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Measuring Education Output in Elementary and Secondary Schools: An Exploratory Analysis

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Education services in the United States are provided by a mixture of public and private organizations and include both non-profit and for-profit entities. Measuring education output evokes all of the usual measurement issues arising with service outputs, further complicated by production in nonmarket situations.

The Office of Productivity and Technology (OPT) Division of Industry Productivity Services (DIPS) is mandated to produce measures of productivity for detailed industries. Historically this program has focused on providing complete coverage of the manufacturing industries with additional coverage of service industries as permitted by availability of high quality data and related measurement methodologies. Recent years have seen an expansion in service sector data and a broadening of output measurement methodologies to address various features of service sector industries, such as provision of difficult- to- measure services in nonmarket settings.

This paper presents exploratory research, conducted in conjunction with OPT's Division of Industry Productivity Services, towards developing a measure of education output for a particular industry in NAICS 61, Education Services: NAICS 611110, Elementary and Secondary Schools. One of the major industries in this sector, Elementary and Secondary Schools includes "establishments primarily engaged in furnishing academic courses and associated course work that comprise a basic preparatory education. A basic preparatory education ordinarily constitutes kindergarten through 12th grade. This industry includes school boards and school districts."¹

I. Industry Background

A. Elementary and Secondary Education Providers

Educational services for elementary and secondary school age students are provided in a variety of venues, including traditional public schools, charter schools, and private schools. For the school year 2007-08, a total of 132,656 elementary and secondary schools existed in the United States. Of these,

¹ Bureau of the Census, 2002, 2007 NAICS definition for NAICS 611110.

98,916 were public schools and 33,740 were private.² Over half of these schools (54%) were elementary schools, 27% were secondary schools, and 19% were combined elementary-secondary schools in 2007-08.

Public Schools

Historically, the US public school system has been the responsibility of local school districts and states. All states except Hawaii have a two-tiered public school system, with a state department of education which sets general requirements and a local school board which manages school district level decisions. By state legislative enactment, school boards are delegated power and authority to develop policies, rules, and regulations to control the operation of the schools, including system organization, school site location, school finance, equipment purchase, staffing, attendance, curriculum, extracurricular activities, and other functions essential to the day-to-day operation of schools within the district's boundaries. Boards may also be authorized by the state legislature to levy taxes, invest resources, initiate eminent domain proceedings, acquire land, and assume bonded indebtedness.³

In addition, the federal government has, through legislation, established various guidelines and standards over the years which must be complied with in order for states to receive federal funds for education. Public schools are also subject to state and federal educational testing requirements.

Public schools include both traditional public schools and charter schools. Charter schools are public schools operating under a contract with the school district in which they exist, which specifies how the school will be managed and performance and financial criteria to be met for renewal of the contract. Charter schools must meet all state educational requirements. The number of charter schools in the US increased from 1500 in 1999-00 to 4400 in 2007-08, or 5% of all public schools. Most charter schools are run by non-profit charter management organizations (CMO's) with a few managed by for-profit education management organizations (EMO's).⁴

² SOURCE: U.S. Department of Education, National Center for Education Statistics. (2010). *Digest of Education Statistics, 2009* (NCES 2010-013), [Chapter 2](#).

³ [School Boards - RESPONSIBILITIES DUTIES DECISION-MAKING AND LEGAL BASIS FOR LOCAL SCHOOL BOARD POWERS - Education, Public, System, National, Educational, and Schools http://education.stateuniversity.com/pages/2391/School-Boards.html#ixzz17YPWJpV6](http://education.stateuniversity.com/pages/2391/School-Boards.html#ixzz17YPWJpV6)

⁴ Non-profit charter management organizations use public funds to develop schools and programs. For-profit education management organizations are firms that, for a certain fee, usually calculated on the basis of per student costs, will manage

Public providers of elementary and secondary educational services were overseen by 17,775 operating local educational agencies in 2007-08.⁵ These agencies included 13,924 regular school districts, responsible for educating students residing within their jurisdictions; 1,399 administrative or service agencies that provide services to school districts; 2,012 independent charter agencies in which all associated schools are charter schools, and 440 agencies operated by the state or some other agencies.⁶

These local educational agencies served about 49.2 million students, with 48.2 million attending public schools in regular school districts; 212,000 students were enrolled in schools overseen by administrative or service agencies; 699,000 students were enrolled in charter schools overseen by independent charter agencies; and 89,000 were enrolled in schools overseen by state and federal-operated and other types of agencies.⁷

Between 1985 and 2009, there was a 29 percent increase in public elementary (defined as pre-k through grade 8) school enrollment and a 20 percent increase in public secondary school enrollment. Enrollment in kindergarten through 8th grade increased by 23 percent over the 1985 to 2007 period.⁸

Average enrollment in public elementary schools was 469; average enrollment in public secondary schools was 706; and average enrollment in public secondary schools excluding alternative schools, special education schools and vocational schools was 816, for the 2007-08 school year.⁹

Of all regular school districts, 76.3% or 10,625 operating school districts were “unified”, and responsible for grades pre-kindergarten through 12th grade. The terms “elementary” and “secondary” when used in describing schools have no universally agreed upon definition. The US Department of Education defines

and operate schools receiving public funds, and provide a stipulated set of instructional services. For-profit education management organizations emerged in the early 1990s in reaction to rising interest in market-based school reforms. Since 1997-98, when 14 EMO’s existed, the number of EMO’s has increased to 95 with the largest growth in smaller size firms. Most of the managed schools are primary schools, and 95% are charter schools. EMO’s operate in 31 states with the largest number of both firms and managed schools in Michigan.

⁵Numbers and Types of Public Elementary and Secondary Local Education Agencies from the Common Core of Data: School Year 2007–08, OCTOBER 2009, Chen-Su Chen, National Center for Education Statistics, NCES 2010-306. The Common Core of Data includes the 50 states, the District of Columbia, Department of Defense Dependent Schools (domestic and overseas), Bureau of Indian Education, Puerto Rico, and the four other jurisdictions of American Samoa, Commonwealth of the Northern Mariana Islands, Guam, and the US Virgin Islands.

⁶ Ibid, p.3.

⁷ Ibid.

⁸ Digest of Education Statistics, 2009, page 1.

⁹ Digest of Education Statistics, 2009, Table 94.

the 2,560 school districts serving grades pre-kindergarten, kindergarten or higher including grade 9 as elementary school districts and the 468 school districts with a low grade of 7 or higher and a high grade of 12 as secondary school districts. The remaining 271 school districts serve some other combination of grades.¹⁰

7,608 school districts were in a rural location, 2,760 were suburban, 2,516 were town locales, and 761 were city locales. 27 of the 13,924 school districts enrolled 100,000 or more students; 909 school districts enrolled fewer than 100 students.¹¹

Private Schools

According to the NCES Private School Survey for 2009-10, 33,366 private schools enrolling 4,700,119 students existed in the United States in the fall of 2009.¹² 21,425 of these private schools were elementary schools; 2,776 were secondary schools; and 9,165 were combined elementary and secondary schools.¹³ Of the 33,366 private schools, 10,635 are nonsectarian and 22,731 are religious affiliated. While the majority of private schools have a regular elementary and secondary program emphasis; 2,653 are Montessori schools; 917 have a special program emphasis such as performing arts or language immersion; 1,779 have a special education program emphasis; 1,327 are alternative schools; and 4,122 have an early childhood education program emphasis.¹⁴

Average enrollment for regular elementary private schools was 148.4; for regular secondary private schools average enrollment was 362.0; and for combined elementary/secondary private schools average enrollment was 213.7.¹⁵

Private schools served 10% of elementary and secondary students in the United States in 2009-2010. The vast majority of private schools are non-profits, with only a very small number of for-profit

¹⁰ Numbers and Types of Public Elementary and Secondary Local Education Agencies from the Common Core of Data: School Year 2007-08, OCTOBER 2009, Chen-Su Chen, National Center for Education Statistics, NCES 2010-306, p. 3.

¹¹ Ibid.

¹² Characteristics of Private Schools in the United States: Results From the 2009-10 Private School Universe Survey, Table 1, Number and percentage distribution of private schools, students, and full-time equivalent (FTE) teachers, by selected characteristics: United States, 2009-10, p. 6.

¹³ Ibid.

¹⁴ Ibid.

¹⁵ National Center for Education Statistics, Private School Survey, Table 7. Average private school size, by school level and selected characteristics: United States, 2009-10.

elementary and secondary schools. Most for-profit elementary and secondary schools are a result of the movement towards Education Management Organizations (EMO's) beginning in the 1990's. In 2000, the US had about 200 for-profit elementary and secondary schools serving roughly 100,000 of 53 million students in grades K-12. Although nominally "for-profit" organizations, few of these schools are in fact profitable.¹⁶

Private schools must observe federal, state and local laws such as annual reports to the Internal Revenue Service (IRS), maintenance of state-required attendance, curriculum and safety records and reports, and compliance with local building, fire and sanitation codes.¹⁷ Private schools may receive federal funds under three programs: federal breakfast and lunch programs through the National School Lunch Program, Individuals with Disabilities Education Act Grants, and Title I Funds for Supplemental Education. Private schools seeking to participate in these federally funded educational programs must meet the applicable federal requirements.

Private schools often are accredited by various accrediting agencies, such as regional accrediting associations (for example, Middle States Association), Independent School Associations (for example, Association of Independent Schools of New England), or national accrediting associations (such as National Christian School Association).

Private school students generally perform higher than their public school counterparts on standardized achievement tests. As with earlier results from the National Assessment of Educational Progress (NAEP), private school students performed higher than public school students on the NAEP: 2000 tests. Their average scores were above those of public school students on the 4th-grade reading test and on the 4th-, 8th-, and 12th-grade science and mathematics proficiency tests.¹⁸ Some studies suggest this is because of selectivity in students admitted to private schools.¹⁹

¹⁶ See "For-Profit Schools," by Symonds, Palmer, Lindorff, and McCann, *Business Week*, February 7, 2000.

http://www.businessweek.com/2000/00_06/b3667001.htm

¹⁷ <http://privateschool.about.com/od/choosingaschool/qt/comparison.htm>

¹⁸ Ibid.

¹⁹ "Comparing Public and Private Schools: The Puzzling Role of Selectivity Bias," Richard J. Murnane, Stuart Newstead and Randall J. Olsen, *Journal of Business & Economic Statistics*, Vol. 3, No. 1 (Jan., 1985), pp. 23-35

Specialty Schools

This industry includes private schools which offer boarding options for students. In 1993-94, 4.5% of private schools offered boarding and in those schools offering boarding, an average 47% of their students boarded.²⁰

This industry also includes military academies providing elementary and secondary education services. These are included as either public (includes public secondary schools, charter schools based on military academy model) or private schools. Public military academies often include a mandatory Junior Reserve Officer Training Corps component and may receive US Department of Defense funding.

Separate public and private schools solely serving disabled students and public and private residential schools for students with disabilities are also included in this industry. The number of students served in these categories is quite small, however. In 2008, 13.2% of public school students ages 3-21 were served under the Individuals with Disabilities Education Act (IDEA) in various settings including regular classrooms. Only 3% of students ages 6-21, classified as disabled, were served in separate public or private schools for the disabled only. Public or private residential facilities served only .4% of disabled students. Parents placed 1.1% of disabled students in regular private schools. Another .4% of disabled students received educational services while either homebound or in a hospital placement. Lastly, .4% of disabled students received educational services in a correctional facility.²¹

B. Elementary and Secondary Education Services

Public School

Public elementary and secondary schools are operated according to state and federal requirements under the direction of local school boards. Typically, students are provided with instructional services and additional services such as transportation and food programs. Support services for learning and

²⁰ See Table 1.11: Percentage of private schools with boarding students and percentage of students boarding at these schools, by affiliation: 1993-94, U.S. Department of Education, Schools and Staffing Survey: 1993-94.

²¹ See Table 46. Percentage distribution of students 6 to 21 years old served under Individuals with Disabilities Education Act, Part B, by educational environment and type of disability: Selected years, fall 1989 through fall 2008. U.S. Department of Education, Office of Special Education Programs, Individuals with Disabilities Education Act (IDEA) database.

emotionally and physically disabled students are also provided. Some states also require public schools to provide services to the community such as free adult education programs.

Educational standards for grades K-12 are established at a state level and overseen by the individual state's education department. State department of education requirements typically describe educational output in the following ways:

- Proficiency in basic subjects such as reading, writing, mathematics and science.
- Minimal achievement gaps by race, gender, ethnicity and socioeconomic status.
- College readiness – availability and participation in college credit programs such as AP, IB, state sponsored versions (UConn early college experience program).
- Rigor of program in terms of graduation requirements (minimum number of credits in English, Mathematics, Science, Social Studies, Arts or Vocational Education, Physical Education, World Language (added in Connecticut)).

State requirements for completion of a high school diploma vary across states. The number of Carnegie units a student is required to complete, and in which subject areas, differs fairly markedly across states, as of 2011.²² The NCES Digest of Education Statistics presents data on the number of Carnegie units required by various states for completion of high school diplomas in public schools.²³

Private School

Private high schools typically have more demanding graduation requirements than do public high schools. Compared with public schools, private schools required more coursework (in 4-year high school programs) in 1999–2000 in social studies, mathematics, science, foreign language, and computer science. For example, private schools required on average 3.1 years of mathematics, while public schools required 2.7 years. The figures for foreign language study also differed: 1.5 years at private schools but 0.5 years at public schools. In addition, about 40 percent of private schools required some

²² The Carnegie Unit, first defined by the Carnegie Foundation for the Advancement of Teaching in 1906, is a standard measure of the amount of time a student has studied a subject. For example, a total of 120 hours in one subject—meeting 4 or 5 times a week for 40 to 60 minutes, for 36 to 40 weeks each year—earns the student one "unit" of high school credit.

<http://www.carnegiefoundation.org/faqs>

²³ See <http://nces.ed.gov/programs/digest/d00/dt154.asp>.

form of community service for high school graduation, four times the rate for public schools (10 percent).²⁴

II. Measuring Education Output

A. Background

Input-based output measures, often used to capture services produced in a nonmarket setting, are of limited value. These measures are not appropriate for use in measuring productivity, since the output growth rate is based on the related input growth rates.

One starting point for measuring educational output is to look at how industry providers themselves measure their output. All three types of schools (traditional public, charter, private) track numerous metrics, in addition to the number of students enrolled. These include performance measures such as student/teacher ratios; parental involvement proxies; high school course difficulty rankings; lesson quality rankings; teacher experience and qualification; student composition; number of Advanced Placement (AP), International Baccalaureate (IB), or Dual Credit courses completed; standardized testing of student achievement in selected subjects; percent of pupils moving up each year; average daily attendance; high school drop out rates; graduation rates; percent of graduating students enrolling in college ; and percent of transfer requests out of a specific school. These are only a few of numerous measures often cited in assessing educational programs.

Apart from performance assessment by schools and school districts, the Federal government, through the Federal Elementary and Secondary Education Act (ESEA), requires schools and school districts to provide Annual Yearly Progress (AYP) Reports. In addition, the Federal No Child Left Behind Act of 2001 requires states to hold schools, districts and states to yearly standards of achievement on standardized tests in reading and mathematics. These standards are used to determine if schools, districts and states are making Adequate Yearly Progress (AYP) as a whole, and for specific subgroups of students (including racial/ethnic groups, special education students and English language learners). Schools, districts and states failing to meet the AYP levels of achievement for two consecutive years in the same subject are

²⁴ Ibid.

considered to be in need of improvement and must take specific steps to improve performance of their students.

States generally maintain testing programs in addition to meeting federal requirements for testing. Individual states perform testing in public and charter schools using standardized tests as required by their state department of education.²⁵ Charter schools are typically required by the charter agreement to participate in state and national testing programs. Private schools may or may not be required by a state to participate in state level academic testing. Schools may also devise measures of progress towards state goals, such as California's Public Schools Accountability Act of 1999, and the related Academic Performance Index (calculated for each California school based on statewide test results).

Fraumeni, Reinsdorf, Robinson, and Williams (2008) provide a survey of public sector education output measures used in the international community, as well as developing their own experimental estimates of public school education output in the US for comparison. They find that, while many countries have experimented with various quality adjusted volume measures, these countries often adopt a simple volume measure such as number of students enrolled or number of pupil hours taught as their official education output measure.

Volume measures used by national accounting offices from various countries range from the very simple, such as a count of students enrolled, to more complex measures which include a quality adjustment reflecting some aspect of educational outcome. For primary and secondary education, Australia, Canada, Finland, Germany, Israel and the Netherlands use a volume measure such as number of pupils or number of teaching hours with no further adjustment. Italy uses the number of pupils as a volume measure and adjusts for differences in class size using a congestion measure. The United Kingdom uses the number of pupils as a volume measure with a constant annual adjustment of .25 to account for the rise in educational standards and the quality of teaching over time.

Another source of information on measuring education output is presented in "Towards Measuring Education and Health Volume Output: An OECD Handbook," (OECD Committee on Statistics, 2007). This

²⁵ Commonly used standardized tests include the Iowa Tests of Basic Skills for K-8 and the Iowa Tests of Educational Development, used for grades 9-12, published by Riverside Publishing/ Houghton Mifflin; the Stanford Achievement Test, Ninth Edition, published by Harcourt Educational Measurement; and the Michigan Educational Assessment Program (MEAP), devised to assess educational achievements of students in the Michigan school systems.

Handbook describes many of the theoretical issues involved in measuring education output, and states guidelines for use by OECD member nations in developing education output measures.

B. Empirical Measures

This paper presents physical volume based measures for elementary and secondary school education services, for public schools only.²⁶ Using data on the number of students enrolled in public schools, both unadjusted and quality adjusted education output measures for “all students” are constructed. Heterogeneous “disabled/non-disabled” output measures accounting for differences in disabled and non-disabled public school student education services are also constructed. Measures explicitly including selected non-instructional services (food and transportation services) are constructed for both the “all students” and “disabled/non-disabled” measures.

Homogeneous Education Output Measures

Physical volume based measures of educational output for “all students” are constructed separately for public and private elementary and secondary school students. The “all students” measures include simple measures based solely on student enrollment, $Q^{All Pub}$ and $Q^{All Priv}$; quality adjusted measures, $Q_q^{All Pub}$ and $Q_q^{All Priv}$, which adjust for quality differences using national test score data; and a quality adjusted measure which explicitly accounts for food and transportation services as separate non-instructional outputs, for public school students only, $Q_{q,T,F}^{All Pub}$.

Enrollment Data

The simple “all students” education output measures, constructed for public school students only, $Q^{All Pub}$, and private school students only, $Q^{All Priv}$, use data on elementary and secondary school student enrollment from the National Center for Education Statistics (NCES).²⁷ NCES maintains numerous surveys on education at all levels including early childhood, elementary and secondary, and

²⁶ The unpublished paper “Measuring Education Output in Elementary and Secondary Schools: An Exploration,” by Susan G. Powers, December 2011, presents unadjusted and quality adjusted education output measures for public and private schools using alternative Census and NCES data sets.

²⁷ Elementary and secondary school student enrollment data for public and private schools is available from both the Bureau of the Census and from the National Center for Education Statistics (NCES). The Census and NCES data exhibit similar long run trends. However, the Census data exhibits greater annual variability, particularly for private schools. As a result, NCES student enrollment data is used in constructing the education output measures in this paper.

postsecondary education. Data on elementary and secondary public school education is available from the NCES Common Core of Data (CCD) database and is obtained from public school administrative records.²⁸

NCES is also able to provide private school enrollment data based on the results of their Private School Survey, first conducted during the 1989-90 school year: “The Private School Survey (PSS) consists of a single survey that is completed by administrative personnel in private elementary and secondary schools. Information collected includes religious orientation; level of school; size of school; length of school year; total enrollment (K-12); number of high school graduates; whether a school is single-sexed or coeducational and enrollment by sex; number of teachers employed; program emphasis; and existence and type of Kindergarten program. The PSS is collected on a biennial basis.”²⁹ The Private School Survey attempts to build a complete and accurate list of all private elementary and secondary schools in the US.

Quality Adjustment

Quality adjusted education output measures for all students in public schools, $Q_q^{All\ Pub}$, and private schools, $Q_q^{All\ Priv}$, are constructed by adjusting the student enrollment based output measures using national test score data. Quality adjustments to the physical volume measures of elementary and secondary school education are used to better capture educational output relative to the simple physical volume measure. Physical volume measures alone fail to reflect changes in education output over time as a result of changes over time in the educational services provided. Number of students enrolled is a useful starting point for capturing elementary and secondary education output, but it does not reflect changes over time in the level of education attained by students.

The educational attainment of students has been shown to vary over time depending on various factors, such as teacher quality, class size, curriculum quality and so forth. However, it is not always clear to

²⁸ “CCD is a comprehensive, annual, national statistical database of all public elementary and secondary schools and school districts, which contains data that are designed to be comparable across all states. CCD is made up of a set of five surveys sent to state education departments. Most of the data are obtained from administrative records maintained by the state education agencies (SEAs). Statistical information is collected annually from public elementary and secondary schools (approximately 94,000) public school districts (approximately 17,000) and the 50 states, the District of Columbia, Department of Defense Schools, and the outlying areas. The SEAs compile CCD requested data into prescribed formats and transmit the information to NCES. “See <http://nces.ed.gov/ccd/bat/> NCES description of Common Core of Data database.

²⁹ <http://nces.ed.gov/ccd/elsi/>

what extent the various characteristics of the educational environment and activities influence educational output. Fraumeni, Reinsdorf, Robinson, Williams (2008) note that while the direction of influence a particular characteristic of the educational environment, such as improved student/ teacher ratios, has on educational output may be known, quantifying the impact on educational output is difficult. Typically little is known about the empirical relationship between a specific characteristic and educational output.³⁰

After evaluating various combinations of characteristics, including teaching staff composition, pupil/teacher ratios, and the high school drop out rates, Fraumeni et. al. find that it is difficult to determine the level of adjustment to incorporate. Conservative estimates of ad hoc multipliers are included in exploratory computations of US elementary and secondary education output measures to dampen the impact of the quality adjustments, for illustrative purposes.³¹

Other countries have addressed this issue by using relatively simple physical volume based measures of education output, supplemented by an accumulation of knowledge regarding changes in educational services and the impact of these changes on education outputs. This “triangulation” approach provides a broader base of information on quality of education services by gathering supportive evidence of quality change.³² The United Kingdom, for example, incorporates this approach into its measurement program, which uses a physical volume measure of primary and secondary education output adjusted with a flat .25 quality adjustment factor based on General Certificate of Secondary Education (GCSE) or equivalent average point scores (APS) to reflect a historical trend of improvements in curriculum.³³

Research is ongoing in the US towards developing an empirical relationship between the educational characteristics of US public and private schools and the resulting education outputs. However, no consensus exists on this relationship at this time. For that reason, this paper takes a preliminary step towards quality adjustment by using test scores from the National Assessment of Educational Progress

³⁰ “Price and Real Output Measures for the Education Function of Government: Exploratory Estimates for Primary and Secondary Education,” by Barbara M. Fraumeni, Marshall B. Reinsdorf, Brooks B. Robinson and Matthew P. Williams, Working Paper 14099, National Bureau of Economic Research, June 2008, p. 20.

³¹ Ibid, pp. 30-31.

³² See Atkinson Commission (2005), pp. 139-140. Also see Wild, Munro and Ayoubkhani (2009) which presents education quality change evidence gathered through the triangulation process.

³³ See Baird, Haynes, Massey and Wild, UK Centre for the Measurement of Government Activity, Office of National Statistics (2010), pp. 19-27. Also “The ONS Productivity Handbook: A Statistical Overview and Guide,” edited by Dawn Camus, Office for National Statistics, Palgrave MacMillan, Hampshire, England, 2007, p. 118.

(NAEP) Long Term Trend (LTT) testing program to quality adjust the NAICS physical volume education output measures for public and private elementary and secondary schools.³⁴ NAEP LTT test scores are available for ages 9, 13, and 17 in various subjects. Mathematics test scores under the Long Term Trend testing program are available for selected years from 1973 forward.

NAEP maintains two assessment programs, the Main NAEP Assessments³⁵ which are revised about every decade to reflect changes in curriculum in the nation's schools, and the Long Term Trend Assessments, which have remained relatively unchanged since they were first administered in 1971. Both of these assessment programs include public and private elementary and secondary schools, with data reported for the categories of all schools, public only, and private only.

To best measure changes in the educational levels of students over time, the Long Term Trend Assessment data is used. Because the assessment framework underlying the Main NAEP Assessments is revamped approximately every decade to match changes in curriculum and instructional services, the length of time for comparisons to be made using Main NAEP Assessments is reduced.³⁶ By comparison, the Long Term Trend assessment has used "substantially the same assessments" since its inception in 1969.³⁷ The LTT assessment originally included reading, mathematics, writing and science subjects. As of the 2004 assessment year, writing and science are covered by the Main Assessment and no longer included in the LTT assessment.

³⁴ The National Assessment of Educational Progress (NAEP) is the largest nationally representative and continuing assessment of elementary and secondary school students in the United States. Assessments are conducted periodically in mathematics, reading, science, writing, the arts, civics, economics, geography, and U.S. history. The NAEP (also known as "the Nation's Report Card") is a congressionally-mandated assessment in various subject areas administered by the National Center for Education Statistics, a branch of the U.S. Department of Education. Results are summarized only at the national, state and large urban district levels. NAEP assessments are administered uniformly using the same sets of test booklets across the nation, and as a result serve as a common metric for all states and selected urban districts. The assessment stays essentially the same from year to year, with only carefully documented changes. This permits NAEP to provide a clear picture of student academic progress over time. Long Term Trend assessment in mathematics and reading is conducted differently from the NAEP's main Assessments and the two types of assessments are not comparable. For additional information, see <http://nces.ed.gov/nationsreportcard/about/>.

³⁵ The Main NAEP Assessments occur at Grades 4, 8 and 12 every two years in various subjects. Mathematics and Reading assessments are generally held every two years. Mathematics assessment data for Grades 4 and 8 is available for 1990, 1992, 1996, 2000, 2003, 2005, 2007 and 2009; data for Grade 12 is only available for 2005 and 2009. Reading assessment data is available for 1992, 1994, 1998, 2000, 2002, 2004, 2005, 2007 and 2009. Other subjects assessed include the Arts, Civics, Economics, Foreign Language, Geography, Science, Technology and Engineering Literacy, US History, World History, and Writing. However, the number of years of available assessment data for these additional subjects is more limited.

³⁶ See <http://nces.ed.gov/nationsreportcard/about/national.asp>.

³⁷ See <http://nces.ed.gov/nationsreportcard/ltt/moreabout.asp>.

The LTT reading and mathematics scores for ages 9, 13, and 17 are used to adjust the NCES elementary and secondary student enrollment data series for public schools only and private schools only. Reading test score data for all public and private schools combined is available for 1971, 1975, 1980, 1984, 1988, 1990, 1992, 1994, 1996, 1999, 2004, and 2008; and available for public only and private only schools for the above testing years from 1980 forward. Mathematics test score data for all public and private schools combined is available for 1973, 1978, 1982, 1986, 1990, 1992, 1994, 1996, 1999, 2004 and 2008. For public only and private only schools, mathematics test scores are available for the above testing years from 1978 forward.

The test score data is interpolated between testing years to estimate test scores for non-testing years. A ratio of the reading or mathematics test score to the perfect score is computed for each year, for each of the three categories of all schools, public schools only, and private schools only. For “public schools only” and “private schools only,” reading and mathematics test scores are not available until 1980 and 1978 respectively. As a result, the “all school” test score is used as a starting point for interpolating “public school only” and “private school only” test score values from either 1971 or 1973 to the first available test score data point.

These ratios are used to quality adjust student enrollment. For public school quality adjusted education output measures, school student enrollment for grades K-8 is adjusted by first averaging the mathematics test score ratios for ages 9 and 13 to get a single score for grades K-8. This is also done for the reading test score ratios for ages 9 and 13. The combined mathematics and reading test scores for grades K-8 are then averaged together, and the resulting test score ratio series is multiplied by public school student enrollment for grades K-8 to obtain a quality adjusted education output measure for grades K-8.

For grades 9-12, mathematics and reading test scores for the age 17 testing group in public schools only are averaged and used to quality adjust student enrollment in these grades in public schools.

The grades K-8 and 9-12 quality adjusted enrollment data series are totaled to obtain a quality adjusted elementary and secondary public school education output series for grades K-12. Measures are constructed for 1978-2008 using the NCES student enrollment data.

Similarly, mathematics and reading test score ratios for ages 9 and 13 in private schools only are averaged together and combined to obtain a test score adjustment series for grades K-8 in private schools. For grades 9-12, the mathematics and reading test score ratios for age 17 in private schools only are combined and used to adjust grade 9-12 private school student enrollment. These quality adjusted enrollment series are totaled to obtain quality adjusted education output for grades K-12 in private schools only. Measures are constructed for 1989-2008 using the NCES private school student enrollment data.³⁸

Non-Instructional Services

This paper explores the importance of non-instructional food and transportation services in overall education output by estimating a third “all students” measure, for public schools only, which explicitly includes food and transportation services. This third “all students” education output measure, $Q_{q,T,F}^{All Pub}$, is a function of educational services, transportation services and food services.

Public schools provide a range of services to students. These include instructional services; student support services such as guidance counseling, health room services, attendance services, occupational therapy, physical therapy and speech pathology services; and non-instructional services such as transportation services and food services. While private schools may provide transportation services to their students, typically this is provided for an additional fee. Private schools also provide food services, and have the option of participating in the free and reduced price lunch program overseen by the U.S. Department of Agriculture. However, it is overwhelmingly public schools that provide both of these services to students.

Educational services are estimated as a physical volume measure based on public school student enrollment of all students and quality adjusted using NAEP long term trend test scores. Transportation services for “all students” are estimated using a physical count of elementary and secondary school students transported at public expense.³⁹ Data on transportation services for “all students”, including the number of students transported at public expense and public school transportation expenditures, is

³⁸The NCES private school enrollment data is available only on a biennial basis. As a result, even years of data are interpolated.

³⁹ U.S. Department of Education, National Center for Education Statistics, *Statistics of State School Systems*, 1929–30 through 1975–76; *Revenues and Expenditures for Public Elementary and Secondary Education*, 1977–78 and 1979–80; Common Core of Data (CCD), “National Public Education Financial Survey,” 1987–88 through 2007–08; Bobit Publishing Co., *School Bus Fleet*, “School Transportation: 2000–2001 School Year” and “2010 Fact Book”; *School Transportation News*, “K–12 Enrollment/Transportation Data,” 2001–02 through 2007–08; and unpublished data.

obtained from the U.S. Department of Education.⁴⁰ Food services for “all students” are estimated using a physical count of the number of school lunches served.⁴¹ Data on food services, including number of lunches served and total expenditures for food services, is obtained from the U.S. Department of Agriculture National School Lunch Program and the U.S. Department of Education.⁴²

For each individual output measure underlying the “all students” output measure, shares of total expenditures are constructed using expenditure data from the National Public Education Financial Survey.⁴³ For educational services, the expenditure share weight is calculated as total expenditures less transportation and food services expenditures. An overall “all students” educational output measure is constructed as an aggregate of the three individual output measures using the expenditure share weights.

Heterogeneous Education Output Measures

Public elementary and secondary schools in the United States are required to meet the needs of a diverse population of students, including disabled students, English language learners, and students from an impoverished background. While private schools may also provide schooling for these groups, the majority of students in these categories attend public schools. The public school system relies upon state and local funding, supplemented by federal programs and funds, to provide educational services to all students. These services include both instructional and noninstructional services, which vary according to the needs of specific groups of children. Because instructional and noninstructional services provided to students vary according to the type of student, the cost of providing educational services for each student category differs. Educational services provided to a non-disabled, non-English

⁴⁰ Data on transportation expenditures is obtained from the National Center for Education Statistics, Common Core of Data (CCD), and “National Public Education Financial Survey, as published in the Digest of Education Statistics. Data on the number of students transported is obtained from the U.S. Department of Education, National Center for Education Statistics, *Statistics of State School Systems*, 1929–30 through 1975–76; *Revenues and Expenditures for Public Elementary and Secondary Education*, 1977–78 and 1979–80; Common Core of Data (CCD), “National Public Education Financial Survey,” 1987–88 through 2007–08; Bobit Publishing Co., *School Bus Fleet*, “School Transportation: 2000–2001 School Year” and “2010 Fact Book”; *School Transportation News*, “K–12 Enrollment/Transportation Data,” 2001–02 through 2007–08; and unpublished data.

⁴¹ School lunch data is obtained from the U.S. Department of Agriculture, National School Lunch Program.

⁴² Data on total expenditures for food services is obtained from the U.S. Department of Education, National Center for Education Statistics, Common Core of Data (CCD), “National Public Education Financial Survey,” as published in the Digest of Education Statistics.

⁴³ U.S. Department of Education, National Center for Education Statistics, Common Core of Data (CCD), “National Public Education Financial Survey.”

Language Learner from an above poverty line family are different in nature and cost from those provided to disabled students, English Language Learners, or students from impoverished families.

Disabled students include children with physical, psychiatric, emotional, behavioral and learning disorders. Under the Individuals with Disabilities Education Act (IDEA) (1975), Section 504 of the Rehabilitation Act of 1973, and the Americans with Disabilities Act (ADA) (1990), these students are entitled to receive a free and appropriate education in the least restrictive environment possible.

Disabled students may receive a range of services including direct instruction in a resource room setting to assist in developing reading and language, writing, mathematics, and organizational skills; speech and language services; additional instruction in self-contained classrooms, accommodations and support in general classrooms for students with learning disabilities; instruction in alternative settings for children with emotional disorders; deaf, hard of hearing and vision impaired student services including assistive technologies and consultation; special education instruction and occupational and physical therapy for students with physical disabilities; and special transportation services.

English Language Learners are accommodated by a range of different instructional approaches, varying by state and school district. These include English only instruction in English immersion programs; English as a second language programs which provide instruction primarily in English, accompanied by support for English language skills; Transitional Bilingual Education, in which instruction is in the student's native language with part of the school day used to develop English language skills, and dual language instruction, in which instruction is given in two languages to students in the same classroom by two teachers who team teach, one in each language.⁴⁴ In addition to instruction, schools provide noninstructional services such as educational testing; psychological, speech and audiology services; transportation services; and food services.

The population of students drawn from near or below poverty level families is provided with additional services under Title I, Part A of the Elementary and Secondary Schools Act which provides financial assistance to local educational agencies and schools with high numbers or high percentages of children from low-income families to help ensure that all children meet challenging state academic standards.

⁴⁴ ["English-Language Learners,"](#) Education Week, February 24, 2012.

Title I funds are provided in the form of grants to local educational agencies.⁴⁵ Local education agencies target the Title I funds they receive to schools with the highest percentages of children from low-income families. Unless a participating school is operating a school-wide program, the school must focus Title I services on children who are failing, or most at risk of failing, to meet state academic standards. Schools in which children from low-income families make up at least 40 percent of enrollment are eligible to use Title I funds for school-wide programs that serve all children in the school. Local education agencies also must use Title I funds to provide academic enrichment services to eligible children enrolled in private schools.⁴⁶ In addition to Title I funds, students from near and below poverty level families benefit from the National School Lunch Program, which provides free and reduced price meals, school breakfasts, and in some instances summer feeding programs to eligible students.

Due to limited data on the cost differences associated with educating English language learners and impoverished students, the heterogeneous education output measures developed in this paper distinguish only between educational outputs for disabled and non-disabled students.⁴⁷ Disabled and non-disabled student groups do have considerable differences in the education services provided, long term trend test scores, and respective education costs. However, disabled students comprise only 10 to 13% of all students historically and so only a partial accounting for differences in education output by student category is reflected in this paper.

An initial simple disabled/non-disabled measure, $Q^{DND Pub}$, is calculated based on disabled and non-disabled student enrollment data for comparison with the “all student” output measure. A second heterogeneous output measure, $Q_q^{DND Pub}$, adjusts for differences in the provision of disabled and non-

⁴⁵ Basic Grants provide funds to local education agencies (LEAs) in which the number of children counted in the formula is at least 10 and exceeds 2 percent of an LEA's school-age population. Concentration Grants flow to LEAs where the number of formula children exceeds 6,500 or 15 percent of the total school-age population. Targeted Grants are based on the same data used for Basic and Concentration Grants except that the data are weighted so that LEAs with higher numbers or higher percentages of children from low-income families receive more funds. Targeted Grants flow to LEAs where the number of schoolchildren counted in the formula (without application of the formula weights) is at least 10 and at least 5 percent of the LEA's school-age population. Education Finance Incentive Grants (EFIG) distribute funds to states based on factors that measure a state's effort to provide financial support for education compared to its relative wealth as measured by its per capita income; and the degree to which education expenditures among LEAs within the state are equalized. Source: US Department of Education.

⁴⁶ U.S. Department of Education.

⁴⁷ While data on the number of students enrolled in public schools from each of these categories is readily available, and NAEP test score data for students in these groups has recently become available, constructing expenditure share weights for each of these student categories requires additional research. Data on the cost differences in educating students in each of these groups is not readily available and requires further development.

disabled student education services and is quality adjusted using NAEP test score data for disabled and non-disabled student groups. A third “disabled/ non-disabled” output measure, $Q_{q,ST,RT,F}^{DND Pub}$, explicitly accounts for noninstructional services such as food, regular transportation services for both disabled and non-disabled students and special transportation services for disabled students requiring this level of transportation. In this third “disabled/non-disabled” measure, education output is a weighted function of quality adjusted educational services for disabled students, quality adjusted educational services for non-disabled students, special transportation services for disabled students, regular transportation services for disabled and non-disabled students, and food services for all students. The weights used are total expenditure weights. These measures are constructed for public elementary and secondary schools only due to the limited data available for private schools.

Enrollment Data

Public school student enrollment data for grades K-12 from the National Center for Education Statistics (NCES) is used as the basis for the disabled/ non-disabled physical volume measures of education output.⁴⁸ For the disabled/non-disabled education output measures, public school student enrollment in the disabled and non-disabled categories is estimated using data on the number of students ages 3-21 served under the Individuals with Disabilities Education Act as a percent of public school enrollment. This data is obtained from the U.S. Department of Education, as published in the Digest of Education Statistics.⁴⁹ The NCES public school enrollment data for all students is split into disabled and non-disabled student enrollment categories based on the percentage of disabled students enrolled in public schools. This percentage ranges from 10.1 in 1980 to 13.2 in 2009, with a high of 13.8 in 2004.⁵⁰

Quality Adjusting “Disabled/ Non-Disabled” Output Measures

Until 1996, differences in the educational performance of students with specific educational needs were difficult to track. NAEP provided no testing accommodations for students with disabilities or English language learners prior to 1996. As a result, many of these students were excluded from NAEP testing, limiting the number of students in these categories who were available for testing. With the passage of

⁴⁸ As noted in Powers (December 2011), the NCES enrollment data exhibits a similar trend to the Census enrollment data for elementary and secondary schools and less year to year variability.

⁴⁹ U.S. Department of Education, Office of Special Education Programs, *Annual Report to Congress on the Implementation of the Individuals with Disabilities Education Act*, selected years, 1979 through 2006; and Individuals with Disabilities Education Act (IDEA) database, retrieved September 13, 2010, from <http://www.ideadata.org/PartBdata.asp>. National Center for Education Statistics, *Statistics of Public Elementary and Secondary School Systems, 1977–78 and 1980–81*; Common Core of Data (CCD), “State Nonfiscal Survey of Public Elementary/Secondary Education,” 1990–91 through 2008–09.

⁵⁰ Digest of Education Statistics, 2001 and 2010.

the Individuals with Disabilities Education Act in 1997, NAEP prepared new guidelines for testing accommodations and inclusion of students with disabilities and English language learners. Beginning in 2004, NAEP long term reading and mathematics test scores were published for students with disabilities, English language learners, and students approved for free and reduced price lunches.⁵¹

For disabled/ non-disabled quality adjusted education output measures, public school disabled and non-disabled student enrollments are adjusted separately using the NAEP long term trend reading and mathematics scores for disabled and non-disabled students ages 9, 13, and 17. Because reading and mathematics test scores for disabled and non-disabled students are only published for 2004 and 2008, these test scores are extrapolated back to 1980 by multiplying the current years' "all students" test score by the ratio of the previous years' disabled (or non-disabled) student test score to the previous years' "all students" test score. Further research is underway to improve the estimation of the disabled and non-disabled student test scores using unpublished NAEP data.⁵² The test score data for disabled and non-disabled students is interpolated between the 2004 and 2008 testing years to estimate test scores for non-testing years. A ratio of the reading or mathematics test score to the perfect score is computed for each year.

These ratios are then used to quality adjust disabled and non-disabled student enrollment. For public school disabled student quality adjusted education output measures, estimated public school disabled student enrollment for grades K-8 is adjusted by first averaging the mathematics test score ratios for ages 9 and 13 to get a single score for grades K-8. This is also done for the reading test score ratios for ages 9 and 13. The combined mathematics and reading test scores for grades K-8 are then averaged together, and the resulting test score ratio series is multiplied by public school disabled students enrollment for grades K-8 to obtain a quality adjusted education output measure for grades K-8.

For grades 9-12, mathematics and reading test scores for the age 17 testing group in public schools only are averaged and used to quality adjust disabled student enrollment in these grades in public schools.

⁵¹ "NAEP 2004 Trends in Academic Progress: Three Decades of Student Performance in Reading and Mathematics," NCES 2005-464, July 2005, Institute of Education Sciences, National Center for Education Statistics, US Department of Education, p. 103. See also NAEP web-site <http://nces.ed.gov/nationsreportcard/about/inclusion.asp>.

⁵² Steven Flint of the Division of Industry Productivity Studies, Office of Productivity Research, Bureau of Labor Statistics, is currently engaged in developing this data from a restricted access dataset available from the NAEP.

The grades K-8 and 9-12 quality adjusted enrollment data series are totaled to obtain a quality adjusted disabled student elementary and secondary public school education output series for grades K-12. Similar procedures are followed to obtain a quality adjusted non-disabled student elementary and secondary public school education output series for grades K-12.

Non-Instructional Services for “Disabled/ Non-Disabled” Output Measures

The “disabled/non-disabled” educational output measure, $Q_{q,ST,RT,F}^{DND Pub}$, is a function of educational services for disabled students, educational services for non-disabled students, special transportation services for disabled students, regular transportation services, and food services. Educational services for disabled and non-disabled students are physical volume measures based on public school student enrollment of disabled and non-disabled students and quality adjusted using NAEP long term trend test scores for disabled and non-disabled student categories, respectively. Public school student enrollment of disabled students is estimated using data on the percentage of children in pre-kindergarten through grade 12 served under the Individuals with Disabilities Education Act, Part B, based on total enrollment in public schools.⁵³

Two transportation services measures are constructed in order to account for the more costly special transportation services provided to some disabled students and the less costly regular transportation services provided to disabled students not requiring special transportation and to non-disabled students. Data on the percentage of disabled students requiring regular or special transportation and of that percentage, the percentage requiring special transportation, the cost per pupil of special and regular transportation services, and total public school transportation expenditures is used to develop estimates of the number of disabled students requiring special transportation, the expenditure on special transportation, the number of disabled and non-disabled students requiring regular transportation and the expenditure on regular transportation.⁵⁴ Estimated transportation services for disabled and non-disabled students are developed using data on the percent of disabled students requiring special transportation, the percent of disabled students requiring special or regular

⁵³ U.S. Department of Education, Office of Special Education Programs, *Annual Report to Congress on the Implementation of the Individuals with Disabilities Education Act*, selected years, 1992 through 2006, and Individuals with Disabilities Education Act (IDEA) database, retrieved September 2, 2010, from <http://www.ideadata.org/PartBdata.asp>. National Center for Education Statistics, Common Core of Data (CCD), “State Nonfiscal Survey of Public Elementary/ Secondary Education,” 2008–09.

⁵⁴ American Institutes for Research, Center for Special Education Finance, Special Education Expenditure Project, “What are We Spending on Transportation Services for Students with Disabilities, 1999-2000?”, Report 3, November 2002. Study prepared under the auspices of the U.S. Department of Education, Office of Special Programs; Moore et al (1988); National Public Education Financial Survey.

transportation, the per pupil transportation expenditure for students receiving special transportation, and the per pupil transportation expenditure for disabled and non-disabled students receiving regular transportation.⁵⁵

Food services are not distinguished separately for disabled and non-disabled students, and are estimated using a physical count of the number of lunches served. Estimates of food services for disabled and non-disabled students are based on data from the U.S. Department of Agriculture National School Lunch Program and the U.S. Department of Education. Number of lunches served and expenditures on school lunches for disabled and non-disabled student categories are estimated using the respective ratios of disabled students to all students and non-disabled students to all students.

For each of the five individual output measures underlying the disabled/non-disabled education output measure, expenditure share weights are constructed using data from the U.S. Department of Education, National Center for Education Statistics, Common Core of Data (CCD), "National Public Education Financial Survey," Moore et al (1988), and the Special Education Expenditure Project Report "What are We Spending on Transportation Services for Students with Disabilities, 1999-2000."

For the purpose of constructing expenditure share weights, expenditures for disabled students' educational services are estimated using a ratio of the average expenditure to educate a student with disabilities relative to the average expenditure on a regular education student.⁵⁶ Disabled student special and regular transportation and food costs are subtracted from educational expenditures for disabled students to calculate the expenditure weight for disabled students' educational services. Expenditures for special transportation services are calculated using estimates of the percent of disabled students requiring special transportation services and estimates of the higher cost of special transportation services. Expenditures for regular transportation services are estimated using data on the percent of disabled students requiring regular transportation services and expenditures on regular transportation services. Expenditures for food services are based on the same price per meal for

⁵⁵ Data on the percent of disabled students receiving special transportation is obtained from "What are We Spending on Transportation Services for Students with Disabilities, 1999-2000," Report 3, November 2002, Special Education Expenditure Project, Office of Special Education Programs, U.S. Department of Education; and from Moore, Strang, Schwartz, and Braddock (1988).

⁵⁶ American Institutes for Research, Center for Special Education Finance, Special Education Expenditure Project, "Total Expenditures for Students with Disabilities, 1999-2000: Spending Variation by Disability," Report 5, June 2003. Study prepared under the auspices of the U.S. Department of Education, Office of Special Education Programs.

disabled and non-disabled students, and split between disabled and non-disabled students in proportion to the percents of disabled and non-disabled students.

C. Empirical Results

Table 1 presents the annual growth rates of “all student”, disabled and non-disabled public school student enrollment for 1981-2008, and private school student enrollment for 1990-2007. The annual growth rates of disabled and non-disabled public school student enrollments tend to differ, with a .70 correlation rate; disabled and all public school student enrollments have a .80 rate of correlation; and non-disabled and all public school student enrollments have a .99 correlation rate. Table 2 displays annual growth rates for private school student enrollment for 1990-2007.

Table 3 presents the annual growth rates of alternative public school education output measures for the years 1981-2008 or 1990-2007, depending on data availability. The simple “all students” public school enrollment as an education output measure, $Q^{All Pub}$, generally has a lower annual growth rate of education output when compared to the quality-adjusted “all students” public school enrollment based measure, $Q_q^{All Pub}$. The annual growth rates of the “all students” education output measure with explicit transportation and food services, $Q_{q,T,F}^{All Pub}$, are generally higher than the annual growth rates of the simple “all students” measure $Q^{All Pub}$ and the quality adjusted “all students” measure $Q_q^{All Pub}$ without explicit transportation and food services. The measure $Q^{DND Pub}$, which accounts for differences in education output for disabled and non-disabled students, has generally lower annual growth rates than the homogeneous “all students” measure, with the exception of the years 2003-07, where annual growth rates are higher. Quality adjusting the disabled/non-disabled output measure, $Q_q^{DND Pub}$, results in a somewhat higher annual growth rates. Basing education output on separate disabled and non-disabled student education outputs and explicitly accounting for special and regular transportation and food services, as does the measure $Q_{q,ST,RT,F}^{DND Pub}$, results in a measure which generally has lower annual growth rates than the three “all students” output measures in the early years and higher annual growth rates in the later years. This may be the result of a decline in per student costs of educating disabled students relative to non-disabled students over time. Historically, with the

Table 1. Public School Enrollment, Grades K-12
(Annual Growth Rates)

YEAR	All Students	Disabled Students	Non-Disabled Students
1981	-2.052	-0.805	-2.192
1982	-1.213	0.029	-1.354
1983	-0.792	0.439	-0.935
1984	-0.124	1.101	-0.267
1985	0.439	1.656	0.295
1986	0.762	1.968	0.617
1987	0.620	1.810	0.475
1988	0.373	2.198	0.148
1989	0.793	1.693	0.680
1990	1.570	2.469	1.455
1991	1.853	3.640	1.623
1992	1.553	3.304	1.324
1993	1.420	3.139	1.190
1994	1.373	3.062	1.142
1995	1.597	3.262	1.365
1996	1.667	3.307	1.435
1997	1.093	2.697	0.861
1998	0.884	2.460	0.652
1999	0.595	2.143	0.364
2000	0.697	1.460	0.581
2001	0.817	1.575	0.701
2002	0.986	1.739	0.869
2003	0.683	2.175	0.450
2004	0.450	1.183	0.333
2005	0.569	-0.160	0.685
2006	0.322	-0.411	0.438
2007	-0.042	-1.512	0.190
2008	-0.260	-1.749	-0.030

Table 2. Private School Enrollment, Grades K-12*(Annual Growth Rates)*

YEAR	Total	Grades K-8	Grades 9-12
1990	2.91	3.08	2.33
1991	2.82	2.99	2.28
1992	-0.64	-0.24	-1.94
1993	-0.64	-0.24	-1.98
1994	2.43	2.24	3.08
1995	2.37	2.19	2.99
1996	1.28	1.14	1.75
1997	1.26	1.13	1.72
1998	-0.50	-0.39	-0.84
1999	-0.50	-0.39	-0.85
2000	2.83	2.12	5.15
2001	2.75	2.08	4.90
2002	-3.22	-3.72	-1.67
2003	-3.33	-3.87	-1.70
2004	-0.60	-1.45	1.94
2005	-0.61	-1.47	1.90
2006	-2.30	-2.87	-0.69
2007	-2.35	-2.96	-0.70

¹ Source: National Center for Education Statistics, Private School Survey. Data is obtained from the Common Core of Data database <http://nces.ed.gov/ccd/> for years 1989, 1991, 1993, 1995, 1997, 1999, 2001, 2003, 2005, and 2007. For 1990, 1992, 1994, 1996, 1998, 2000, 2002, 2004, and 2006 interpolated values are used.

Table 3. Alternative Public School Education Output Measures
(Annual Growth Rates)

YEAR	$Q^{All\ Pub}$ All Public School Students	$Q^{All\ Pub}_q$ All Public School Students (Quality Adjusted Using LTT Test Scores)	$Q^{All\ Pub}_{q, T, F}$ All Public School Students Separate Transportation and Food Services (Quality Adjusted Using LTT Test Scores)	$Q^{DND\ Pub}$ Disabled/Non-Disabled Public School Students	$Q^{DND\ Pub}_q$ Disabled/Non-Disabled Public School Students (Quality Adjusted Using LTT Test Scores)	$Q^{DND\ Pub}_{q, ST, RT, F}$ Disabled/Non-Disabled Public School Students Separate Special and Regular Transportation and Food Services (Quality Adjusted Using LTT Test Scores)
1981	-2.052	-2.200	na	na	na	na
1982	-1.213	-1.369	na	na	na	na
1983	-0.792	-0.738	na	na	na	na
1984	-0.124	0.025	na	na	na	na
1985	0.439	0.715	na	na	na	na
1986	0.762	0.793	na	na	na	na
1987	0.620	0.698	na	na	na	na
1988	0.373	0.398	na	na	na	na
1989	0.793	0.675	na	na	na	na
1990	1.570	1.539	1.534	1.539	1.519	1.790
1991	1.853	2.029	2.166	1.564	1.721	1.352
1992	1.553	1.740	1.716	1.274	1.446	1.424
1993	1.420	1.403	1.394	1.150	1.119	1.014
1994	1.373	1.368	1.283	1.111	1.092	0.950
1995	1.597	1.795	1.858	1.342	1.524	1.586
1996	1.667	1.888	1.832	1.421	1.624	1.687
1997	1.093	1.194	1.283	0.856	0.942	1.046
1998	0.884	0.964	1.070	0.655	0.722	0.942
1999	0.595	0.709	0.750	0.376	0.473	0.706
2000	0.697	0.914	0.839	0.459	0.665	1.107
2001	0.817	1.057	1.069	0.579	0.806	1.104
2002	0.986	1.261	1.272	0.748	1.007	1.366
2003	0.683	0.945	0.970	0.211	0.445	0.674
2004	0.450	0.723	0.733	0.215	0.471	0.957
2005	0.569	0.836	0.816	0.804	1.206	1.832
2006	0.322	0.553	0.579	0.558	0.925	1.393
2007	-0.042	0.145	0.142	0.431	0.766	1.493
2008	-0.260	-0.104				

implementation of the Individuals with Disabilities in Education Act, increasing numbers of disabled students are receiving educational services in less restrictive, and less costly, settings.

Table 4 presents average annual growth rates for the alternative education output measures, for selected time periods. The average annual growth rates of the quality-adjusted “all students” measure are consistently higher than those of the simple “all students” measure; similarly the average annual growth rates of the “all students” measure with explicit transportation and food services are consistently higher than those of the simple “all students” and the quality-adjusted “all students” measures. Average annual growth rates of the “disabled/ non-disabled” measures are generally lower than those of the three “all students” measures in the early time periods and greater than the “all students” measures in the later time periods. Average annual growth rates for unadjusted and quality adjusted private school education output are shown in Table 5.

Table 6 presents differences in acceleration for selected pairs of the public school education output measures in selected time periods. The three “all students” measures – simple “all students”, quality-adjusted “all students”, and quality adjusted “all students” with explicit transportation and food services- show little difference in acceleration in the (1990-01, 2001-07), (1990-95, 1995-01) and (1995-01, 2001-07) time periods. The “disabled/non-disabled” measure $Q_{q,ST,RT,F}^{DND Pub}$ has the greatest difference in acceleration relative to the “all students” measure $Q^{All Pub}$, with differences in acceleration of .85, .43 and .66 in the (1990-01, 2001-07), (1990-95, 1995-01), and (1995-01, 2001-07) time periods. If a one percentage point difference in acceleration is considered to indicate a substantial difference between output measures, these results encourage interest in adjusting for differences in the educational outputs provided to heterogeneous student groups. However, these results are only suggestive of the importance of accounting for differences in educational outputs provided to students. Since disabled students include only 10 to 13% of all public school students and disabled student expenditures range from 20 to 22% of total expenditures, accounting more fully for the range of educational outputs provided at different costs to diverse student populations may result in an improved measure of education output.

Table 4. Alternative Public School Education Output Measures
Average Annual Growth Rates

Time Period	$Q^{All\ Pub}$ All Public School Students	$Q^{All\ Pub}_q$ All Public School Students <i>(Quality Adjusted Using LTT Test Scores)</i>	$Q^{All\ Pub}_{q, T, F}$ All Public School Students Separate Transportation and Food Services <i>(Quality Adjusted Using LTT Test Scores)</i>	$Q^{DND\ Pub}$ Disabled/Non-Disabled Public School Students	$Q^{DND\ Pub}_q$ Disabled/Non-Disabled Public School Students <i>(Quality Adjusted Using LTT Test Scores)</i>	$Q^{DND\ Pub}_{q, ST, RT, F}$ Disabled/Non-Disabled Public School Students Separate Special and Regular Transportation and Food Services <i>(Quality Adjusted Using LTT Test Scores)</i>
1981-82	-1.213	-1.369	na	na	na	na
1981-90	0.267	0.301	na	na	na	na
1981-07	0.726	0.853	na	na	na	na
1982-90	0.453	0.511	na	na	na	na
1990-91	1.853	2.029	2.166	1.564	1.721	1.352
1990-95	1.559	1.667	1.683	1.288	1.380	1.265
1990-01	1.231	1.368	1.386	0.980	1.102	1.174
1990-07	0.970	1.147	1.162	0.808	0.996	1.213
1991-01	1.169	1.303	1.309	0.922	1.041	1.156
1995-01	0.958	1.120	1.140	0.724	0.871	1.098
2001-07	0.494	0.743	0.751	0.494	0.803	1.285

Table 5. Private School Student Enrollment¹*(Average Annual Growth Rates)*

	K-12	K-8	9-12
1981-82	NA	NA	NA
1981-90	NA	NA	NA
1981-07	NA	NA	NA
1982-90	NA	NA	NA
1990-91	2.82	2.99	2.28
1990-95	1.26	1.38	0.86
1990-01	1.21	1.14	1.45
1990-07	0.04	-0.24	0.88
1991-01	1.05	0.96	1.37
1995-01	1.18	0.94	1.94
2001-07	-2.08	-2.73	-0.17

¹Source: National Center for Education Statistics, Private School Survey. Data obtained from the Common Core of Data database <http://nces.ed.gov/ccd/> for years 1989, 1991, 1993, 1995, 1997, 1999, 2001, 2003, 2005, and 2007. For 1990, 1992, 1994, 1996, 1998, 2000, 2002, 2004, and 2006 interpolated values are used.

Table 6. Education Output Measures, Public School Grades K-12
Average Annual Percent Change and Differences in Acceleration, Selected Time Periods

Measure	(1990-01) (1)	(2001-07) (2)	Acceleration (2001-07)- (1990-2001)	Difference in Acceleration (B-A)	(1990-95) (1)	(1995-01) (2)	Acceleration (1995-01)- (1990-95)	Difference in Acceleration (B-A)	(1995-01) (1)	(2001-07) (2)	Acceleration (2001-07)- (1995-01)	Difference in Acceleration (B-A)
A. $Q^{All\ Pub}$	1.23	0.49	-0.74	0.11	1.56	0.96	-0.60	0.05	0.96	0.49	-0.47	0.09
B. $Q^{All\ Pub}_q$	1.37	0.74	-0.63		1.67	1.12	-0.55		1.12	0.74	-0.38	
A. $Q^{All\ Pub}$	1.23	0.49	-0.74	0.10	1.56	0.96	-0.60	0.06	0.96	0.49	-0.47	0.08
B. $Q^{All\ Pub}_{q, T, F}$	1.39	0.75	-0.64		1.68	1.14	-0.54		1.14	0.75	-0.39	
A. $Q^{All\ Pub}$	1.23	0.49	-0.74	0.25	1.56	0.96	-0.60	0.03	0.96	0.49	-0.47	0.24
B. $Q^{DND\ Pub}$	0.98	0.49	-0.49		1.29	0.72	-0.57		0.72	0.49	-0.23	
A. $Q^{All\ Pub}$	1.23	0.49	-0.74	0.44	1.56	0.96	-0.60	0.09	0.96	0.49	-0.47	0.40
B. $Q^{DND\ Pub}_q$	1.10	0.80	-0.30		1.38	0.87	-0.51		0.87	0.80	-0.07	
A. $Q^{All\ Pub}$	1.23	0.49	-0.74	0.85	1.56	0.96	-0.60	0.43	0.96	0.49	-0.47	0.66
B. $Q^{DND\ Pub}_{q, ST, RT, F}$	1.17	1.29	0.11		1.27	1.10	-0.17		1.10	1.29	0.19	
A. $Q^{All\ Pub}_q$	1.37	0.74	-0.63	0.14	1.67	1.12	-0.55	-0.02	1.12	0.74	-0.38	0.15
B. $Q^{DND\ Pub}$	0.98	0.49	-0.49		1.29	0.72	-0.57		0.72	0.49	-0.23	
A. $Q^{All\ Pub}_q$	1.37	0.74	-0.63	0.33	1.67	1.12	-0.55	0.04	1.12	0.74	-0.38	0.31
B. $Q^{DND\ Pub}_q$	1.10	0.80	-0.30		1.38	0.87	-0.51		0.87	0.80	-0.07	

Table 6. Education Output Measures, Public School Grades K-12
Average Annual Percent Change and Differences in Acceleration, Selected Time Periods

Measure	(1990-01) (1)	(2001-07) (2)	Acceleration (2001-07)- (1990-2001)	Difference in Acceleration (B-A)	(1990-95) (1)	(1995-01) (2)	Acceleration (1995-01)- (1990-95)	Difference in Acceleration (B-A)	(1995-01) (1)	(2001-07) (2)	Acceleration (2001-07)- (1995-01)	Difference in Acceleration (B-A)
A. $Q_q^{All\ Pub}$	1.37	0.74	-0.63	0.74	1.67	1.12	-0.55	0.38	1.12	0.74	-0.38	0.57
B. $Q_{q, ST, RT, F}^{DND\ Pub}$	1.17	1.29	0.11		1.27	1.10	-0.17		1.10	1.29	0.19	
A. $Q_{q, T, F}^{All\ Pub}$	1.39	0.75	-0.64	0.15	1.68	1.14	-0.54	-0.03	1.14	0.75	-0.39	0.16
B. $Q^{DND\ Pub}$	0.98	0.49	-0.49		1.29	0.72	-0.57		0.72	0.49	-0.23	
A. $Q_{q, T, F}^{All\ Pub}$	1.39	0.75	-0.64	0.34	1.68	1.14	-0.54	0.03	1.14	0.75	-0.39	0.32
B. $Q_q^{DND\ Pub}$	1.10	0.80	-0.30		1.38	0.87	-0.51		0.87	0.80	-0.07	
A. $Q_{q, T, F}^{All\ Pub}$	1.39	0.75	-0.64	0.75	1.68	1.14	-0.54	0.37	1.14	0.75	-0.39	0.58
B. $Q_{q, ST, RT, F}^{DND\ Pub}$	1.17	1.29	0.11		1.27	1.10	-0.17		1.10	1.29	0.19	
A. $Q^{DND\ Pub}$	0.98	0.49	-0.49	0.19	1.29	0.72	-0.57	0.06	0.72	0.49	-0.23	0.16
B. $Q_q^{DND\ Pub}$	1.10	0.80	-0.30		1.38	0.87	-0.51		0.87	0.80	-0.07	
A. $Q^{DND\ Pub}$	0.98	0.49	-0.49	0.60	1.29	0.72	-0.57	0.40	0.72	0.49	-0.23	0.41
B. $Q_{q, ST, RT, F}^{DND\ Pub}$	1.17	1.29	0.11		1.27	1.10	-0.17		1.10	1.29	0.19	
A. $Q_q^{DND\ Pub}$	1.10	0.80	-0.30	0.41	1.38	0.87	-0.51	0.34	0.87	0.80	-0.07	0.26
B. $Q_{q, ST, RT, F}^{DND\ Pub}$	1.17	1.29	0.11		1.27	1.10	-0.17		1.10	1.29	0.19	

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