Translating Learning Loss to Lifetime Earnings

The following table summarizes the estimated future income loss for students in six cities (Boston, Chicago, Washington DC, Houston, New York City, and Sacramento), as calculated by Harvard researcher, Thomas Kane, and his colleagues.

District	2019-22 Loss	Estimated	Estimated	Total K-12	Total Estimated
	in Math	Present Value	Loss in	Students in	Loss in Lifetime
	Achievement	of Lifetime	Lifetime	Public School	Income in
	(SD units)	Income	Income Per	District in	Metro Area
			Student	2020-21	
Boston Public	-0.227	\$1,419,185	\$26,885	48,112	\$1,288,206,848
Schools					
Chicago Public	-0.327	\$1,193,742	\$32,381	341,382	\$11,054,145,536
Schools					
District of	-0.339	\$1,423,516	\$40,064	49,896	\$1,999,014,784
Columbia					
Public Schools					
Houston	-0.281	\$1,111,080	\$25 <i>,</i> 890	196,943	\$5,098,791,424
Independent					
School District					
New York City	-0.215	\$1,375,898	\$24,562	912,994	\$22,425,059,328
Public Schools					
Sacramento	-0.143	\$1,110,462	\$13,180	40,711	\$536,574,176
City Unified					
School District					

Estimated Income Loss by Metropolitan Area

The estimated loss in lifetime earnings ranged from \$13,180 per student in Sacramento to \$40,064 per student in the District of Columbia. These estimated losses apply to the average student in each district. When multiplied by the number of students enrolled in each district, the aggregate loss in lifetime earnings ranged from \$536 million in Sacramento to \$22 billion in NYC.

Below, we describe each of the columns:

The 2019-22 Loss in Math Achievement is the weighted average of the loss in 4th and 8th grade math on the NAEP Trial Urban District Assessment (TUDA) between the 2019 and 2022. (Since we were estimating losses across grades 3-8, we weighted the 4th grade score by 5/8 and the 8th grade score by 3/8.) In Sacramento, which did not participate in TUDA, this number represents the loss in math achievement from the Education Recovery Scorecard. To be consistent with our research on the relationship between

NAEP scores and earnings, the loss in achievement in NAEP points is divided by the 1992 NAEP standard deviation in each grade.

• The **Estimated Present Value of Lifetime Income** is based on the resident population of each metropolitan area in the 2019 American Community Survey. For each single year of age *k* between 6 and 18, we calculated the mean incomes of those with any positive earnings during the year, *Earn*_{age}. We then used the following formula to estimate present value of earnings:

 $PV_k = \frac{1}{(1+r)^{(28-k)}} \sum_{age=28}^{64} \left(\frac{(1+p)}{(1+r)}\right)^{age-28} \overline{Earn}_{age}.$

Where r, the discount rate, is assumed to be .03 and, p, the annual increase in real productivity is .01. We then averaged across age, k.

- Estimated Lost Income per Student uses the relationship between the NAEP scores and earnings by birth cohort to infer the cost per SD loss in math achievement from Doty et al. (See below for full citation). In that paper, we matched 8th grade math scores by state and birth cohort to those sampled in the decennial census and the American Community Survey. We ask, "How much did average earnings improve for the birth cohorts in the states with large increases in the NAEP, when compared to the same birth cohorts in states with small increases in the NAEP?" We estimate an 8.3 percent annual earnings increase in the cohort for each standard deviation increase in achievement. Thus, we estimate the loss as .083 times the product of the 2019-22 Loss in Achievement and the Estimated Present Value of Lifetime Income.
- **Total K-12 Enrollment in the Public School District for 2020-21** is the number of students who were enrolled in the public school district during the school year most affected by the pandemic. We drew these from the Common Core of Data.
- **Total Estimated Loss in Lifetime Income** is the product of Estimated Lost Income per Student and Total K-12 Enrollment.

Citation:

Doty, Elena, Thomas J. Kane, Tyler Patterson and Douglas O. Staiger "What Do Changes in State Test Scores Imply for Later Life Outcomes?", *NBER Working Paper No. 30701*, December 2022.