



TECHNICAL APPENDIX FOR “A RECORD DECLINE IN GOVERNMENT JOBS: IMPLICATIONS FOR THE ECONOMY AND AMERICA’S WORKFORCE”

The Hamilton Project

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In the August jobs blog on public-sector employment, we calculated the costs and benefits from the fall in the number of teachers during the recovery from the Great Recession. This appendix explains the details and data sources for the calculation.

WAGES LOST DUE TO LARGER CLASSES

Change in Class Size

According to the CPS, there were 3,942,700 public school teachers in 2009 and 3,721,938 in 2011. This implies a 5.9 percent average increase in the student-teacher ratio during this period. This assumes that schools react to losses by putting students into larger classes with the remaining teachers, as opposed to by having the remaining teachers teach more classes. At the same time, this figure is conservative to the extent that it does not account for increased student enrollment over this period.

Effect of Class Size

“[How does your kindergarten classroom affect your earnings? Evidence from Project STAR](#)” by Raj Chetty et. al. uses its estimates of how increases in test scores translate to increases in earnings to estimate the effect of reducing class sizes. They calculate that a 33 percent reduction in class size for an average treatment of 2.14 years results in a \$9,460 net present value of increased wages in 2009 dollars (p. 49). This represents the average increase in wages over a lifetime from the 33 percent reduction in class size, discounted by 3 percent to age six. This number is divided by 2.14 to represent one year of treatment, and then multiplied by (5.9/33) to represent the effect of the actual increase in class sizes observed from 2009 to 2011. In 2011 dollars, the net-present-value cost of raising class sizes by 5.9 percent for a single year is \$833 for each six-year-old.

Aggregating Across Grades

The net present value of \$833 is discounted to account for the fact that six-year-olds will not experience increased wages until they graduate and begin earning money in the future. For older students, the increased wages will take effect sooner, and so should be discounted less. To adjust for this, we multiply \$833 by $1.03^{(\text{grade of student})}$.

[NCES](#) reports public school enrollment of 49.3 million for the 2010-11 school year. Assuming that students are equally distributed across grades, we multiply by the per-pupil value, and sum to get total lost wages: \$49.3 billion per year. In arriving at this figure, we assume that the effects of class size on student earnings are constant across grades.

Summary

To calculate the change in class size, we look at how the number of teachers changed from 2009 to 2011. The formula for change in class size given a change in the number of teachers from year 1 to year 2 is:

$$\frac{\text{number teachers}_{\text{year 1}} - \text{number teachers}_{\text{year 2}}}{\text{number teachers}_{\text{year 2}}} = \frac{3,942,700 - 3,721,938}{3,721,938} = 5.9\%$$

For each kindergartner, the net present value of increased wages is:

$$\frac{(\$9,460 \text{ for } 33\% \text{ reduction in class size for an average of } 2.14 \text{ years})}{2.14 \text{ years}} \times \left(\frac{5.9 \text{ percent}}{33 \text{ percent}} \right) = \$795$$

In 2011 dollars, this becomes \$833.

Then we add across grades, adjusting for differences in discounting, and multiply by the number of students per grade (about 3.8 million):

$$\text{Total loss in earnings per year} = (3.8 \text{ million}) \sum_{i=0}^{12} \$833 \times (1.03)^i = \$49.3 \text{ billion}$$

MONEY SAVED FROM FEWER TEACHERS

[NCES](#) reports an average base salary of \$38,600 for teachers with two years of experience in the 2007-08 school year. We use this number to represent the average saving per teacher since most of the teachers fired (or not hired) are new. Moreover, an [NCES report](#) on teacher compensation from 2006-07 surveyed several states and found that the average ratio of benefits to salary for each teacher ranged from around 17 percent to nearly 30 percent. We take the conservative approach and assume that teachers earn an additional 30 percent of their salary in the form of benefits, leading to a total salary plus benefits of \$50,180. We multiply this figure by the number of teachers lost between 2009 and 2011 and inflate to 2011 dollars, and find the aggregate savings are \$11.8 billion.

DATA SOURCES FOR JOBS CALCULATIONS

We use data from both the Current Employment Statistics and Current Population Survey. All headline numbers for changes in total government employment come from Current Employment Statistics. To get a more granular look at changes in specific occupations, we use the March Supplements of the Current Population Survey.

POPULATION MEASUREMENT FOR GRAPHS AND EMPLOYMENT STATISTICS

All government-employment statistics and graphs use adults 16 and older as a population, as the BLS does in calculating workforce-participation rates. If we use only working-age adults (ages 16 to 64) as a population, the general trends in government employment remain the same, although some of the magnitudes change slightly. In particular, if we use this smaller population,

the ratio of government employment to population is the lowest since April 1985—as opposed to the lowest since 1980. Also, if the ratio of government employment to population had stayed at its 2001-2007 average, there would be 1.2 million more jobs, and the unemployment rate would be 0.8 percentage points lower.