Per-Pupil School Revenue (2016\$)



Productivity: NAEP Points per \$1000, Grade 4 Reading



Productivity: NAEP Points per \$1000, Grade 4 Math



Longitudinal, Cross-State Analysis

- National Assessment of Educational Progress (NAEP) test scores: 4th grade math & reading, 8th grade math & reading
- Every state: 2003, 2005, 2007, 2009, 2011, 2013, 2015
- Most states, varying years: 1992, 1996, 1998, 2000, 2002
- Demographics of test takers: free and reduced-price lunch, English language learners, student with disabilities, test accommodation, race.

Means, Math Scores & Revenue (2016\$)

<u>4th Grade Math</u>			
	<u>Mean</u>	<u>Std. Deviation</u>	<u>Observations</u>
NAEP Score	234.25	10.56	484
Per Pupil Revenue	\$12,163	\$3,432	484
<u>8th Grade Math</u>			
NAEP Score	278.04	10.22	478
Per Pupil Revenue	\$12,176	\$3,433	478

Means, Reading Scores & Revenue (2016\$)

<u>4th Grade Reading</u>			
	<u>Mean</u>	<u>Std. Deviation</u>	<u>Observations</u>
NAEP Score	218.82	7.58	482
Per Pupil Revenue	\$12,229	\$3,414	482
<u>8th Grade Reading</u>			
NAEP Score	263.23	6.76	436
Per Pupil Revenue	\$12,530	\$3,389	436

Use of Regression Analysis to Show . . .

- The relationship of test scores to spending, while controlling for:
 - demographic changes
 - the uniqueness of each state
 - national trends over time
- The change in productivity (NAEP points per \$1000), controlling for:
 - demographic changes
 - the uniqueness of each state

Test Score Regressions on Spending

Grade 4 Math, All Student Avg.

<u>Variable</u>	<u>(1)</u>	<u>(2)</u>	<u>(3)</u>	<u>(4)</u>
Real per-pupil spending (1000\$)	1.21***	.218**	1.22***	.305**
Demographics	no	yes	yes	yes
State effects	no	no	yes	yes
Year effects	no	no	no	yes
R ²	.1546	.6907	.8881	.9526

Test Score Regressions on Spending

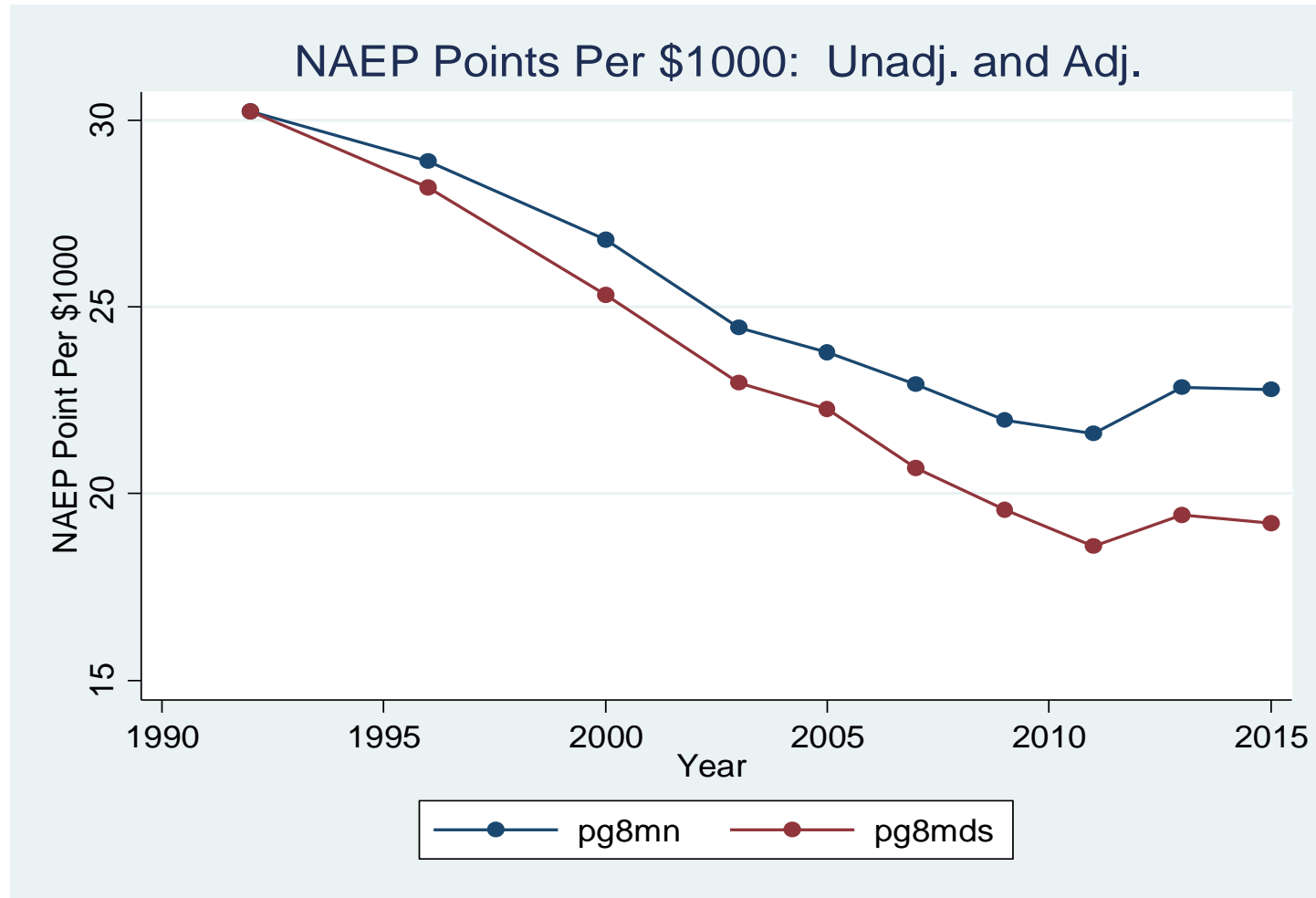
Grade 4 Math, Black Student Avg.

<u>Variable</u>	<u>(1)</u>	<u>(2)</u>	<u>(3)</u>	<u>(4)</u>
Real per-pupil spending (1000\$)	1.39***	.170	1.41***	.132
Demographics	no	yes	yes	yes
State effects	no	no	yes	yes
Year effects	no	no	no	yes
R ²	.1617	.6625	.8621	.9331

Some Computations: Association of Spending with Test Scores

	Grade 4 Math		Grade 8 Math		Grade 4 Reading		Grade 8 Reading	
	Demog., State	Demog., State/Year	Demog., State	Demog., State/Year	Demog., State	Demog., State/Year	Demog., State	Demog., State/Year
Effect of \$1,000 on scores	1.22 pts.	0.31 pts.	1.37 pts.	0.57 pts.	.66 pts.	0.27 pts.	0.25 pts.	0.20 pts.
\$ needed for 5 pts.	\$4,098	\$16,129	\$3,650	\$8,772	--	--	--	--
\$ needed for 3.5 pts	--	--	--	--	\$5,303	\$12,963	\$14,000	\$17,500

Productivity Again: Across Time and States, 8th Grade Math



Final Thoughts

- Small improvements in outcomes, large increases in spending. Similar story as Hoxby (2004).
- Other things matter, e.g., “non-cognitive” skills, creativity, extracurriculars. Are these improving?
- Should there be a call for more fundamental and deeper reform?
- What should research on reform focus on? Tying knowledge, incentives, and decision authority.
 - the link of resources and rewards to school success
 - decision-making power for teachers, parents
 - limiting political influence over decision making