A Decomposition of Long-Term Trends in Mathematics and Reading in the National Assessment of Educational Progress [NAEP]

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The National Assessment of Educational Progress (NAEP), conducted by U.S. Department of Education Statistics, is a nationally representative periodic assessment of U.S. student knowledge and abilities in a number of subjects. The main NAEP assessments are administered approximately every two years, and the content and questions change periodically to reflect national changes in curriculum and learning. The main NAEP assessments are administered to students, regardless of age, in grades 4, 8, and 12.

The NAEP long-term trend (LTT) assessments in mathematics and reading use the same testing instruments and procedures to assess changes in academic performance for students at ages 9, 13, and 17, regardless of grade. The LTT testing instruments and testing procedures have remained the same to precisely replicate the test results from the 1970s to the 1990s. In 2004 some changes have been introduced to the LTT testing instruments, and efforts have been made to "bridge" the 2004 results to earlier tests.

Since the 1970s there has been only slight improvement in mathematics scores (see Figure 1) and very little improvement in reading scores (see Figure 2) for all ages. However, the composition of students taking these tests has changed markedly in terms of race and ethnicity and other characteristics. The purpose of this paper is to use demographic standardization and decomposition techniques to examine the effect of racial, ethnic and other changes in the composition of U.S. student population on national reading and mathematics scores. The gaps in mathematics scores between whites and African Americans, or whites and Hispanics, has varied over the period of study, whereas there has been some improvement in the white-African

American gap in reading scores over time. How has the changing composition of the student population influenced the effect of these and other gaps on overall NAEP scores?

Demographic standardization techniques are useful to examine how a trend, such as education scores or fertility, might occur if the same composition of individuals at risk did not change over time. Thus, standardization eliminates compositional effects on overall rates (Das Gupta, 1993). For the NAEP scores, we will standardize the scores based on the composition of the 9, 13, and 17 year old student populations at the beginning of the LTT NAEP mathematics and reading assessments. There are several factors we can use to standardize the student populations, such as gender, race/ethnicity, and region of country. Our analyses will determine how the changing characteristics of the student populations, particularly changing racial and ethnic compositions, have affected the trends in mathematics and reading scores.

Decomposition techniques are related to standardization techniques in that the former decomposes the effects of the changes in the NAEP scores to determine the unique main effects of the factors used to standardize the rates (Das Gupta, 1993). We use the Das Gupta (1993) technique for standardization and decomposition, which is based on the work of Kitagawa (1955). The methods are mathematical rather than statistical in that the solution is derived from algebraic equations rather than statistical modeling with errors. The end results are additive main effects, which are easier to interpret.

We will calculate standardized scores for both NAEP subjects for the three age groups. Additionally, we will present graphs that show the decomposition effects of factors such as race, ethnicity, gender, and region on the NAEP mathematics and reading scores for U.S. children aged 9, 13, and 17.

REFERENCES:

Das Gupta, P. (1993). *Standardization and Decomposition of Rates: A User's Manual.* U.S. Bureau of Census, Current Population Reports, P23-186.

Kitagawa, E.M. (1955). Components of a difference between two rates. *Journal of the American Statistical Association, 50,* 1168-1194.

Figure 1. Long-term trends in NAEP Mathematics Scores

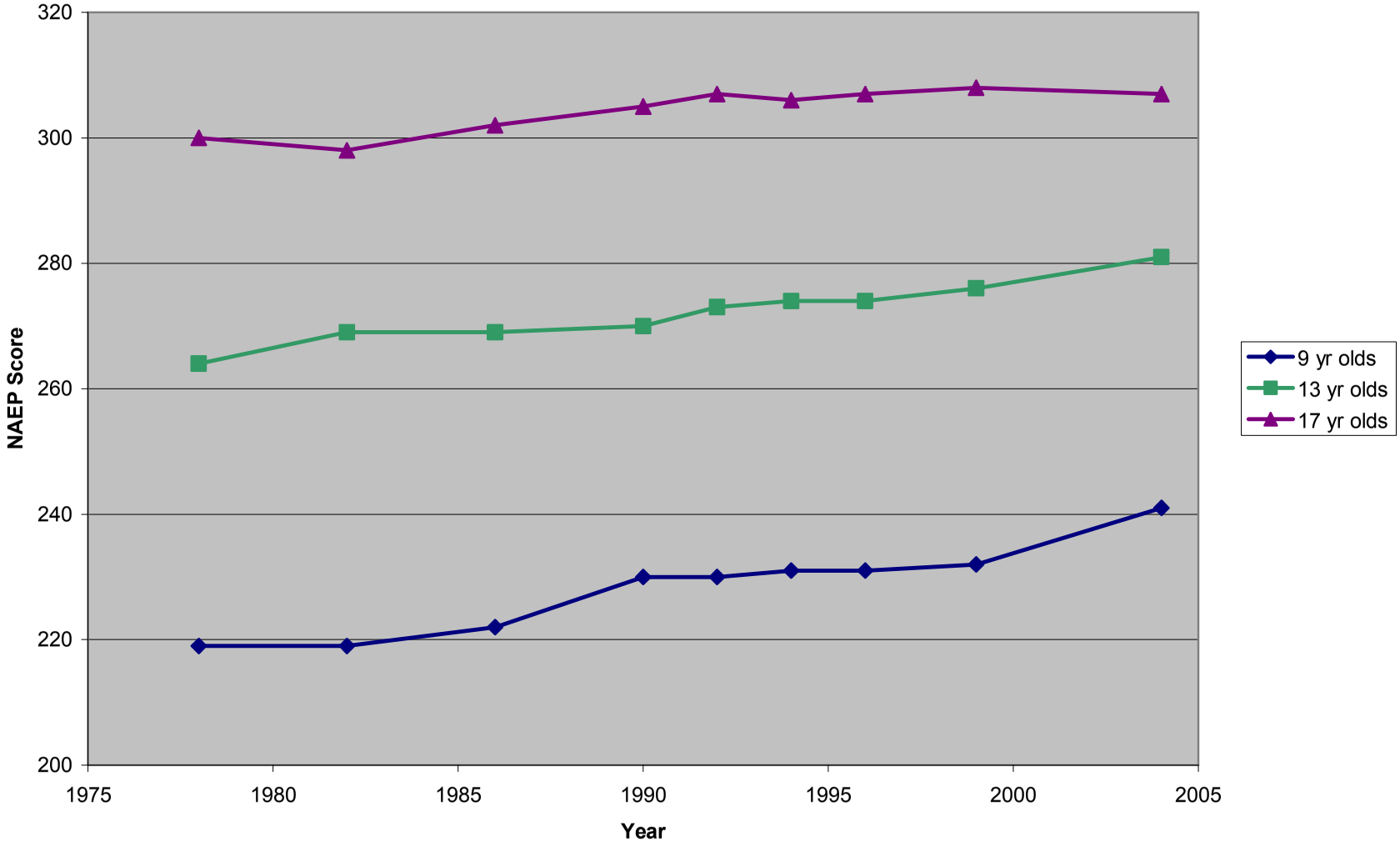

Figure 2. Long-term trends in NAEP Reading scores