

Technical Appendixes

Appendix A

Projection Methodology

The general procedure for *Projections of Education Statistics to 2014* was to express the variable to be projected as a percent of a “base” variable. These percents were then projected and applied to projections of the “base” variable. For example, the number of 18-year-old college students was expressed as a percent of the 18-year-old population for each year from 1972 through 2002. This enrollment rate was then projected through the year 2014 and applied to projections of the 18-year-old population from the U.S. Census Bureau.

Enrollment projections are based primarily on population projections. Projections of high school graduates and earned degrees conferred are based primarily on enrollment projections.

Exponential smoothing and multiple linear regression are the two major projection techniques used in this publication. Single exponential smoothing is used when the historical data have a basically horizontal pattern. On the other hand, double exponential smoothing is used when the time series is expected to change linearly with time. In general, exponential smoothing places more weight on recent observations than on earlier ones. The weights for observations decrease exponentially as one moves further into the past. As a result, the older data have less influence on these projections. The rate at which the weights of older observations decrease is determined by the smoothing constant selected.

$$P = \alpha X_t + \alpha(1 - \alpha)X_{t-1} + \alpha(1 - \alpha)^2 X_{t-2} + \alpha(1 - \alpha)^3 X_{t-3} + \dots$$

where:

P = projected value

α = smoothing constant ($0 < \alpha < 1$)

X_t = observation for time t

This equation illustrates that the projection is a weighted average based on exponentially decreasing weights. For a high smoothing constant, weights for earlier observations decrease rapidly. For a low

smoothing constant, decreases are more moderate. Projections of enrollments and public high school graduates are based on a smoothing constant of $\alpha = 0.4$.

The farther apart the observations are spaced in time, the more likely it is that there are changes in the underlying social, political, and economic structure. Since the observations are on an annual basis, major shifts in the underlying process are more likely in the time span of just a few observations than if the observations were available on a monthly or weekly basis. As a result, the underlying process for annual models tends to be less stable from one observation to the next. Another reason for using high smoothing constants for some time series is that most of the observations are fairly accurate, because most observations are population values rather than sample estimates. Therefore, large shifts tend to indicate actual changes in the process rather than noise in the data.

Multiple linear regression is also used in making projections of college enrollment and earned degrees conferred. This technique is used when it is believed that a strong relationship exists between the variable being projected (the dependent variable) and independent variables. However, this technique is used only when accurate data and reliable projections of the independent variables are available.

The functional form primarily used is the multiplicative model. When used with two independent variables, this model takes the form:

$$Y = aX_1^{b_1} X_2^{b_2}$$

This equation can easily be transformed into the linear form by taking the natural log (ln) of both sides of the equation:

$$\ln Y = \ln(a) + b_1 \ln X_1 + b_2 \ln X_2$$

The multiplicative model has a number of advantages. Research has found that it is a reasonable way to represent human behavior. Constant elasticities are assumed, which means that a 1 percent change in $\ln X$ will lead to a given percent change in $\ln Y$. This percent change is equal to b_1 . And the multiplicative model lends itself easily to “a priori” analysis because the researcher

does not have to worry about units of measurement when specifying relationships. In fact, the multiplicative model is considered the standard in economic analyses. For additional information, see *Forecasting: Methods and Applications* by Spiro Makridakis, Steven C. Wheelwright, and Rob J. Hyndman (John Wiley and Sons, 1998, p. 607).

Assumptions

All projections are based on underlying assumptions, and these assumptions determine projection results to a large extent. It is important that users of projections understand the assumptions to determine the acceptability of projected time series for their purposes. Descriptions of the primary assumptions upon which the projections of time series are based are presented in table A1.

For some projections, low, middle, and high alternatives are shown. These alternatives reveal the level of uncertainty involved in making projections, and they also point out the sensitivity of projections to the assumptions on which they are based.

Two of the factors involved in the higher education enrollment projections are household income, which represents ability to pay, and an age-specific unemployment rate, which acts as a proxy for opportunity costs faced by students. During a pessimistic economy, both household income and the ability to pay are likely to decline, having a negative impact on higher education enrollment. However, during a pessimistic economy, unemployment rates would likely to increase, with the result that the estimated opportunity costs will be lower. This could have a positive impact on higher education enrollment, as the students face less attractive alternatives. This will be apparent in the short term, resulting in a potential reversal in the expected pattern across the alternative economic scenarios. As a result, the high alternative projections will be lower than the low alternative projections. However, in the long term, the effect of the per capita income variable dominates the effects of the unemployment rate. This results in a pattern where the high alternative projections are greater than the low alternative projections.

Many of the projections in this publication are demographically based on U.S. Census Bureau middle series projections of the population by age. The population projections developed by the U.S. Census Bureau are based on the 2000 census and the middle series assumptions for the fertility rate, internal migration, net immigration, and mortality rate. For a discussion on the intercensal population estimates, see appendix C.

The future fertility rate assumption, which determines projections of the number of births, is one

key assumption in making population projections. This assumption plays a major role in determining population projections for the age groups enrolled in nursery school, kindergarten, and elementary grades. The effects of the fertility rate assumption are more pronounced toward the end of the projection period, while the immigration assumptions affect all years.

For enrollments in secondary grades and college, the fertility assumption is of no consequence, since all the population cohorts for these enrollment ranges have already been born. For projections of enrollments in elementary schools, only middle series population projections were considered. Projections of high school graduates are based on projections of the percent of grade 12 enrollment that are high school graduates. Projections of associate's, bachelor's, master's, doctor's, and first-professional degrees are based on projections of college-age populations and college enrollment, by sex, attendance status, level enrolled by student, and type of institution. Projections of college enrollment are also based on disposable income per capita and unemployment rates. The projections of elementary and secondary teachers are based on education revenue receipts from state sources and enrollments. The projections of expenditures of public elementary and secondary schools and public degree-granting institutions are based on enrollments and projections of disposable income per capita and various revenue measures of state and local governments. Projections of disposable income per capita and unemployment rates were obtained from the company Global Insight, Inc. Many additional assumptions were made in projecting these variables.

Limitations of Projections

Projections of time series usually differ from the final reported data due to errors from many sources. This is because of the inherent nature of the statistical universe from which the basic data are obtained and the properties of projection methodologies, which depend on the validity of many assumptions. Therefore, alternative projections are shown for most statistical series to denote the uncertainty involved in making projections. These alternatives are not statistical confidence limits, but instead represent judgments made by the authors as to reasonable upper and lower bounds. The mean absolute percentage error is one way to express the forecast accuracy of past projections. This measure expresses the average value of the absolute value of errors in percentage terms. For example, the mean absolute percentage errors of public school enrollment in grades K–12 for lead times of 1, 2, 5, and 10 years were 0.3, 0.5, 1.1, and 2.6 percent, respectively. For more information on mean absolute percentage errors, see table A2.

Table A1. Summary of forecast assumptions to 2014

Variables	Middle alternative	Low alternative	High alternative
Demographic assumptions			
Population	Projections are consistent with the Census Bureau middle series estimates.	Same as middle alternative	Same as middle alternative
18- to 24-year-old population	Average annual growth rate of 0.6%	Same as middle alternative	Same as middle alternative
25- to 29-year-old population	Average annual growth rate of 1.3%	Same as middle alternative	Same as middle alternative
30- to 34-year-old population	Average annual growth rate of 0.4%	Same as middle alternative	Same as middle alternative
35- to 44-year-old population	Average annual decline of 0.7%	Same as middle alternative	Same as middle alternative
Economic assumptions			
Disposable income per capita in constant dollars	Annual percent changes range between 1.6% and 3.1% with an annual growth rate of 2.4%	Annual percent changes range between 1.2% and 2.4% with an annual growth rate of 1.8%	Annual percent changes range between 1.8% and 3.8% with an annual growth rate of 3.0%
Education revenue receipts from state sources per capita in constant dollars	Annual percent changes range between 1.5% and 3.5% with an annual growth rate of 2.4%	Annual percent changes range between 0.8% and 2.7% with an annual growth rate of 1.7%	Annual percent changes range between 1.8% and 4.4% with an annual growth rate of 3.2%
Inflation rate	Inflation rate ranges between 1.2% and 2.9%	Inflation rate ranges between 1.2% and 3.5%	Inflation rate ranges between 1.2% and 2.9%
Personal taxes and nontax receipts to state and local governments per capita in constant dollars	Annual percent changes range between 1.9% and 7.1% with an annual growth rate of 3.9%	Annual percent changes range between 1.4% and 7.0% with an annual growth rate of 3.1%	Annual percent changes range between 2.8% and 7.2% with an annual growth rate of 5.7%
Unemployment rate (men)			
Ages 18 to 19	Remains between 12.8% and 17.0%	Remains between 13.5% and 17.5%	Remains between 12.9% and 14.9%
Ages 20 to 24	Remains between 7.1% and 9.6%	Remains between 7.5% and 10.0%	Remains between 7.2% and 8.5%
Age 25 and over	Remains between 3.4% and 4.6%	Remains between 3.6% and 4.8%	Remains between 3.4% and 4.1%
Unemployment rate (women)			
Ages 18 to 19	Remains between 10.7% and 13.9%	Remains between 11.2% and 14.1%	Remains between 10.8% and 12.5%
Ages 20 to 24	Remains between 6.8% and 9.0%	Remains between 7.1% and 9.3%	Remains between 6.9% and 8.0%
Age 25 and over	Remains between 3.3% and 4.4%	Remains between 3.5% and 4.6%	Remains between 3.3% and 3.9%

SOURCE: U.S. Department of Commerce, Bureau of the Census, previously unpublished tabulation (June 2004); and Global Insight, Inc., "U.S. Quarterly Model." (This table was prepared October 2004.)

Table A2. Mean absolute percentage errors (MAPEs) by lead time for selected statistics in all public elementary and secondary schools and degree-granting institutions

Statistics	Lead time (years)									
	1	2	3	4	5	6	7	8	9	10
Public elementary and secondary schools										
PK–12 enrollment	0.3	0.5	0.7	1.0	1.1	1.3	1.5	1.8	2.2	2.6
PK–8 enrollment	0.3	0.6	0.8	1.0	1.1	1.4	1.9	2.5	3.1	3.7
9–12 enrollment	0.4	0.7	1.0	1.1	1.2	1.5	1.9	2.1	2.3	2.4
High school graduates	0.8	0.9	1.5	1.6	1.2	1.6	2.5	3.5	3.9	4.2
Elementary and secondary teachers	1.0	1.5	1.8	2.2	2.7	3.3	4.0	4.0	4.7	5.4
Total current expenditures ¹	1.4	2.4	2.4	2.2	3.2	4.0	4.2	4.1	3.1	3.1
Current expenditures per pupil in fall enrollment ¹	1.4	2.2	2.2	2.3	3.7	4.5	4.6	4.9	5.2	5.7
Estimated average annual teacher salaries ¹	1.2	1.6	2.1	3.6	5.1	6.7	8.3	9.1	10.3	10.7
Degree-granting institutions										
Total enrollment	1.8	2.6	2.3	1.7	4.0	6.0	7.4	—	—	—
Men	1.9	3.0	3.2	3.3	5.3	6.9	7.7	—	—	—
Women	1.9	3.0	2.8	1.2	3.0	5.3	7.2	—	—	—
4-year institutions	1.2	2.1	2.2	2.2	3.9	5.3	6.5	—	—	—
2-year institutions	2.7	4.4	3.9	2.7	4.8	7.0	9.0	—	—	—
Associate's degrees	2.5	2.9	3.2	4.9	5.6	5.5	6.2	8.6	8.9	—
Bachelor's degrees	1.0	2.0	2.6	3.4	5.7	6.8	7.5	7.4	8.0	—
Master's degrees	1.2	4.1	7.3	8.8	11.3	12.9	13.5	11.6	12.0	—
Doctor's degrees	2.2	3.5	2.2	3.1	2.5	2.2	4.4	3.5	2.1	—
First-professional degrees	1.3	1.3	1.8	3.8	5.5	8.0	8.8	9.4	9.0	—
Current-fund expenditures in public 4-year institutions ¹	0.9	0.9	1.3	2.7	4.6	4.6	4.3	3.3	3.7	4.5
Current-fund expenditures in public 2-year institutions ¹	1.6	3.0	3.1	3.3	3.8	3.8	4.6	5.3	5.9	7.6

—Not available. Not all actual values were available to calculate a MAPE for this lead time.

¹In constant dollars based on the Consumer Price Index for all urban consumers, Bureau of Labor Statistics, U.S. Department of Labor.

NOTE: Mean absolute percentage error is the average value of the absolute values of errors expressed in percentage terms. MAPEs for K-12 enrollments were calculated using the last 21 editions of *Projections of Education Statistics*. MAPEs for high school graduates were calculated from the past 14 editions of *Projections of Education Statistics*.

MAPEs for teachers were calculated from the past 14 editions containing teachers projections and MAPEs for current expenditures and teacher salaries were calculated using projections from the last 14 editions containing current expenditure and teacher salary projections. MAPEs for degree-granting institution enrollments and earned degrees were calculated using the last 7 and 8 editions, respectively. MAPEs for current-fund expenditures were calculated using the last 9 editions of *Projections of Education Statistics* that included projections of current-fund expenditures. Calculations were made using unrounded numbers. Some data have been revised from previously published numbers.

SOURCE: U.S. Department of Education, National Center for Education Statistics, *Projections of Education Statistics*, various issues. (This table was prepared October 2004.)

Enrollment

National

Enrollment projections are based on projected enrollment rates, by age and sex, where the enrollment rate for a given population for a certain level of education is the number of people in that population enrolled at that level of education divided by the total number of people in that population. These enrollment rates were projected by taking into account the most recent trends, as well as the effects of economic conditions and demographic changes. The projected enrollment rates were then used in the Education Forecasting Model (EDMOD), which consists of age-specific rates by sex and by enrollment levels.

Enrollments by age and age groups from the U.S. Census Bureau were adjusted to NCES totals to compute rates for 1972 through 2002. The first stage of EDMOD is an age-specific enrollment model in which these enrollment rates are projected and applied to age-specific population projections from the U.S. Census Bureau. This stage includes all ages for students enrolled in grades K–12 and for students enrolled in colleges and universities. This stage, which is used separately for each sex, consists of the following categories: (1) nursery and kindergarten; (2) elementary grades 1–8; (3) secondary grades 9–12; (4) full-time college enrollment; and (5) part-time college enrollment.

At the postsecondary level, projections of full-time and part-time college enrollments were considered only for ages 16 and over. College enrollment is negligible for earlier ages. Full-time and part-time enrollments are modeled separately, with each model run by sex. Within an enrollment category, where applicable, college enrollment rates were projected by individual ages 16 through 24 and for the age groups 25 to 29, 30 to 34, and 35 years and over. Three alternative projections were made using various economic assumptions. Table A3 shows enrollment rates for 2002 and middle alternative projected enrollment rates for 2009 and 2014. Table A4 shows the equations used to project the enrollments for men by attendance status. Table A5 shows the equations used to project enrollment rates for women by attendance.

Enrollment in Public Elementary and Secondary Schools, by Grade Group and Organizational Level

The second stage of EDMOD projects public enrollment in elementary and secondary schools by grade group and by organizational level. Public enrollments by

age were based on enrollment rate projections for nursery and kindergarten, grade 1, elementary ungraded and special, and secondary ungraded and special. Grade progression rate projections were used for grades 2 through 12. Table A6 shows the public school enrollment rates, and table A7 shows the public school grade progression rates for 2002 and projections for 2009 and 2014. The projected rates in tables A6 and A7 were used to compute the projections of enrollments in elementary and secondary schools, by grade, shown in table 1.

College Enrollment, by Sex, Attendance Status, and Level Enrolled, and by Type and Control of Institution

The third stage of EDMOD projects enrollments in degree-granting institutions, by age group, sex, attendance status, and level enrolled by student, and by type and control of institution. These projections for 2009 and 2014 are shown in tables A8 and A9, along with actual values for 2002. For all projections, it was assumed that there was no enrollment in 2-year institutions at the postbaccalaureate level (graduate and first-professional).

The projected rates in tables A8 and A9 were then adjusted to agree with the projected age-specific enrollment rates in the first stage of EDMOD. The adjusted rates were then applied to the projected enrollments by age group, sex, and attendance status from the first stage of EDMOD to obtain projections by age group, sex, attendance status, level enrolled, and type of institution.

For each enrollment category—sex, attendance status, level enrolled, and type of institution—public enrollment was projected as a percent of total enrollment. Projections for 2009 and 2014 are shown in table A10, along with actual percents for 2002. The projected rates were then applied to the projected enrollments in each enrollment category to obtain projections by control of institution.

For each category by sex, enrollment level, and type and control of institution, graduate enrollment was projected as a percent of postbaccalaureate enrollment. Actual rates for 2002 and projections for 2009 and 2014 are shown in table A11. The projected rates in table A11 were then applied to projections of postbaccalaureate enrollment to obtain graduate and first-professional enrollment projections by sex, attendance status, and type and control of institution.

Full-Time-Equivalent Enrollment, by Type and Control of Institution and by Level Enrolled

The fourth stage of EDMOD projects full-time-equivalent enrollment, by type and control of institution and by level enrolled. For each enrollment category by level enrolled and by type and control of institution, the full-time-equivalent of part-time enrollment was projected as a percent of part-time enrollment. Actual percents for 2002 and projections for 2009 and 2014 are shown in table A12.

These projected percents were applied to part-time projections of enrollment by level enrolled and by type and control of institution from the third stage of EDMOD. These equivalent of part-time projections were added to projections of full-time enrollment (from the previous stage) to obtain projections of full-time-equivalent enrollment.

Projection Accuracy

An analysis of projection errors from the past 21 editions of *Projections of Education Statistics* indicates that the mean absolute percentage errors (MAPEs) for lead times of 1, 2, 5, and 10 years out for projections of public school enrollment in grades K–12 were 0.3, 0.5, 1.1, and 2.6 percent, respectively. For the 1-year-out prediction, this means that one would expect the projection to be within 0.3 percent of the actual value, on the average. For projections of public school enrollment in grades K–8, the MAPEs for lead times of 1, 2, 5, and 10 years out were 0.3, 0.6, 1.1, and 3.7 percent, respectively, while those for projections of public school enrollment in grades 9–12 were 0.4, 0.7, 1.2, and 2.4 percent for the same lead times.

For projections of total enrollment in degree-granting institutions, an analysis of projection errors based on the past 7 editions of *Projections of Education Statistics* indicates that the MAPEs for lead times of 1, 2, and 5 years were 1.8, 2.6, and 4.0 percent, respectively. For the 1-year-out prediction, this means that one would expect the projection to be within 1.8 percent of the actual value, on the average. For more information on MAPEs, see table A2, page 94.

Basic Methodology

The notation and equations that follow describe the basic models used to project public elementary and secondary enrollment.

Public Elementary and Secondary Enrollment

Let:

- i = Subscript denoting age
- j = Subscript denoting grade
- t = Subscript denoting time
- K_t = Enrollment at the nursery and kindergarten level
- G_{jt} = Enrollment in grade j
- G_{1t} = Enrollment in grade 1
- E_t = Enrollment in elementary special and ungraded programs
- S_t = Enrollment in secondary special and ungraded programs
- P_{it} = Population age i
- RK_t = Enrollment rate for nursery and kindergarten
- RG_{1t} = Enrollment rate for grade 1
- RE_t = Enrollment rate for elementary special and ungraded programs
- RS_t = Enrollment rate for secondary special and ungraded programs
- RPG_t = Enrollment rate for postgraduate programs
- EG_t = Total enrollment in elementary grades (K–8)
- SG_t = Total enrollment in secondary grades (9–12)
- R_{jt} = Progression rate for grade j : the proportion that enrollment in grade j in year t is of enrollment in grade $j - 1$ in year $t - 1$.

Then:

$$EG_t = K_t + E_t + \sum_{j=1}^8 G_{jt}$$

$$SG_t = S_t + \sum_{j=9}^{12} G_{jt}$$

where:

$$K_t = RK_t(P_{5t})$$

$$G_{jt} = R_{jt} \left(G_{j-1,t-1} \right)$$

$$E_t = RE_t \left(\sum_{j=5}^{13} P_{jt} \right)$$

$$G_{1t} = RG_{1t}(P_{6t})$$

$$S_t = RS_t \left(\sum_{i=14}^{17} P_{it} \right)$$

Enrollment in Degree-Granting Institutions

For degree-granting institutions, projections were computed separately by sex and attendance status of student. The notation and equations are:

Let:

- i = Subscript denoting age except:
 $i = 25$: ages 25–29
 $i = 26$: ages 30–34
 $i = 27$: ages 35 and over for enrollment (35–44 for population)
- t = Subscript denoting year
- j = Subscript denoting sex
- k = Subscript denoting attendance status
- E_{ijkt} = Enrollment of students age i by sex and attendance status
- P_{ijt} = Population age i by sex
- R_{ijkt} = Enrollment rate for students age i by sex and attendance status

T_{ijkt} = Total enrollment for particular subset of students: full-time men, full-time women, part-time men, part-time women

Then:

$$T_{ijkt} = \sum_{i=16}^{27} E_{ijkt}$$

where:

$$E_{ijkt} = R_{ijkt}(P_{ijt})$$

Methodological Tables

Tables A13 and A14 give the rates used to calculate projections of enrollments and basic assumptions underlying enrollment projections.

Private School Enrollment

This edition is the fourth report that projected trends in elementary and secondary enrollment by grade level in private schools using the grade progression rate method.

Private school enrollment data from the National Center for Education Statistics Private School Universe Survey for 1989–90, 1991–92, 1993–94, 1995–96, 1997–98, 1999–2000, and 2001–02 were used to develop these projections. In addition, population estimates for 1989 to 2002 and population projections for 2003 to 2014 from the U.S. Census Bureau were used to develop the projections.

The grade progression rate method was used to project private elementary and secondary school enrollment. The grade progression rate method starts with 6-year-olds entering first grade and then follows their progress through private elementary and secondary schools. The method requires calculating the ratio of the number of children in one year who “survive” the year and enroll in the next grade the following year.

Projections of enrollment in private elementary and secondary schools were developed using primarily the grade progression rate method. In contrast, kindergarten and first-grade enrollments are based on projected enrollment rates of 5- and 6-year-olds. These projected enrollment rates are applied to population projections of 5- and 6-year-olds developed by the U.S. Census Bureau.

Enrollments in grades 2 through 12 are based on projected grade progression rates. These projected rates are then applied to the current enrollment by grade to yield grade-by-grade projections for future years. Enrollment rates of 5- and 6-year-olds and grade

progression rates are projected using single exponential smoothing. Elementary ungraded and secondary ungraded are projected to remain constant at their 2001 levels. To obtain projections of total enrollment, projections of enrollments for the individual grades (kindergarten through 12) and ungraded were summed.

The grade progression rate method assumes that past trends in factors affecting private school enrollments will continue over the projection period. This assumption implies that all factors influencing enrollments will display future patterns consistent with past patterns. This method implicitly includes the net effect of such factors as migration, dropouts, deaths, nonpromotion, and transfers to and from public schools.

Mean absolute percentage errors (MAPEs) of the projection accuracy of private school enrollment were not developed because this projection method has been developed only recently and there is not yet enough historical information to evaluate model performance. As additional data become available, MAPEs can then be calculated.

State Level

For the 50 states and the District of Columbia, this edition contains projected trends in elementary and secondary enrollment by grade level in public schools from 2003 to the year 2014. This is the 10th report on state-level projections for public school elementary and secondary education statistics.

Public school enrollment data from the National Center for Education Statistics Common Core of Data survey for 1980 to 2002 were used to develop these projections. This survey does not collect enrollment data for private schools.

Population estimates for 1980 to 2002 and population projections for 2003 to 2014 from the U.S. Census Bureau were used to develop the enrollment projections. Both the population estimates and projections used in this year's update have been revised relative to last year's update. First, the population estimates used in this year's *Projections of Education Statistics to 2014* incorporate the Census Bureau's state-level intercensal revisions to the population from 1990 to 1999. These intercensal revisions were released by the Census Bureau to ensure consistency in the data between the 1990 Census and the 2000 Census. Second, due to the timing of the release of the new set of the U.S. Census Bureau's state-level population projections, the old set of state-level population projections were adjusted for use in this year's edition. The old set of state-level population projections from the U.S. Census Bureau are consistent with the 2001 population estimates, but do not take into account the new 2002 estimates that were available, nor do they match with the new set of national-

level population projections.

The adjustment of the state-level population projections had two steps. First, the projections for the years 2003 to 2014 were adjusted to match with the new 2002 data using the overlap year of data for 2002. The ratio used to adjust each state's projections was constructed by taking the new estimate for 2002 divided by the old 2002 projection from the old set of state-level population projections from the U.S. Census Bureau that match the 2001 estimate. This level adjustment ensured that the projections were consistent with the new 2002 estimates. A second adjustment was then done to ensure that the sum of the adjusted states summed to the new national totals. The final adjusted state-level projections used to develop the state-level projections for this edition of the *Projections of Education Statistics to 2014* both line up with the new 2002 state-level estimates and take into account the new national level, but do not take account new patterns in state by state enrollment that may emerge when the complete population forecast is released.

The changes in both the underlying population estimates and projections impact the final state-level enrollment projections in this year's edition of the *Projections of Education Statistics*. While the impact varies by state, this year's state-level projections are substantially different than the state-level projections released in last year's publication, *Projections of Education Statistics to 2013*.

Table A13 describes the number of years, projection methods, and smoothing constants used to project enrollments in public schools. Also included in table A13 is the procedure for choosing the different smoothing constants for the time-series models.

All states, with the exception of Washington, DC, were projected using the same single exponential smoothing parameter. Due to the quality of the Washington, DC data, the smoothing parameters for Washington DC were estimated using a feature of the model software EViews 4.1 using the available historical data. This approach yielded more consistent projections of Washington, DC enrollments.

Projections of enrollment in public elementary and secondary schools by state were developed using primarily the grade progression rate method. Kindergarten and first-grade enrollments are based on projected enrollment rates of 5- and 6-year-olds. These projected enrollment rates are applied to population projections of 5- and 6-year-olds developed by the U.S. Census Bureau.

Enrollments in grades 2 through 12 are based on projected grade progression rates in each state. These projected rates are then applied to the current enrollment by grade to yield grade-by-grade projections for future years. Enrollment rates of 5- and 6-year-olds and grade progression rates are projected using single exponential smoothing. Elementary ungraded and secondary

ungraded are projected to remain constant at their 2002 levels. To obtain projections of total enrollment, projections of enrollments for the individual grades (kindergarten through 12) and ungraded were summed.

The grade progression rate method assumes that past trends in factors affecting public school enrollments will continue over the projection period. This assumption implies that all factors influencing enrollments will display future patterns consistent with past patterns. Therefore, this method has limitations when applied to states with unusual changes in migration rates. This method implicitly includes the net effect of such factors

as migration, dropouts, deaths, nonpromotion, and transfers to and from private schools.

Adjustment to National Projections

The sum of the projections of state enrollments was adjusted to equal the national projections of public school K–12, K–8, and 9–12 enrollments shown in table 1. For details on the methods used to develop the national projections for this statistic, see the section on national enrollment projections in this appendix.

Table A3. Actual and middle alternative projected numbers for college enrollment rates, by age, sex and attendance status: Fall 2002, 2009, and 2014

Age, sex, and attendance status	Actual 2002	Projected	
		2009	2014
Men			
Full-time			
16 years old	0.4	0.3	0.3
17 years old	2.4	2.6	2.7
18 years old	28.8	30.1	30.9
19 years old	34.2	32.8	33.6
20 years old	30.0	31.3	32.1
21 years old	29.4	30.7	31.5
22 years old	20.8	21.9	22.6
23 years old	13.6	14.3	14.8
24 years old	10.5	11.1	11.4
25 to 29 years old	4.8	5.1	5.3
30 to 34 years old	1.7	1.9	1.9
35 to 44 years old	1.1	1.2	1.2
Part-time			
16 years old	#	#	#
17 years old	0.8	0.8	0.9
18 years old	5.0	5.2	5.3
19 years old	8.7	9.4	9.7
20 years old	7.7	8.0	8.3
21 years old	5.7	5.9	6.1
22 years old	6.0	6.2	6.5
23 years old	6.7	7.0	7.3
24 years old	7.0	7.4	7.7
25 to 29 years old	4.4	4.6	4.8
30 to 34 years old	3.5	3.7	3.8
35 to 44 years old	4.1	4.4	4.6
Women			
Full-time			
16 years old	0.4	0.4	0.4
17 years old	4.1	4.5	4.9
18 years old	35.1	38.6	40.6
19 years old	46.9	50.5	52.5
20 years old	41.2	44.8	46.8
21 years old	32.3	35.6	37.5
22 years old	22.3	25.0	26.5
23 years old	15.2	17.2	18.4
24 years old	12.5	14.3	15.3
25 to 29 years old	5.9	7.9	8.5
30 to 34 years old	2.7	3.2	3.4
35 to 44 years old	1.9	2.3	2.4
Part-time			
16 years old	0.5	0.2	0.2
17 years old	0.8	0.9	0.9
18 years old	7.8	8.1	8.3
19 years old	9.4	9.6	9.6
20 years old	7.6	7.9	7.9
21 years old	8.2	8.5	8.7
22 years old	11.2	11.9	12.1
23 years old	9.7	10.4	10.7
24 years old	10.0	10.7	11.1
25 to 29 years old	7.2	7.7	8.0
30 to 34 years old	4.6	5.0	5.3
35 to 44 years old	6.9	7.5	7.9

Rounds to zero.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Enrollment in Degree-Granting Institutions Model, 1980–2002. (This table was prepared October 2004.)

Table A4. Equations for full-time and part-time college enrollment rates of men

Independent variable	Coefficient	Standard error	T-statistic	R ²	D.W. statistic
Full-time					
Age17	-5.87	0.20	-29.8	0.99	2.16
Age18	-3.23	0.15	-21.7		
Age19	-3.22	0.73	-4.4		
Age 20	-3.22	0.14	-23.5		
Age 21	-3.34	0.14	-24.6		
Age 22	-3.83	0.14	-27.7		
Age 23	-4.25	0.14	-31.2		
Age 24	-4.56	0.14	-32.1		
Age 25	-5.40	0.15	-35.8		
Age25-29	-6.38	0.15	-44.0		
Age35-44	-7.05	0.15	-47.5		
LNRYPDRNMA	0.45	0.03	17.2		
LNRUM	0.08	0.02	4.0		
Rho17	0.58	0.12	4.9		
Rho18	0.61	0.08	8.0		
Rho19	0.96	0.11	8.4		
Rho20	0.36	0.12	3.0		
Rho21	-0.05	0.15	-0.3		
Rho22	0.17	0.13	1.3		
Rho23	-0.05	0.12	-0.4		
Rho24	0.51	0.10	5.1		
Rho25-29	0.70	0.07	9.5		
Rho30-34	0.49	0.09	5.4		
Rho35-44	0.59	0.09	6.7		
Part-time					
Age17	-8.79	0.77	-11.4	0.30	1.51
Age18	-4.98	0.27	-18.2		
Age19	-4.66	0.31	-14.9		
Age 20	-4.62	0.27	-16.8		
Age 21	-4.72	0.27	-17.3		
Age 22	-4.57	0.28	-16.3		
Age 23	-4.88	0.27	-17.9		
Age 24	-5.10	0.29	-17.5		
Age 25	-5.25	0.35	-15.0		
Age25-29	-5.61	0.35	-16.2		
Age35-44	-5.60	0.28	-20.0		
LNRYPDRNMA	0.43	0.05	8.5		
LNRUM	0.06	0.02	2.4		
Rho17	-0.38	0.16	-2.4		
Rho18	-0.31	0.10	-3.0		
Rho19	0.77	0.06	13.6		
Rho20	0.25	0.11	2.3		
Rho21	0.00	0.10	0.0		
Rho22	0.36	0.14	2.5		
Rho23	0.10	0.08	1.2		
Rho24	0.61	0.08	8.1		
Rho25-29	0.84	0.07	11.8		
Rho30-34	0.84	0.06	13.3		
Rho35-44	0.65	0.07	9.5		

R² = Coefficient of determination.

D.W. statistic = Durbin-Watson statistic.

Where:

AGE(age) = Enrollment rate by age.

Rho(age) = Autocorrelation coefficient for each age.

LNRUM = Log unemployment rate for men.

LNRYPDRNMA = Log of three-period weighted average of per capita real disposable income.

NOTE: The regression method used to estimate the full-time and part-time equations was pooled seemingly unrelated regression with first-order autocorrelation correction. The time period used to estimate the equations is from 1975 to 2002. The number of observations is 297. For additional information, see M. D. Intriligator, *Econometric Models, Techniques, & Applications*, New Jersey: Prentice-Hall, Inc., 1978, pp. 165-173.

SOURCE: U.S. Department of Education, National Center for Education Statistics: Integrated Postsecondary Education Data System, "Fall Enrollment Survey" (IPEDS-EF:89-99), and Spring 2001 through Spring 2003; and Enrollment in Degree-Granting Institutions Model, 1980-2002. (This table was prepared October 2004.)

Table A5. Equations for full-time and part-time college enrollment rates of women

Independent variable	Coefficient	Standard error	T-statistic	R ²	D.W. statistic
Full-time					
Age17	-8.88	0.55	-16.2	0.99	2.30
Age18	-6.02	0.23	-26.7		
Age19	-5.85	0.17	-35.2		
Age 20	-6.04	0.16	-38.0		
Age 21	-6.24	0.16	-39.1		
Age 22	-6.97	0.19	-36.9		
Age 23	-7.38	0.19	-39.7		
Age 24	-7.66	0.17	-46.0		
Age 25	-8.08	1.56	-5.2		
Age25-29	-9.08	0.16	-58.3		
Age35-44	-9.31	0.16	-59.6		
LNRYPDRNMA	1.06	0.04	27.1		
LNRUF	0.26	0.05	5.2		
Rho17	0.90	0.07	13.5		
Rho18	0.81	0.09	8.7		
Rho19	0.13	0.15	0.9		
Rho20	-0.23	0.16	-1.4		
Rho21	0.07	0.14	0.5		
Rho22	0.75	0.09	8.3		
Rho23	0.73	0.10	7.2		
Rho24	0.58	0.12	4.9		
Rho25-29	0.97	0.13	7.4		
Rho30-34	0.02	0.17	0.1		
Rho35-44	-0.18	0.12	-1.4		
Part-time					
Age17	-8.84	0.80	-11.1	0.76	2.4
Age18	-5.82	0.21	-27.1		
Age19	-5.65	0.23	-24.4		
Age 20	-5.58	0.21	-26.7		
Age 21	-5.70	0.21	-27.0		
Age 22	-5.56	0.21	-26.5		
Age 23	-5.87	0.21	-27.9		
Age 24	-6.05	0.22	-27.7		
Age 25	-6.02	0.21	-28.3		
Age25-29	-6.30	0.24	-26.4		
Age35-44	-6.01	0.22	-27.0		
LNRYPDRNMA	0.70	0.04	17.2		
LNRUF	0.19	0.04	4.7		
Rho17	0.61	0.12	5.1		
Rho18	0.30	0.15	2.0		
Rho19	0.61	0.11	5.7		
Rho20	-0.14	0.12	-1.2		
Rho21	0.09	0.09	1.1		
Rho22	0.13	0.12	1.1		
Rho23	0.01	0.12	0.1		
Rho24	0.53	0.12	4.4		
Rho25-29	0.38	0.12	3.1		
Rho30-34	0.74	0.07	9.9		
Rho35-44	0.67	0.10	6.5		

R² = Coefficient of determination.

D.W. statistic = Durbin-Watson statistic.

Where:

AGE(age) = Enrollment rate by age.

Rho(age) = Autocorrelation coefficient for each age.

LNRUM = Log unemployment rate for men.

LNRYPDRNMA = Log of three-period weighted average of per capita real disposable income.

NOTE: The regression method used to estimate the full-time and part-time equations was pooled seemingly unrelated regression with first-order autocorrelation correction. The time period used to estimate the equations is from 1975 to 2002. The number of observations is 297. For additional information, see M. D. Intriligator, *Econometric Models, Techniques, & Applications*, New Jersey: Prentice-Hall, Inc., 1978, pp. 165-173.

SOURCE: U.S. Department of Education, National Center for Education Statistics: Integrated Postsecondary Education Data System, "Fall Enrollment Survey" (IPEDS-EF:89-99), and Spring 2001 through Spring 2003; and Enrollment in Degree-Granting Institutions Model, 1980-2002. (This table was prepared October 2004.)

Table A6. Actual and projected numbers for enrollment rates in public schools, by grade level: Fall 2002, and 2003 through 2014

Grade level	Actual 2002	Projected 2003 through 2014
Kindergarten	105.5	108.7
Grade 1	91.1	91.0
Elementary ungraded	1.0	0.9
Secondary ungraded	0.9	0.9

NOTE: The the base age for each grade level is as follows: kindergarten, 5-years-old; grade 1, 6-years-old; elementary ungraded, 5- to 13-years-olds; and secondary ungraded 14- to 17-years-olds.

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Elementary and Secondary Enrollment Model, 1972–2002. (This table was prepared October 2004.)

Table A7. Actual and projected numbers for public school grade progression rates: Fall 2002, and 2003 through 2014

Grade	Actual 2002	Projected 2003 through 2014
1 to 2	98.5	98.5
2 to 3	100.4	100.6
3 to 4	100.3	100.3
4 to 5	100.4	100.4
5 to 6	101.5	101.6
6 to 7	101.5	101.5
7 to 8	99.4	99.5
8 to 9	113.1	113.3
9 to 10	88.9	89.1
10 to 11	90.4	90.8
11 to 12	92.3	93.1

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Elementary and Secondary Enrollment Model, 1972–2002. (This table was prepared October 2004.)

Table A8. Actual and projected numbers for the percentage distribution of full-time enrollment rates, by level enrolled and type of institutions, for each age and sex classification: Fall 2002, and 2003 through 2014

Age	Men		Women	
	Actual 2002	Projected 2003 through 2014	Actual 2002	Projected 2003 through 2014
Undergraduate, 4-year institutions				
16 and 17 years old	53.3	54.1	58.8	53.4
18 and 19 years old	65.4	65.3	68.0	67.9
20 and 21 years old	76.6	75.9	77.8	77.9
22 to 24 years old	63.5	62.9	60.1	60.6
25 to 29 years old	44.4	44.2	44.9	42.1
30 to 34 years old	39.1	34.3	42.1	41.1
35 years and over	34.4	37.6	39.8	38.2
Undergraduate, 2-year institutions				
16 and 17 years old	44.6	44.0	39.8	43.9
18 and 19 years old	33.7	33.6	31.1	31.4
20 and 21 years old	21.3	21.9	20.0	20.1
22 to 24 years old	16.4	17.1	17.8	18.2
25 to 29 years old	16.6	19.6	21.2	23.1
30 to 34 years old	16.0	19.9	31.2	29.1
35 years and over	33.1	26.8	32.6	34.5
Postbaccalaureate, 4-year institutions				
16 and 17 years old	2.1	1.9	1.5	2.7
18 and 19 years old	0.9	1.1	0.8	0.7
20 and 21 years old	2.2	2.2	2.2	2.0
22 to 24 years old	20.0	20.0	22.1	21.2
25 to 29 years old	39.0	36.2	33.9	34.8
30 to 34 years old	44.9	45.8	26.7	29.8
35 years and over	32.6	35.6	27.6	27.3

NOTE: Projections shown for 2009 and 2014 were adjusted to add to 100 percent before computing projections shown in tables 10 through 21.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Enrollment in Degree-Granting Institutions Model, 1980–2002. (This table was prepared October 2004.)

Table A9. Actual and projected numbers for the percentage distribution of part-time enrollment rates, by level enrolled and type of institutions, for each age and sex classification: Fall 2002, and 2003 through 2014

Age	Men		Women	
	Actual 2002	Projected 2003 through 2014	Actual 2002	Projected 2003 through 2014
Undergraduate, 4-year institutions				
16 and 17 years old	19.4	23.4	43.0	26.9
18 and 19 years old	15.1	13.9	19.6	21.2
20 and 21 years old	31.2	29.1	27.0	28.5
22 to 24 years old	30.3	30.3	31.0	28.4
25 to 29 years old	27.6	27.3	23.4	21.9
30 to 34 years old	22.6	23.7	23.5	23.8
35 years and over	20.7	21.1	22.1	22.0
Undergraduate, 2-year institutions				
16 and 17 years old	80.2	76.4	56.7	72.9
18 and 19 years old	84.1	85.5	80.0	78.5
20 and 21 years old	67.8	69.9	72.1	70.8
22 to 24 years old	61.4	61.6	58.7	61.1
25 to 29 years old	53.9	53.3	53.2	55.5
30 to 34 years old	46.9	48.2	54.4	52.0
35 years and over	53.3	53.3	53.6	54.0
Postbaccalaureate, 4-year institutions				
16 and 17 years old	0.4	0.2	0.3	0.2
18 and 19 years old	0.8	0.6	0.4	0.3
20 and 21 years old	0.9	0.9	0.9	0.8
22 to 24 years old	8.3	8.1	10.3	10.6
25 to 29 years old	18.6	19.4	23.5	22.7
30 to 34 years old	30.5	28.2	22.1	24.2
35 years and over	25.9	25.6	24.4	24.0

NOTE: Projections shown for 2009 and 2014 were adjusted to add to 100 percent before computing projections shown in tables 10 through 21.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Enrollment in Degree-Granting Institutions Model, 1980–2002. (This table was prepared October 2004.)

Table A10. Actual and projected numbers for public college enrollment as a percent of total enrollment, by attendance status, sex, level enrolled, and type of institution: Fall 2002, and 2003 through 2014

Enrollment category	Men		Women	
	Actual 2002	Projected	Actual 2002	Projected
		2003 through 2014		2003 through 2014
Full-time, undergraduate, 4-year institutions	67.2	67.0	66.2	66.0
Part-time, undergraduate, 4-year institutions	71.2	71.0	68.4	68.5
Full-time, undergraduate, 2-year institutions	90.1	90.5	90.9	91.1
Part-time, undergraduate, 2-year institutions	99.0	99.1	98.9	98.9
Full-time, postbaccalaureate, 4-year institutions	52.9	52.8	54.1	53.5
Part-time, postbaccalaureate, 4-year institutions	57.0	57.1	61.9	61.6

SOURCE: U.S. Department of Education, National Center for Education Statistics, Enrollment in Degree-Granting Institutions Model, 1980–2002. (This table was prepared October 2004.)

Table A11. Actual and projected numbers for graduate enrollment as a percent of total postbaccalaureate enrollment, by sex, attendance status, sex, and type and control of institution: Fall 2002, and 2003 through 2014

Enrollment category	Men		Women	
	Actual 2002	Projected	Actual 2002	Projected
		2003 through 2014		2003 through 2014
Full-time, 4-year, public	78.0	78.5	80.8	80.9
Part-time, 4-year, public	98.8	98.8	99.3	99.3
Full-time, 4-year, private	65.0	66.5	72.8	73.8
Part-time, 4-year, private	91.7	92.0	95.4	95.4

SOURCE: U.S. Department of Education, National Center for Education Statistics, Enrollment in Degree-Granting Institutions Model, 1980–2002. (This table was prepared October 2004.)

Table A12. Actual and projected numbers for full-time enrollment as a percent of part-time enrollment, by level enrolled and by type and control of institution: Fall 2002, and 2003 through 2014

Enrollment category	Actual 2002	Projected 2003 through 2014
Public, 4-year, undergraduate	40.4	40.4
Public, 2-year, undergraduate	33.6	33.6
Private, 4-year, undergraduate	39.3	39.3
Private, 2-year, undergraduate	39.7	39.7
Public, 4-year, graduate	36.2	36.2
Private, 4-year, graduate	38.2	38.2
Public, 4-year, first-professional	60.1	60.1
Private, 4-year, first-professional	54.6	54.6

SOURCE: U.S. Department of Education, National Center for Education Statistics, Enrollment in Degree-Granting Institutions Model, 1980–2002. (This table was prepared October 2004.)

Table A13. Number of years, projection methods, and smoothing constants used to project state-level public school enrollments and high school graduates

Projected state variable	Number of years	Projection method	Smoothing constant ¹	Basis for smoothing
	(1972–2002)			constant
Grade progression rates	30	Single exponential smoothing	0.4	Empirical research
Graduates/grade 12 enrollment ...	30	Single exponential smoothing	0.4	Empirical research

¹Alternative smoothing constants were used for the District of Columbia. These smoothing constants were estimated using a feature of the model software program EViews 4.1.

SOURCE: U.S. Department of Education, National Center for Education Statistics, State Public Elementary and Secondary Enrollment Model, 1980–2002, and State Public High School Graduates Model, 1980–81 through 2001–02. (This table was prepared October 2004.)

Table A14. Enrollment (assumptions)

Variables	Assumptions	Alternatives	Tables
Elementary and secondary enrollment	Age-specific enrollment rates will remain constant at levels consistent with the most recent rates.	Middle (no alternatives)	1-9
	Public enrollment rates and public grade retention rates will remain constant at levels consistent with the most recent rates.	Middle (no alternatives)	1-9
	The percentage of 7th- and 8th-grade public students enrolled in schools organized as secondary schools will remain constant at levels consistent with the most recent rates.	Middle (no alternatives)	1-9
<hr/>			
College enrollment, by age			
Full-time men, full-time women, and part-time women	Age-specific enrollment rates are a function of dummy variables by age, middle alternative log of four-period weighted average of real disposable income per capita, and middle alternative log unemployment rate by age group.	Middle	10-19
	Age-specific enrollment rates are a function of dummy variables by age, low alternative log of four-period weighted average of real disposable income per capita, and low alternative log unemployment rate by age group.	Low	10-19
	Age-specific enrollment rates are a function of dummy variables by age, high alternative log of four-period weighted average of real disposable income per capita, and high alternative log unemployment rate by age group.	High	10-19
Part-time men	Age-specific enrollment rates for men are a function of dummy variables by age, the middle alternative log of four-period weighted average of real disposable income per capita, and middle alternative log unemployment rate by age group.	Middle	10-19
	Age-specific enrollment rates for men are a function of dummy variables by age, the low alternative log of four-period weighted average of real disposable income per capita, and low alternative log unemployment rate by age group.	Low	10-19
	Age-specific enrollment rates for men are a function of dummy variables by age, the high alternative log of four-period weighted average of real disposable income per capita, and high alternative log unemployment rate by age group.	High	10-19
<hr/>			
College enrollment, by sex, attendance status, level enrolled, and type of institution	For each group and for each attendance status separately, percent of total enrollment by sex, level enrolled, and type of institution will follow past trends through 2014. For each age group and attendance status category, the sum of the percentages must equal 100 percent.	High, middle, and low	10-19
<hr/>			
College enrollment, by control of institution	For each enrollment category, by sex, attendance status, and level enrolled, and by type of institution, public enrollment as a percent of total enrollment will remain constant at levels consistent with the most recent rates.	High, middle, and low	10-19
<hr/>			
Graduate enrollment	For each enrollment category, by sex and attendance status of student, and by type and control of institution, graduate enrollment as a percent of postbaccalaureate enrollment will remain constant at levels consistent with the most recent rates.	High, middle, and low	20
<hr/>			
Full-time-equivalent of part-time enrollment	For each enrollment category, by type and control of institution and level enrolled, the percent that full-time-equivalent of part-time enrollment is of part-time enrollment will remain constant at levels consistent with the most recent rates.	High, middle, and low	22

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Elementary and Secondary Enrollment Model, 1972–2002, State Public Elementary and Secondary Enrollment Model, 1980–2002, and Enrollment in Degree-Granting Institutions Model, 1980–2002. (This table was prepared October 2004.)

High School Graduates

National

Projections of public high school graduates were developed in the following manner. The number of public high school graduates was expressed as a percent of grade 12 enrollment in public schools for 1972–73 to 2001–02. This percent was projected using single exponential smoothing and applied to projections of grade 12 enrollment to yield projections of high school graduates in public schools. (This percent does not make any specific assumptions regarding the dropout rate. The effect of the 12th- grade dropout proportion is reflected implicitly in the graduate proportion.) The grade 12 enrollment was projected based on grade progression rates. This percent was assumed to remain constant at levels consistent with the most recent rates. This method assumes that past trends in factors affecting graduation ratios, such as dropouts, migration, and public or private transfers, will continue over the projection period. In addition to student behaviors, the projected number of graduates could be impacted by changes in policies affecting graduation requirements.

Projections of private high school graduates were calculated using the same methodology as public high school graduates, using data from 1988–89 to 2000–02.

Projection Accuracy

An analysis of projections from models used in the past 14 editions of *Projections of Education Statistics* indicates that the mean absolute percentage errors (MAPEs) for projections of public high school graduates were 0.8 percent for 1 year ahead, 0.9 percent for 2 years ahead, 1.2 percent for 5 years ahead, and 4.2 percent for 10 years ahead. For the 1-year-ahead prediction, this means that one would expect the projection to be within 0.8

percent of the actual value, on the average. For more information on the mean absolute percentage errors, see table A2, page 94.

State Level

This edition contains projections of high school graduates from public schools by state from 2002–03 to 2013–14. Public school graduate data from the National Center for Education Statistics Common Core of Data survey for 1980–81 to 2001–02 were used to develop these projections. This survey does not collect graduate data for private schools.

Projections of public high school graduates by state were developed in the following manner. For each state, the number of public high school graduates was expressed as a percent of grade 12 enrollment in public schools for 1980–81 to 2001–02. This percent was projected using single exponential smoothing and applied to projections of grade 12 enrollment to yield projections of high school graduates in public schools. All states, with the exception of Washington, DC, were projected using the same single exponential smoothing parameter. Due to the quality of the Washington, DC data, the smoothing parameters for Washington DC were estimated using a feature of the model software program EViews 4.1 using the available historical data. This approach yielded more consistent projections of Washington, DC graduates. Projections of grade 12 enrollment were developed based on the grade progression rates discussed in appendix A, Enrollment. This percent was assumed to remain constant at levels consistent with the most recent rates. This method assumes that past trends in factors affecting public high school graduates will continue over the projection period.

Degrees Conferred

Projections of associate's, bachelor's, master's, doctor's, and first-professional degrees by sex were based on demographic models that relate degree awards to college-age populations and college enrollment by level enrolled and attendance status.

Associate's Degrees

Associate's degree projections by sex were based on a weighted average over the last 2 years of undergraduate enrollment by attendance status in 2-year institutions and sex relative to the 18- to 24-year-old population by sex. The previous year is weighted two-thirds, and 2 years back is weighted one-third. Results of the regression analysis used to project associate's degrees by sex are shown in table A15.

Bachelor's Degrees

Bachelor's degree projections by sex were based on a weighted average over the last 4 years of undergraduate enrollment by attendance status in 4-year institutions and sex relative to the 18- to 24-year-old population by sex. The weights for the previous 4 years—0.4, 0.3, 0.2, and 0.1—give more weight to the most recent years. Results of the regression analysis used to project bachelor's degrees by sex are shown in table A15. For some years, projections of undergraduate enrollment from the middle alternative projections were greater than those from the high alternative projections. (See page 92.) Hence, for some years, projections of bachelor's degrees from the middle alternative projections are greater than those from the high alternative projections.

Master's Degrees

Master's degree projections by sex were based on a weighted average over the last 2 years of graduate enrollment by attendance status and sex relative to the 25- to 34-year-old population by sex. The previous year is weighted two-thirds, and 2 years back is weighted one-third. Results of the regression analysis used to project master's degrees by sex are shown in table A15. For some years, projections of graduate enrollment from the middle alternative projections were greater than those from the high alternative projections. (See page 92.) Hence, for some years, projections of master's degrees from the middle alternative projections are greater than those from the high alternative projections.

Doctor's Degrees

Doctor's degree projections by sex were based on a weighted average over the last 4 years of graduate enrollment by attendance status and sex relative to the 5- to 44-year-old population by sex. The weights for the previous 4 years—0.4, 0.3, 0.2, and 0.1—give more weight to the most recent years. The results of the regression analysis used to project doctor's degrees by sex are shown in table A15.

First-Professional Degrees

First-professional degree projections by sex were based on a weighted average over the last 3 years of first-professional enrollment by attendance status in 4-year institutions and sex relative to the 25- to 34-year-old population by sex. The weights for the previous 3 years—0.5, 0.33, and 0.17—give more weight to the most recent years. Results of the regression analysis used to project first-professional degrees by sex are shown in table A15.

Methodological Tables

These tables describe equations used to calculate projections (table A15), and basic assumptions underlying projections (table A16).

Projection Accuracy

An analysis of projection errors from similar models used in the past eight editions of *Projections of Education Statistics* indicates that mean absolute percentage errors (MAPEs) for associate's degrees were 2.5 percent for 1 year out, 2.9 percent for 2 years out, and 5.6 percent for 5 years out. For the 1-year-out prediction, this means that one would expect the projection to be within 2.5 percent of the actual value, on average. MAPEs for bachelor's degree projections were 1.0 percent for 1 year out, 2.0 percent for 2 years out, and 5.7 percent for 5 years out. MAPEs for master's degrees were 1.2, 4.1, and 11.3 percent, respectively. For doctor's degrees, the MAPEs were 2.2, 3.5, and 2.5 percent, respectively. For first-professional degrees, the MAPEs were 1.3, 1.3, and 5.5 percent, respectively. For more information on the MAPEs, see table A2.

Table A15. Equations for degrees conferred

Dependent variable	Equation	R ²	Durbin-Watson statistic ¹	Error distribution		Time period
				pattern ²	Rho	
Associate degrees Men	LNASSOCM = 4.9 + 0.4LNUG2ML2 (9.6)	0.95	2.0	AR(1)	0.58 (5.0)	1975–76 to 2002–03
Associate degrees Women	LNASSOCW = 5.6 + 0.5LNUG2WL2 (16.3)	0.99	1.5	AR(1)	0.64 (8.1)	1975–76 to 2002–03
Bachelor's degrees Men	LNBACHM = 6.3 - 0.6LNUG4ML4 (4.4)	0.98	1.6	AR(1)	0.87 (3.9)	1977–78 to 2002–03
Bachelor's degrees Women	LNBACHW = 6.7 - 0.7LNUG4WL4 (10.2)	0.99	1.3	AR(1)	0.81 (4.5)	1977–78 to 2002–03
Master's degrees Men	LNMASTM = 6.9 + 0.6LNGML2 (4.4)	0.97	1.4	AR(1)	1.02 (9.2)	1975–76 to 2002–03
Master's degrees Women	LNMASTW = 7.7 + 0.7LNGWL2 (19.9)	0.99	1.4	AR(1)	0.79 (18.2)	1975–76 to 2002–03
Doctor's degrees Men	LNDOCM = 3.2 + 0.4LNGML4 (6.3)	0.99	1.7	AR(1)	0.69 (6.7)	1977–78 to 2002–03
Doctor's degrees Women	LNDOCW = 1.2 + 0.3LNGWL4 (2.8)	0.93	2.3	AR(1)	1.01 (15.9)	1977–78 to 2002–03
First-professional degrees Men	LNFPROM = 3.5 + 0.2LNFPM3 (3.1)	0.99	1.7	AR(1)	0.87 (22.7)	1976–77 to 2002–03
First-professional degrees Women	LNFPROW = 7.9 + 0.6LNFPL3 (34.6)	0.98	0.9	AR(1)	0.05 (0.5)	1976–77 to 2002–03

¹For an explanation of the Durbin-Watson statistic, see J. Johnston and J. Dinardo, *Econometric Methods*, New York: McGraw-Hill, 1996.

²AR(1) indicates that the models was estimated using least squares with the AR(1) process for correcting for first-order autocorrelation. For a general discussion of the problem of autocorrelation, and the method used to forecast in the presence of autocorrelation, see G. Judge, W. Hill, R. Griffiths, H. Lutkepohl, and T. Lee, *The Theory and Practice of Econometrics*, New York: John Wiley and Sons, 1985, pp. 315–318.

Where:

LNASSOCM = Log of the ratio of associate degrees awarded to men relative to the population of 18- to 24- year old men

LNASSOCW = Log of the ratio of associate degrees awarded to woman relative to the population of 18- to 24- year old women

LNBACHM = Log of the ratio of bachelor's degrees awarded to men relative to the population of 18- to 24- year old men

LNBACHW = Log of the ratio of bachelor's degrees awarded to women relative to the population of 18- to 24- year old women

LNMASTM = Log of the ratio of master's degrees awarded to men relative to the population of 25- to 34- year old men

LNMASTW = Log of the ratio of master's degrees awarded to women relative to the population of 25- to 34- year old women

LNDOCM = Log of the ratio of doctor's degrees awarded to men relative to the population of 35- to 44- year old men

LNDOCW = Log of the ratio of doctor's degrees awarded to women relative to the population of 35- to 44- year old women

LNFPROM = Log of the ratio of first-professional degrees awarded to men relative to the population of 25- to 34- year old men

LNFPROW = Log of the ratio of first-professional degrees awarded to women relative to the population of 25- to 34- year old women

LNUG2ML2 = Log of the ratio of full-time male undergraduate enrollment in 2-year institutions to the male population of 18- to 24-year-olds, weighted over the last 2 years (where weights are .67 and .33 for descending lagged years), plus the similar Log ratio for part-time male undergraduate enrollment in 2-year institutions.

LNUG2WL2 = Log of the ratio of full-time female undergraduate enrollment in 2-year institutions to the female population of 18- to 24-year-olds, weighted over the last 2 years (where weights are .67 and .33 for descending lagged years), plus the similar Log ratio for part-time female undergraduate enrollment in 2-year institutions.

LNUG4ML4 = Log of the ratio of full-time male undergraduate enrollment in 4-year institutions to the male population of 18- to 24-year-olds, weighted over the last 4 years (where weights are .4, .3, .2, and .1 for descending lagged years), plus the similar Log ratio for part-time male undergraduate enrollment in 4-year institutions.

LNUG4WL4 = Log of the ratio of full-time female undergraduate enrollment in 4-year institutions to the female population of 18- to 24-year-olds, weighted over the last 4 years (where weights are .4, .3, .2, and .1 for descending lagged years), plus the similar Log ratio for part-time female undergraduate enrollment in 4-year institutions.

LNGML2 = Log of the ratio of full-time male graduate school enrollment to the male population of 25- to 34-year-olds, weighted over the last 2 years (where weights are .67 and .33 for descending lagged years), plus the similar Log ratio for part-time male graduate school enrollment.

LNGWL2 = Log of the ratio of full-time female school graduate enrollment to the female population of 25- to 34-year-olds, weighted over the last 2 years (where weights are .67 and .33 for descending lagged years), plus the similar Log ratio for part-time female graduate school enrollment.

LNGML4 = Log of the ratio of full-time male graduate school enrollment to the male population of 35- to 44-year-olds, weighted over the last 4 years (where weights are .4, .3, .2, and .1 for descending lagged years), plus the similar Log ratio for part-time male graduate school enrollment.

LNGWL4 = Log of the ratio of full-time female graduate school enrollment to the female population of 35- to 44-year-olds, weighted over the last 4 years (where weights are .4, .3, .2, and .1 for descending lagged years), plus the similar Log ratio for part-time female graduate school enrollment.

LNFPM3 = Log of the ratio of full-time male first-professional school enrollment to the male population of 25- to 34-year-olds, weighted over the last 3 years (where weights are .5, .33, and .17 for descending lagged years), plus the similar Log ratio for part-time male first-professional school enrollment.

LNFPL3 = Log of the ratio of full-time female first-professional school enrollment to the female population of 25- to 34-year-olds, weighted over the last 3 years (where weights are .5, .33, and .17 for descending lagged years), plus the similar Log ratio for part-time female first-professional school enrollment.

NOTE: R² indicates the coefficient of determination. Rho measures the correlation between errors in time period t and time period t minus 1. Numbers in parentheses are t-statistics.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Degrees Conferred Model, 1975–76 through 2002–03. (This table was prepared October 2004.)

Table A16. Degrees conferred (assumptions)

Variables		Assumptions	Alternative	Table
Associate's degrees				
Men	The number of associate's degrees awarded to men is a linear function of the log of the ratio of full-time male undergraduate enrollment in 2-year institutions to the male population of 18- to 24-year-olds, weighted over the last 2 years (where weights are .67 and .33 for descending lagged years), plus the similar log ratio for part-time male undergraduate enrollment in 2-year institutions. This relationship will continue through 2013–14.		Middle	26
Women	The number of associate's degrees awarded to women is a linear function of the log of the ratio of full-time female undergraduate enrollment in 2-year institutions to the female population of 18- to 24-year-olds, weighted over the last 2 years (where weights are .67 and .33 for descending lagged years), plus the similar log ratio for part-time female undergraduate enrollment in 2-year institutions. This relationship will continue through 2013–14.		Middle	26
Bachelor's degrees				
Men	The number of bachelor's degrees awarded to men is a linear function of the log of the ratio of full-time male undergraduate enrollment in 4-year institutions to the male population of 18- to 24-year-olds, weighted over the last 4 years (where weights are .4, .3, .2, and .1 for descending lagged years), plus the similar log ratio for part-time male undergraduate enrollment in 4-year institutions. This relationship will continue through 2013–14.		Middle	27
Women	The number of bachelor's degrees awarded to women is a linear function of the log of the ratio of full-time female undergraduate enrollment in 4-year institutions to the female population of 18- to 24-year-olds, weighted over the last 4 years (where weights are .4, .3, .2, and .1 for descending lagged years), plus the similar log ratio for part-time female undergraduate enrollment in 4-year institutions. This relationship will continue through 2013–14.		Middle	27
Master's degrees				
Men	The number of master's degrees awarded to men is a linear function of the log of the ratio of full-time male graduate school enrollment to the male population of 25- to 34-year-olds, weighted over the the last 2 years (where weights are .67 and .33 for descending lagged years), plus the similar log ratio for part-time male graduate school enrollment. This relationship will continue through 2013–14.		Middle	28
Women	The number of master's degrees awarded to women is a linear function of the log of the ratio of full-time female graduate school enrollment to the female population of 25- to 34-year-olds, weighted over the the last 2 years (where weights are .67 and .33 for descending lagged years), plus the similar log ratio for part-time female graduate school enrollment. This relationship will continue through 2013–14.		Middle	28
Doctor's degrees				
Men	The number of doctor's degrees awarded to men is a linear function of the log of the ratio of full-time male graduate school enrollment to the male population of 35- to 44-year-olds, weighted over the the last 4 years (where weights are .4, .3, .2, and .1 for descending lagged years), plus the similar log ratio for part-time male graduate school enrollment. This relationship will continue through 2013–14.		Middle	29
Women	The number of doctor's degrees awarded to women is a linear function of the log of the ratio of full-time female graduate school enrollment to the female population of 35- to 44-year-olds, weighted over the the last 4 years (where weights are .4, .3, .2, and .1 for descending lagged years), plus the similar log ratio for part-time female graduate school enrollment. This relationship will continue through 2013–14.		Middle	29
First-professional degrees				
Men	The number of first-professional degrees awarded to men is a linear function of the log of the ratio of full-time male first-professional school enrollment to the male population of 25- to 34-year-olds, weighted over the last 3 years (where weights are .5, .33, and .17 for descending lagged years), plus the similar log ratio for part-time male first-professional school enrollment. This relationship will continue through 2013–14.		Middle	30
Women	The number of first-professional degrees awarded to women is a linear function of the log of the ratio of full-time female first-professional school enrollment to the female population of 25- to 34-year-olds, weighted over the last 3 years (where weights are .5, .33, and .17 for descending lagged years), plus the similar log ratio for part-time female first-professional school enrollment. This relationship will continue through 2013–14.		Middle	30

SOURCE: U.S. Department of Education, National Center for Education Statistics, Degrees Conferred Model, 1975–76 through 2002–03. (This table was prepared October 2004.)

Elementary and Secondary Teachers

Public Elementary and Secondary Teachers

The number of public elementary and secondary teachers was projected separately for the elementary and secondary levels. The number of public elementary teachers was projected using the public elementary student/teacher ratio. The ratio was modeled as a function of local education revenue from state sources per student, and the level of elementary and secondary teacher wages relative to the overall economy-level wages. The number of public elementary teachers was obtained by applying the projected public elementary student/teacher ratio to previously projected enrollment in public elementary schools. The number of public secondary teachers was projected using the public secondary student-teacher ratio. The ratio was modeled as a function of local education revenue from state sources per student and public secondary enrollment relative to the 11- to 18-year-old population. The number of public secondary teachers was obtained by applying the projected public secondary student-teacher ratio to previously projected enrollment in public secondary schools.

The models were estimated using the AR1 model for correcting for autocorrelation, and all variables are in log form. Local education revenue from state sources were in constant 2000 dollars.

The equations in this section should be viewed as forecasting rather than structural equations, as the limitations of time and available data precluded the building of a large-scale, structural teacher model. The particular equations shown were selected on the basis of their statistical properties, such as coefficients of determination (R^2 s), the t-statistics of the coefficients, the Durbin-Watson statistic, and residual plots.

The multiple regression technique will yield good forecasting results only if the relationships that existed among the variables in the past continue throughout the projection period.

The public elementary teacher model is:

$$\ln(\text{RELENRTCH}_t) = b_0 + b_1 \ln(\text{RSALARY}_t) + b_2 \ln(\text{RSGRNTELENR}_t)$$

where:

RELENRTCH_t is the public elementary student/teacher ratio in year t;

RSALARY_t is the average teacher wage relative to the overall economy-level wage in year t; and

RSGRNTELENR_t is the level of education revenue from state sources deflated by the consumer prices chained-price index in constant 2000 dollars per public elementary student in year t.

Each variable affects the public elementary student/teacher ratio in the expected way. As the average teacher wage relative to the overall economy-level wage increases, schools economize on teachers by increasing the student/teacher ratio as teachers are now more expensive to hire. As the level of real grants per elementary student increases, the class size decreases. The more money being devoted to education, the more teachers are hired, thus decreasing the student/teacher ratio.

The public secondary teacher model is:

$$\ln(\text{RSCENRTCH}_t) = b_0 + b_1 \ln(\text{RSGRNTSCENR}_t) + b_2 \ln(\text{RSCENRPU}_t)$$

where:

RSCENRTCH_t is the public secondary student/teacher ratio in year t;

RSGRNTSCENR_t is the level of education revenue from state sources deflated by the consumer prices chained-price index in constant 2000 dollars per public secondary student in year t; and

RSCENRPU_t is the number of students enrolled in public secondary schools relative to the secondary school-age population in year t.

Each variable affects the public secondary student-teacher ratio in the expected way. As the level of real grants per secondary student increases, the student/teacher ratio decreases. The more money being devoted to education, the more teachers are hired, thus decreasing the student-teacher ratio. As enrollment rates (number of enrolled students relative to the school-age population) increase, the ratio also increases: increases in the enrollment rate are not matched one-for-one in increases in the number of teachers.

Table A17 summarizes the results for the elementary and secondary public teacher models.

Enrollment is by organizational level, not by grade

level. Thus, secondary enrollment is not the same as grade 9–12 enrollment because some states count some grade 7 and 8 enrollment as secondary. Therefore, the distribution of the number of teachers is also by organizational level, not by grade span.

Private Elementary and Secondary Teachers

Projections of private elementary and secondary teachers were derived in the following manner. From 1960 to 2001, the ratio of private school teachers to public school teachers was calculated by organizational level. These ratios were projected using single exponential smoothing, yielding a constant value over the projection period. This constant value was then applied to projections of public school teachers by organizational level to yield projections of private school teachers. This method assumes that the future pattern in the trend of private school teachers will be the same as that for public school teachers. The reader is cautioned that a number of factors could alter the assumption of constant ratios over the projection period.

The total number of public school teachers, enrollment by organizational level, and education revenue from state sources used in these projections were from the Common Core of Data (CCD) survey conducted by NCES. The proportion of public school teachers by organizational level was taken from the National Education Association and then applied to the total number of teachers from the CCD to produce the number of teachers by organizational level.

Projection Accuracy

An analysis of projection errors from the past 14 editions of *Projections of Education Statistics* indicated that the mean absolute percentage errors (MAPEs) for projections of classroom teachers in public elementary and secondary schools were 1.0 percent for 1 year out, 1.5 percent for 2 years out, 2.7 percent for 5 years out, and 5.4 percent for 10 years out. For the 2-year-ahead prediction, this means that one would expect the projection to be within 1.5 percent of the actual value, on average. For more information on the MAPEs, see table A2.

Table A17. Equations for public elementary and secondary teachers

Dependent variable	Equation	R ²	Watson statistic ¹	Error distribution		Time period
				pattern ²	Rho	
Elementary	$\ln(\text{RELENRTCH}) = 3.8 + .1 \ln(\text{RSALARY}) - .2 \ln(\text{RSGRNTELENR})$ (5.0) (-7.7)	0.99	2.0	AR(1)	0.22 (1.24)	1968 to 2001
Secondary	$\ln(\text{RSCENRTCH}) = 4.1 - .2 \ln(\text{RSGRNTSCENR}) + .6 \ln(\text{RSCENRPU})$ (-13.3) (4.29)	0.99	1.8	AR(1)	0.61 (3.6)	1973 to 2001

¹For an explanation of the Durbin-Watson statistic, see J. Johnston and J. Dinardo, *Econometric Methods*, New York: McGraw-Hill, 1996.

²AR(1) indicates that the models was estimated using least squares with the AR(1) process for correcting for first-order autocorrelation. For a general discussion of the problem of autocorrelation, and the method used to forecast in the presence of autocorrelation, see G. Judge, W. Hill, R. Griffiths, H. Lutkepohl, and T. Lee, *The Theory and Practice of Econometrics*, New York: John Wiley and Sons, 1985, pp. 315–318.

Where:

RELENRTCH = Log of the ratio of public elementary school enrollment to classroom teachers (i.e., student/teacher ratio)

RSCENRTCH = Log of the ratio of public secondary school enrollment to classroom teachers (i.e., student/teacher ratio)

RSALARY = Log of the average annual teacher salary relative to the overall economy wage in 2000 dollars

RSGRNTELENR = Log of the ratio of education revenue receipts from state sources per capita to public elementary school enrollment in 2000 dollars

RSGRNTSCENR = Log of the ratio of education revenue receipts from state sources per capita to public secondary school enrollment in 2000 dollars

RSCENRPU = Log of the ratio of enrollment in public secondary schools to the 11- to 18-year-old population

NOTE: R² indicates the coefficient of determination. Rho measures the correlation between errors in time period t and time period t minus 1. Numbers in parentheses are t-statistics.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Elementary and Secondary Teacher Model, 1968–2001. (This table was prepared October 2004.)

Expenditures of Public Elementary and Secondary Schools

Econometric techniques were used to produce the projections for current expenditures and average teacher salaries. The particular equations shown were selected on the basis of their statistical properties, such as coefficients of determination (R^2 s), the t -statistics of the variables, the Durbin-Watson statistic, and residual plots. These econometric models will yield good forecasting results only if the relationships that existed among the variables in the past continue throughout the projection period.

Elementary and Secondary School Current Expenditure Model

There is a large body of work, both theoretical and empirical, on the demand for local public services such as education.¹ The elementary and secondary school current expenditure model is based on this work.

The model that is the basis for the elementary and secondary school current expenditure model has been called the median voter model. In brief, the theory states that spending for each public good in the community (in this case, spending for education) reflects the preferences of the “median voter” in the community. This individual is identified as the voter in the community with the median income and median property value. The amount of spending in the community reflects the price of education facing the voter with the median income, as well as his income and tastes. There are competing models in which the level of spending reflects the choices of others in the community, such as the “bureaucrats.”

In a median voter model, the demand for education expenditures is typically linked to four different types of variables: (1) measures of the income of the median voter; (2) measures of intergovernmental aid for education going indirectly to the median voter; (3) measures of the price to the median voter of providing one more dollar of

education expenditures per pupil; and (4) any other variables that may affect one’s tastes for education. The elementary and secondary school current expenditure model contains variables reflecting the first two types of variables. The model is:

$$\ln(\text{CUREXP}_t) = b_0 + b_1\ln(\text{PCI}_t) + b_2\ln(\text{SGRNT}_t)$$

where:

\ln indicates the natural log;

CUREXP_t equals current expenditures of public elementary and secondary schools per pupil in fall enrollment in constant 1982–84 dollars in year t ;

PCI_t equals disposable income per capita in constant 2000 dollars in year t ; and

SGRNT_t equals local governments’ education revenue from state sources, per capita, in constant year 1982–84 dollars in year t . The model used to project this variable is discussed below.

The model was estimated using least squares with the AR(1) process for correcting for autocorrelation. This is the 11th edition of *Projections of Education Statistics* in which AR(1) was used. No correction for autocorrelation had been made in the previous in the prior four editions of *Projections of Education Statistics*. The model was estimated using data from 1969–70 to 2001–02.

There are potential problems with using a model for local government education expenditures for the nation as a whole. Two such problems concern the variable SGRNT. First, the amount of money that local governments receive for education from state governments varies substantially by state. Second, the formulas used to apportion state moneys for education among local governments vary by state.

Beginning in 1988–89, there was a major change in the survey form used to collect data on current expenditures. This new survey form produces a more complete measure of current expenditures; therefore, the values for current expenditures are not completely comparable to the previously collected numbers. Data for a majority of states were also collected for 1986–87 and 1987–88 that were comparable to data from the new survey form. A comparison of these data with those from the old survey form suggests that the use of the new survey form may have increased the national figure for current expenditures by

¹ For a discussion of the theory together with a review of some of the older literature, see Inman, R. P. (1979), “The Fiscal Performance of Local Governments: An Interpretive Review,” in *Current Issues in Urban Economics*, edited by P. Mieszkowski and M. Straszheim, Johns Hopkins Press, Baltimore, Maryland. More recent empirical work include: Gamkhar, S. and Oates, W. (1996). Asymmetries in the Response to Increases and Decreases in Intergovernmental Grants: Some Empirical Findings. *National Tax Journal*, 49(3): 501-512 and Mitias, P. and Turnbull, G. (2001) Grant Illusion, Tax Illusion, and Local Government Spending. *Public Finance Review*. 29(5): 347-368.

approximately 1.4 percent over what it would have been if the survey form had not been changed. When the model was estimated, all values for current expenditures before 1988–89 were increased by 1.4 percent.

The results for the model are shown in table A18. Each variable affects current expenditures in the direction that would be expected. With high levels of income (PCI) or revenue from state sources (SGRNT), the level of spending increases.

From the cross-sectional studies of the demand for education expenditures, we have an estimate of how sensitive current expenditures are to changes in PCI. We can compare the results from this model with those from the cross-sectional studies. For this model, an increase in PCI of 1 percent, with SGRNT held constant, would result in an increase of current expenditures per pupil in fall enrollment of approximately .73 percent. With PCI held constant, an increase of 1 percent in SGRNT would result in an increase in current expenditures per pupil in fall enrollment of approximately .24 percent. Both numbers are well within the range of what has been found in cross-sectional studies.

The results from this model are not completely comparable with those from previous editions of *Projections of Education Statistics*. First, in those earlier editions, the sample period used to estimate the model began with either 1959–60 or 1967–68 rather than 1969–70. Second, in the earlier editions the model contained an additional variable, the ratio of enrollment to the population. Third, in editions prior to *Projections of Education Statistics to 2011* and *Projections of Education Statistics to 2013*,² average daily attendance rather than fall enrollment, was used as the measure of enrollment. This change was made because the definitions of fall enrollment are more consistent from state to state than those of average daily attendance. This change was made due to superior model diagnostics.

There have been other changes to the model used in earlier editions. As with the current expenditure projections in the most recent editions, the population number for each school year is the U.S. Census Bureau's July 1 population number for the upcoming school year. In earlier editions, the school year population numbers were from an economic consulting firm. These changes were made to be consistent with population projections used in producing other projections of education statistics. Also, there have been changes in the definition of disposable income.

Projections for total current expenditures were made by multiplying the projections for current expenditures per pupil in fall enrollment by

projections for fall enrollment. The projections for total current expenditures were also divided by projections for average daily attendance to produce projections of current expenditures per pupil in average daily attendance to provide projections that are consistent with those from earlier years. Projections were developed in 1982–84 dollars and then placed in 2002–03 dollars using the Consumer Price Index. Current-dollar projections were produced by multiplying the constant-dollar projections by projections for the Consumer Price Index. The Consumer Price Index and the other economic variables used in calculating the projections presented in this report were placed in school year terms rather than calendar year terms.

Three alternative sets of projections for current expenditures are presented: the middle alternative projections, the low alternative projections, and the high alternative projections. The alternative sets of projections differ because of varying assumptions about the growth paths for disposable income and revenue from state sources.

The alternative sets of projections for the economic variables, including disposable income, were developed using three economic scenarios prepared by the economic consulting firm, Global Insight, Inc.

Global Insight's February 2004 trend scenario was used as a base for the middle alternative projections of the economic variables. Global Insight's trend scenario depicts a mean of possible paths that the economy could take over the forecast period, barring major shocks. The economy, in this scenario, evolves smoothly, without major fluctuations.

Global Insight's February 2004 pessimistic scenario was used for the low alternative projections, and Global Insight's February 2004 optimistic scenario was used for the high alternative projections.

In the middle alternative projections, disposable income per capita rises each year from 2004–05 to 2013–14 at rates between 1.6 percent and 3.1 percent. In the low alternative projections, disposable income per capita ranges between 1.2 percent and 2.4 percent, and in the high alternative projections, disposable income per capita rises at rates between 1.8 percent and 3.8 percent.

The alternative projections for revenue from state sources, which form a component of the current expenditures model, were produced using the following model:

$$\ln(\text{SGRNT}_t) = b_0 + b_1 \ln(\text{PCI}_t) + b_2 \ln(\text{ENRPOP}_t)$$

where:

\ln indicates the natural log;

SGRNT_t equals local governments' education revenue

² There were no projections of either current expenditures or teacher salaries in *Projections of Education Statistics to 2012*.

from state sources, per capita, in constant 1982–84 dollars in year t ;

$ENRPOP_t$ equals the ratio of fall enrollment to the population in year t ; and

PCI_t equals disposable income per capita in constant 2000 dollars in year t .

The model was estimated using least squares with the AR(1) process for correcting for autocorrelation. The model was estimated using the period from 1971–72 to 2001–02. These models are shown in table A18.

The values of the coefficients in this model follow expectations. As the enrollment increases relative to the population (higher ENRPOP), so does the amount of aid going to education. Finally, other things being equal, as the value of disposable income per capita in real dollar values (higher PCI) increases, the level of local governments' education revenue from state sources per capita also increases.

The revenue from state sources model varies slightly from the models used in the previous two editions of the *Projections of Education Statistics*. This edition's model dropped the term for personal taxes and nontax receipts (PERTAX1) and the inflation rate term (RCPIANN), and added disposable income per capita (PCI). Also, with this edition, the sample period began in 1971–72 rather than 1967–68. This model specification yielded superior model diagnostics than the model used in the previous two editions of the *Projections of Education Statistics*. As in the past two editions of the *Projections of Education Statistics*, this year's model used the same variable to represent enrollment (ENRPOP). In the earlier editions, models used average daily attendance rather than fall enrollment as the measure of enrollment, and the sample period used to produce the forecast began in 1959–60. As with the current expenditures model, the change to fall enrollment was done because the definition of fall enrollment is more consistent across states, and the change in sample period was done because of superior model diagnostics. Other models in the past have contained a second measure of state and local government revenue. Also in earlier editions, similar models were used except the variables were not in log form. Both of these changes were made because of superior model diagnostics.

Three alternative sets of projections for SGRNT were produced using this model. Each is based on a different set of projections for disposable income per capita. The middle set of projections was produced using the values from the middle set of alternative projections. The low set of projections was produced using the values from the low set of alternative projections, and the high set of projections was produced using the values from the high set of alternative projections. In the middle alternative

projections, disposable income per capita rises each year from 2004–05 to 2013–14 at rates between 1.6 percent and 3.1 percent. In the low alternative projections, disposable income per capita ranges between 1.2 percent and 2.4 percent, and in the high alternative projections, disposable income per capita rises at rates between 1.8 percent and 3.8 percent.

Elementary and Secondary Teacher Salary Model

Most studies conducted on teacher salaries, like those on current expenditures, have used cross-sectional data. Unlike current expenditures models, however, the models for teacher salaries from these existing cross-sectional studies cannot easily be reformulated for use with time series data. One problem is that we do not have sufficient information concerning the supply of qualified teachers who are not presently teaching. Instead, the elementary and secondary salary model contains terms that measure the demand for teachers in the economy.

The elementary and secondary teacher salary model is:

$$\ln(\text{SALRY}_t) = b_0 + b_1 \ln(\text{CUREXP}_t) + b_2 \ln(\text{ENRPOP}_t) + b_3 \ln(\text{ENR}_t / \text{ENR1}_t)$$

where:

\ln indicates the natural log;

SALRY_t equals the estimated average annual salary of all full- and part-time teachers in public elementary and secondary schools in constant 1982–84 dollars in year t ;

CUREXP_t equals current expenditures of public elementary and secondary schools per pupil in fall enrollment in constant 1982–84 dollars in year t ;

ENRPOP_t equals the ratio of fall enrollment to the population in year t ;

ENR_t equals fall enrollment in year t ; and

ENR1_t equals fall enrollment in year $t-1$.

The model was estimated using the period from 1970–71 to 2001–02. The model was estimated using least squares with the AR(1) process for correcting for autocorrelation.

Due to the effects on current expenditures caused by the change in survey forms discussed above, the values for current expenditures for 1969–70 to 1987–88 were increased by 1.4 percent when the salary model was estimated.

The equations and results for this model are also shown in table A18. There is no literature for comparing the sizes of the coefficients. However, the direction of the impact each variable has on salaries is as expected: as the level of spending per pupil increases (higher CUREXP), more teachers can be hired, so demand for teachers increases and salaries may increase; as the number of students increases (higher ENRPOP and ENR/ENR1), demand for teachers may increase, so salaries may increase.

The model used in *Projections of Education Statistics to 2014* differs from those in the last two editions. In those two editions, the enrollment ratio variable was the ratio of enrollment lagged one period to enrollment lagged two periods. The models used for the five editions of *Projections of Education Statistics* before that were identical to those used in the two prior editions, except that average daily attendance was used rather than fall enrollment as the measure of enrollment, and the sample period used to produce the forecast began in 1959–60 rather than 1969–70. As with the current expenditures model, the change to fall enrollment was done because the definition of fall enrollment is more consistent across states.

Beginning with the *Projections of Education Statistics to 2006*, variables were in log form. In earlier editions, they were not.

As with current expenditures, three different scenarios are presented for teacher salaries. The same projections for ENRPOP and ENR are used for each alternative projection; the sole difference between the projections is in the projection for current expenditures. The middle alternative projection for salaries uses the middle alternative projection for current expenditures. The low alternative projection for salaries uses the low alternative projection for current expenditures. The high alternative projection for salaries uses the high alternative projection for current expenditures.

Current expenditures, average teacher salaries, and the number of teachers are interrelated; analysis was conducted to see whether the projections of these three time series were consistent.

The number of teachers was multiplied by the average salary and then divided by current expenditures for every school year from 1987–88 until 2013–14 (using the middle alternative projection for teachers, salaries, and current expenditures). The resulting value shows the portion of current expenditures that is spent on teacher salaries. The portion of current expenditures that goes toward teacher salaries has been in a slow downward trend, with the teacher salary share falling from 41 percent in 1987–88 to 36 percent in 2002–03. With the projected values, the portion of current expenditures that goes toward teacher salaries continues to fall slowly, to 33 percent in 2013–14. The results of this analysis

indicate that the projections of these three time series are consistent.

Projection Accuracy

Fourteen of the last 15 editions of *Projections of Education Statistics* contained projections of current expenditures and teacher salaries. The actual values of current expenditures and teacher salaries can be compared with the projected values in the previous editions to examine the accuracy of the models.

The projections from the various editions of *Projections of Education Statistics* were placed in 1982–84 dollars using the Consumer Price Indices that appeared in each edition.

In most of the earlier editions of *Projections of Education Statistics*, average daily attendance rather than fall enrollment was used as the measure of enrollment in the calculation of the current expenditure per pupil projection. However, projections of current expenditures per fall enrollment were presented in most of these earlier editions, and projections of fall enrollment were presented in all of these earlier editions. As a result, the projected values of both current expenditures per pupil in fall enrollment and current expenditures per pupil in average daily attendance can be compared to their respective actual values.

Similar sets of independent variables have been used in the production of the current expenditure projections presented in the last 12 editions of *Projections of Education Statistics*, including this one. The one major change is that in all the earlier editions the set of variables included the ratio of the number of students to the population. There have also been some differences in the construction of the variables. First, as noted, average daily attendance was used in most of the previous editions rather than fall enrollment. Second, in *Projections of Education Statistics to 1997–98*, calendar year data were used for disposable income, the population, and the Consumer Price Index. With the later editions, school year data were used. Third, there have been two revisions in the disposable income time series, the first affecting the *Projections of Education Statistics to 2004* and the second, *Projections of Education Statistics to 2007*. Fourth, in the more recent editions, including this one, the U.S. Bureau of the Census's July 1 number for the population has been used. In the earlier editions, an average of the quarterly values was used. Fifth, in the more recent editions, the U.S. Census Bureau's population projections have been used. In the earlier editions, the population projections came from an economic consulting firm.

There has also been a change in the estimation procedure. In the more recent editions, the AR1 model for correcting for autocorrelation was used to

estimate the model. In the earlier editions, ordinary least squares was used to estimate the model.

Several commonly used statistics can be used to evaluate projections. The values for one of these, the mean absolute percentage error (MAPE), are presented in table A2. MAPEs of expenditure projections are presented for total current expenditures, current expenditures per pupil in fall enrollment, current expenditures per pupil in average daily attendance, and teacher salaries.

To calculate the MAPEs presented in table A2, the projections of each variable were first grouped by lead time; that is, all the projections of each variable that were a given number of years from the last year in the sample period were grouped together. Next, the percent differences between each projection and its actual value were calculated. Finally, for each variable, the mean of the absolute values of the percent differences were calculated, with a separate average for each lead time. These means are the MAPEs. Table A2 contains a series of MAPEs for each dependent variable, with a different MAPE for each lead time.

For some editions of the *Projections of Education Statistics*, the first projection to be listed did not have a lead time of 1 year. For example, in *Projections of Education Statistics to 2002*, the first projection to appear was for 1990–91. This projection was calculated using a sample period ending in 1988–89, so it had a lead time of 2 years. The value that appeared for 1989–1990 was from NCES *Early Estimates*. Only those projections that appeared in an edition of *Projections of Education Statistics* were used in this evaluation.

Projections for teacher salaries also appeared in 14 of the last 15 editions of *Projections of Education Statistics*. In these earlier editions, average daily attendance rather than fall enrollment was used as the measure of enrollment. Beginning with *Projections of Education Statistics to 2006*, all the variables for the teacher salary model were placed in log form. With this change in functional form, there was also a change in the way the change in enrollment was measured.

Sources of Past and Projected Data

Data from several different sources were used to produce the projections in this report. In some instances, the time series used were made by either combining numbers from various sources or manipulating the available numbers. The sources and the methods of manipulation are described here.

The time series used for current expenditures was compiled from several different sources. For the school years ending in even numbers from 1969–70 to 1975–76, the numbers for current expenditures were taken from various issues of *Statistics of State School Systems*, published by NCES. For the school years ending in odd numbers during the 1970s, up to and

including 1976–77, the numbers were taken from various issues of *Revenues and Expenditures for Public Elementary and Secondary Education*, published by NCES. For the school years from 1977–78 until 2001–02, the data are from the NCES Common Core of Data survey and unpublished data.

For 1974–75 and 1976–77, expenditures for summer schools were subtracted from the published figures for current expenditures. The value for 1972–73 was the sum of current expenditures at the local level, expenditures for administration by state boards of education and state departments of education, and expenditures for administration by intermediate administrative units.

Note that although the data from the different sources are similar, they are not entirely consistent. Also, the NCES data beginning with 1980–81 are not entirely consistent with the earlier NCES numbers, due to differing treatments of items such as expenditures for administration by state governments and expenditures for community services.

An alternative source for current expenditures would have been the U.S. Census Bureau's F-33, which offers statistics at the district level. This level of detail was not needed, however.

For most years, the sources for the past values of average daily attendance were identical to the sources for current expenditures.

Projections for average daily attendance for the period from 2002–03 to 2013–14 were made by multiplying the projections for enrollment by the average value of the ratios of average daily attendance to the enrollment from 1990–91 to 2001–02; this average value was approximately .93.

The values for fall enrollment from 1979–80 to 2001–02 were taken from the NCES Common Core of Data survey. The projections for fall enrollment are those presented in chapter 1 of this publication.

For 1969–70 to 2001–02, the sources for revenue from state sources were the two NCES publications *Statistics of State School Systems* and *Revenues and Expenditures for Public Elementary and Secondary Education*, and the NCES Common Core of Data survey. The methods for producing the alternative projections for revenue from state sources are outlined above.

The estimates for average teacher salaries were taken from various issues of the National Education Association's *Estimates of School Statistics*. These numbers come from their annual survey of states.

The projected values for disposable income, personal taxes and nontax receipts to state and local governments, and indirect business taxes and tax accruals to state and local governments were developed using projections developed by Global Insight's U.S. Quarterly Model. Projected values of the Consumer Price Index for all urban consumers, which was used for adjusting current expenditures, teacher salaries, revenue from state sources, and the

state revenue variables, were also developed using the U.S. Quarterly Model.

The U.S. Census Bureau supplied both the historical and projected values for the population.

The values of all the variables from Global Insight were placed in school-year terms. The school-year numbers were calculated by taking the average of the last two quarters of one year and the first two quarters of the next year.

The Elementary and Secondary School Price

Index was considered as a replacement for the Consumer Price Index for placing current expenditures and teacher salaries in constant dollars. This index could not be used because the required projections of the index are not available. There are other price indexes, such as the implicit price deflator for state and local government purchases, which could have been used instead of the Consumer Price Index. These alternatives would have produced somewhat different projections.

Table A18. Equations for current expenditures per pupil in fall enrollment, estimated average annual salaries of teachers, and education revenue from state sources

Dependent variable	Equation	R ²	Durbin-Watson statistic ¹	Error distribution		Time period
				pattern ²	Rho	
Current expenditures per pupil	ln(CUREXP) = -0.5 + 0.7ln(PCI) + 0.2ln(SGRANT) (5.1) (2.5)	0.99	1.4	AR(1)	0.82 (11.2)	1969-70 to 2001-02
Estimated average annual salaries	ln(SALRY) = 7.4 + 0.8ln(CUREXP) + 0.5ln(ENRPOP) + 1.3ln(ENR/ENR1) (5.6) (2.1) (2.4)	0.96	1.58	AR(1)	0.98 (31.2)	1970-71 to 2001-02
Education revenue from state sources per capita	ln(SGRNT) = -.3 + 1.3ln(PCI) + 0.7ln(ENRPOP) (16.1) (5.0)	0.98	1.87	AR(1)	0.49 (3.0)	1971-72 to 2001-02

¹For an explanation of the Durbin-Watson statistic, see J. Johnston and J. Dinardo, *Econometric Methods*, New York: McGraw-Hill, 1996.

²AR(1) indicates that the models was estimated using least squares with the AR(1) process for correcting for first-order autocorrelation. For a general discussion of the problem of autocorrelation, and the method used to forecast when correcting for autocorrelation, see G. Judge, W. Hill, R. Griffiths, H. Lutkepohl, and T. Lee, *The Theory and Practice of Econometrics*, New York: John Wiley and Sons, 1985, pp. 315-318.

Where:

CUREXP = Current expenditures of public elementary and secondary schools per pupil in fall enrollment in constant 1982-84 dollars

SALRY = Average annual salary of teachers in public elementary and secondary schools in constant 1982-84 dollars

SGRANT = Local governments' education revenue from state sources, per capita, in constant 1982-84 dollars

PCI = Disposable income per capita in constant 2000 chained dollars

ENRPOP = Ratio of fall enrollment to the population

ENR = Fall enrollment

ENR1 = Fall enrollment lagged one period

NOTE: R² indicates the coefficient of determination. Rho measures the correlation between errors in time period t and time period t minus 1. Numbers in parentheses are t-statistics.

SOURCE: U.S. Department of Education, National Center for Education Statistics; Elementary and Secondary School Current Expenditures Model, 1969-70 through 2001-02; Elementary and Secondary Teacher Salary Model, 1970-71 through 2001-02; and Revenue Receipts from State Sources Model, 1971-72 through 2001-02. (This table was prepared October 2004.)

Expenditures of Public Degree-Granting Postsecondary Institutions

One current-fund expenditure model and one educational and general expenditure model were estimated for each of two types of degree-granting institutions—public 4-year and public 2-year. Projections are presented for public institutions only, because financial surveys of private institutions have been redesigned and there are not enough data to model with the new accounting method.

The degree-granting institution econometric models were selected on the basis of their statistical properties, such as the coefficients of determination (R^2), the t -statistics of the variables, the Durbin-Watson statistic, and residual plots. These econometric models will yield good forecasting results only if the relationships that existed among the variables in the past continue throughout the projection period.

Degree-Granting Institutions Expenditure Models

Similar econometric models were developed for the two types of public institutions, 4-year and 2-year. Each of the models presented here contains variables measuring at least two of the following three factors historically associated with the level of expenditures: (1) the state of the economy; (2) the inflation rate; and (3) enrollments. Revenues of state and local governments per capita were used to measure the state of the economy, and a dummy for years with inflation rates greater than 8 percent was used in the models for public 4-year institutions. In each model, an enrollment variable was included.

For each dependent variable, a number of alternative specifications were examined. In each case, the choice of the final specification was made after considering such factors as the coefficients of determination, the t -statistics of the variables, residual plots, and ex post mean absolute percentage errors. The final specification of each model has the dependent variables and some of the independent variables as first differences.

Public 4-Year Institutions Expenditure Models

The public 4-year institutions current-fund expenditure model is:

$$DPUTCUR4_t = b_0 + b_1DDSTREV_t + b_2DPUFTE4_t$$

$$+ b_3DUMMY_t$$

where:

$DPUTCUR4_t$ is the change from the year $t-1$ to year t in current-fund expenditures per student in full-time-equivalent (FTE) enrollment in public 4-year institutions in constant 1982–84 dollars;

$DDSTREV_t$ is the change from the year $t-2$ to year $t-1$ in the sum of personal tax and nontax receipts for state and local governments and indirect business taxes and tax accruals, excluding property taxes, for state and local governments, per capita, in constant 1982–84 dollars;

$DPUFTE4_t$ is the change from the year $t-1$ to year t in FTE enrollment in public 4-year institutions in thousands of students; and

$DUMMY_t$ is a dummy variable equaling 1 if the inflation rate in year t is greater than 8 percent and 0 otherwise.

This model and the other econometric models were estimated using a sample period from 1968–69 to 2000–01. Ordinary least squares was used to estimate all the public institution models.

The results for this model are in table A19. Each variable affects current-fund expenditures in a logical fashion. The more revenues that state and local governments receive, the more expenditures they can make for public institutions of higher education. In a year with high inflation ($DUMMY$ equals 1), current-fund expenditures in constant dollars are lower than they would have been otherwise. The more students in public 4-year institutions, the less money is available to be spent per student.

Three projections were produced: the middle alternative set of projections, the low alternative set of projections, and the high alternative set of projections. Each set of projections was based on a different set of assumptions for the revenues of state and local governments per capita. The projections for revenues of state and local governments per capita and the other economic variables used to produce the higher education expenditure projections were produced using the U.S. Quarterly Model of the economic consulting firm, Global Insight, Inc.

In the middle set of alternative projections, the revenues of state and local governments per capita

increase at rates between 1.4 percent and 5.6 percent from 2003–04 to 2013–14. In the low set of alternative projections, the revenues of state and local governments per capita increase at rates between 0.9 and 5.5 percent. In the high set of alternative projections, the revenues of state and local governments per capita increase at rates between 2.5 percent and 6.9 percent.

Projections for total current-fund expenditures were made by multiplying the projections for current-fund expenditures per student in FTE enrollment by projections for FTE enrollment. Projections were developed in 1982–84 dollars and then placed in 2002–03 dollars using projections for the Consumer Price Index. Current dollar projections were produced by multiplying the constant dollar projections by projections for the Consumer Price Index.

A model for educational and general expenditures of public 4-year institutions was developed using the same variables as the current-fund expenditure model. The model is:

$$\text{DPUED4}_t = b_0 + b_1\text{DDSTREV}_t + b_2\text{DPUFTE4}_t + b_3\text{DUMMY}_t$$

where:

DPUED4_t is the change from the year t-1 to year t in educational and general expenditures per student in FTE enrollment in public 4-year institutions in constant 1982–84 dollars.

This model is also shown in table A19.

As with current-fund expenditures, each variable affects expenditures in the expected way.

Public 2-Year Institutions Expenditure Models

The public 2-year institutions current-fund expenditure model has a form similar to the public 4-year institutions current-fund expenditure model, except that the public 2-year institutions model does not contain any inflation variables. The model is:

$$\text{DPUTCUR2}_t = b_0 + b_1\text{DDSTREV}_t + b_2\text{DPUFTE2}_t$$

where:

DPUTCUR2_t is the change from the year t-1 to year t in current-fund expenditures per student in FTE enrollment in public 2-year institutions in constant 1982–84 dollars; and

DPUFTE2_t is the change from the year t-1 to year t in

FTE enrollment in public 2-year institutions in thousands of students.

The results for this model are in table A19. Again, DDSTREV has the expected positive effect on expenditures, and the FTE enrollment variable has the expected negative impact.

The public 2-year institutions educational and general expenditure model is virtually identical to its current-fund expenditure counterpart. It is:

$$\text{DPUED2}_t = b_0 + b_1\text{DDSTREV}_t + b_2\text{DPUFTE2}_t$$

where:

DPUED2_t is the change from the year t-1 to year t in educational and general expenditures per student in FTE enrollment in public 2-year institutions in constant 1982–84 dollars.

The results of this model appear in table A19.

Projection Accuracy

The majority of editions of *Projections of Education Statistics* in the past two decades had projections of expenditures of postsecondary institutions data. The projections that appeared in recent editions of *Projections of Education Statistics* were developed using the same methodology as that presented here. Those that appeared in *Projections of Education Statistics to 2000* were produced using substantially different models.

Several commonly used statistics can be used to evaluate projections. The values for one of these, the mean absolute percentage error (MAPE), are presented in table A2. MAPEs are presented for current-fund expenditures in public 4-year and public 2-year institutions. The MAPEs were calculated using projections from the last nine editions of the *Projections of Education Statistics*.

To calculate the MAPEs, the projections of each variable were first grouped by lead time; that is, all the projections of each variable that were a given number of years from the last year in the sample period were grouped together. Next, the percent differences between each projection and its actual value were calculated. Finally, for each variable, the mean of the absolute values of the percent differences were calculated, with a separate average for each lead time. These means are the MAPEs.

Sources of Data

The current-fund expenditure data and the educational and general expenditure data are from the

Integrated Postsecondary Education Data System (IPEDS) "Finance" surveys of the National Center for Education Statistics (NCES). One manipulation of the educational and general expenditures was required. From 1968–69 to 1973–74, student-aid expenditures were a separate component of current-fund expenditures. From 1974–75 on, scholarships and fellowships have been components of educational and general expenditures. Hence, for the period 1968–69 to 1973–74, student aid was added to the published numbers for educational and general expenditures.

The full-time-equivalent (FTE) enrollment data are from the "Fall Enrollment in Colleges and Universities" surveys of NCES. The FTE enrollment figures for 1968–69, 1969–70, and 1970–71 were estimated using part-time and full-time enrollment data. FTE enrollment was derived by adding one-third of part-time enrollment to total full-time-enrollment.

Between the *Projections of Education Statistics to 2013* and this year's edition to 2014, there were some

redefinitions in Global Insight's U.S. Macro Model. In the government sector, tax receipts no longer include social insurance contributions/taxes. Total taxes are the sum of personal and corporate income taxes, and taxes on production and imports. Thus, the old total tax receipt concepts are more comparable to current total receipts than to total tax receipts. Personal tax receipts have been reduced by the shift of some receipts from taxes to personal current transfers. Receipts formerly classified as negative expenditures have been reclassified as receipts. Thus, both receipts and expenditures are higher than before. Net government saving has not changed. These changes affected the levels of the state revenue variable used in both the 2-year and 4-year current expenditure models; however, both the historical and forecast data were revised such that the data used throughout the models are consistent over time. The newly defined variables have the same desired effect on expenditures as the earlier models.

Table A19. Equations for current-fund expenditures per full-time-equivalent enrollment and educational and general expenditures per full-time-equivalent enrollment in public 4-year institutions and public 2-year institutions

Dependent variable	Equation	R ²	Durbin-Watson statistic ¹	Error distribution pattern ²	Time period
Current-fund expenditures per student in public 4-year institutions	DPUTCUR4 = 289.74 (4.48) + 2.12DDSTREV (2.33) - 1.68DPUFTE4 (-3.73) - 257DUMMY (-2.67)	0.537	1.19	AR(0)	1968–69 to 2000–01
Current-fund expenditures per student in public 2-year institutions	DPUTCUR2 = 47.94 (1.84) + 1.95DDSTREV (4.7) - 0.85DPUFTE2 (-5.54)	0.725	1.90	AR(0)	1968–69 to 2000–01
Educational and general expenditures per student in public 4-year institutions	DPUED4 = 204.97 (2.93) + 2.38DDSTREV (2.42) - 1.64DPUFTE4 (-3.35) - 223DUMMY (-2.14)	0.492	1.09	AR(0)	1968–69 to 2000–01
Educational and general expenditures per student in public 2-year institutions	DPUED2 = 41.9 (1.51) + 1.97DDSTREV (4.46) - 0.73DPUFTE2 (-4.44)	0.665	1.64	AR(0)	1968–69 to 2000–01

¹For an explanation of the Durbin-Watson statistic, see J. Johnston and J. Dinardo, *Econometric Methods*, New York: McGraw-Hill, 1996.

²AR(0) indicates that the models was estimated using least squares with no for correcting for autocorrelation. For a general discussion of the problem of autocorrelation, and the method used to forecast when correcting for autocorrelation, see G. Judge, W. Hill, R. Griffiths, H. Lutkepohl, and T. Lee, *The Theory and Practice of Econometrics*, New York: John Wiley and Sons, 1985, pp. 315–318.

Where:

DPUTCUR4 = Change from the previous year in current-fund expenditures per student in full-time-equivalent (FTE) enrollment in public 4-year institutions in constant 1982–84 dollars

DPUTCUR2 = Change from the previous year in current-fund expenditures per student in FTE enrollment in public 2-year institutions in constant 1982–84 dollars

DPUED4 = Change from the previous year in educational and general expenditures per student in FTE enrollment in public 4-year institutions in constant 1982–84 dollars

DPUED2 = Change from the previous year in educational and general expenditures per student in FTE enrollment in public 2-year institutions in constant 1982–84 dollars

DDSTREV = Change in the 2 years prior to the current year in the sum of personal tax receipts for state and local governments, and total state and local government tax

DPUFTE4 = Change from the previous year in FTE enrollment in public 4-year institutions in thousands of students

DPUFTE2 = Change from the previous year in FTE enrollment in public 2-year institutions in thousands of students

DUMMY = Dummy variable equaling 1 when the inflation rate is greater than 8 percent and 0 otherwise

SOURCE : U.S. Department of Education, National Center for Education Statistics, Higher Education Expenditure Models, 1968–69 to 2000–01. (This table was prepared October 2004.)

Appendix B
Supplementary Tables

Table B1. Annual number of births: 1946 to 2002

Calendar year	Number of births, in thousands	Calendar year	Number of births, in thousands
1946	3,426	1975	3,144
1947	3,834	1976	3,168
1948	3,655	1977	3,327
1949	3,667	1978	3,333
1950	3,645	1979	3,494
1951	3,845	1980	3,612
1952	3,933	1981	3,629
1953	3,989	1982	3,681
1954	4,102	1983	3,639
1955	4,128	1984	3,669
1956	4,244	1985	3,761
1957	4,332	1986	3,757
1958	4,279	1987	3,809
1959	4,313	1988	3,910
1950	4,307	1989	4,041
1961	4,317	1990	4,158
1962	4,213	1991	4,111
1963	4,142	1992	4,065
1964	4,070	1993	4,000
1965	3,801	1994	3,953
1966	3,642	1995	3,900
1967	3,555	1996	3,891
1968	3,535	1997	3,881
1969	3,626	1998	3,942
1970	3,739	1999	3,959
1971	3,556	2000	4,059
1972	3,258	2001	4,026
1973	3,137	2002	4,022
1974	3,160		

NOTE: Some data have been revised from previously published figures.

SOURCE: U.S. Department of Health and Human Services, National Center for Health Statistics (NCHS), Annual Summary of Births, Marriages, Divorces, and Deaths: United States, various years, National Vital Statistics Reports. (This table was prepared October 2004.)

Table B2. Actual and projected numbers for preprimary school-age populations (U.S. Census projections, Middle series): 1989 to 2014

[In thousands]

Year (July 1)	3- to 5-year-olds	3-year-olds	4-year-olds	5-year-olds
Actual				
1989	10,874	3,646	3,669	3,559
1990	11,040	3,660	3,699	3,681
1991	11,151	3,723	3,722	3,707
1992	11,346	3,824	3,790	3,732
1993	11,692	3,989	3,898	3,805
1994	12,001	4,023	4,066	3,912
1995	12,188	4,004	4,103	4,081
1996	12,141	3,936	4,086	4,119
1997	12,019	3,894	4,021	4,104
1998	11,880	3,862	3,979	4,040
1999	11,768	3,827	3,946	3,996
2000	11,681	3,815	3,915	3,951
2001	11,598	3,836	3,829	3,933
2002	11,525	3,828	3,850	3,847
Projected				
2003	11,589	3,879	3,842	3,868
2004	11,831	4,067	3,905	3,859
2005	12,062	4,073	4,075	3,914
2006	12,266	4,101	4,081	4,084
2007	12,331	4,133	4,109	4,089
2008	12,427	4,170	4,140	4,116
2009	12,534	4,209	4,177	4,148
2010	12,650	4,250	4,216	4,184
2011	12,772	4,293	4,256	4,223
2012	12,901	4,338	4,300	4,263
2013	13,033	4,381	4,345	4,307
2014	13,160	4,420	4,388	4,352

NOTE: Some data have been revised from previously published figures. Detail may not sum to totals because of rounding.

SOURCE: U.S. Department of Commerce, Bureau of the Census, *Current Population Estimates and Projections* (September 2004). (This table was prepared October 2004.)

Table B3. Actual and projected numbers for school-age populations (U.S. Census projections, Middle series), ages 5, 6, 5 to 13, and 14 to 17: 1989 to 2014

[In thousands]				
Year (July 1)	5-year-olds	6-year-olds	5- to 13-year-olds	14- to 17-year-olds
Actual				
1989	3,559	3,625	31,412	13,535
1990	3,681	3,563	32,030	13,330
1991	3,707	3,686	32,609	13,491
1992	3,732	3,715	33,199	13,775
1993	3,805	3,743	33,761	14,096
1994	3,912	3,814	34,217	14,637
1995	4,081	3,919	34,825	15,013
1996	4,119	4,088	35,375	15,443
1997	4,104	4,127	35,915	15,769
1998	4,040	4,112	36,454	15,829
1999	3,996	4,045	36,804	16,007
2000	3,951	4,017	37,038	16,092
2001	3,933	3,969	37,059	16,181
2002	3,847	3,951	36,952	16,320
Projected				
2003	3,868	3,865	36,752	16,522
2004	3,859	3,840	36,266	16,897
2005	3,914	3,869	35,968	17,175
2006	4,084	3,923	35,907	17,306
2007	4,089	4,092	35,909	17,289
2008	4,116	4,098	36,012	17,060
2009	4,148	4,124	36,186	16,801
2010	4,184	4,155	36,439	16,566
2011	4,223	4,192	36,805	16,318
2012	4,263	4,230	37,229	16,134
2013	4,307	4,271	37,670	16,023
2014	4,352	4,315	38,106	16,011

NOTE: Some data have been revised from previously published figures. Detail may not sum to totals because of rounding.

SOURCE: U.S. Department of Commerce, Bureau of the Census, *Current Population Estimates and Projections* (September 2004). (This table was prepared October 2004.)

Table B4. Actual and projected numbers for college-age populations (U.S. Census projections, Middle series), ages 18, 18 to 24, 25 to 29, 30 to 34, and 35 to 44: 1989 to 2014

[In thousands]

Year (July 1)	18-year-olds	18- to 24-year-olds	25- to 29-year-olds	30- to 34-year-olds	35- to 44-year-olds
Actual					
1989	3,888	27,378	21,690	21,759	36,494
1990	3,609	27,062	21,402	22,023	37,866
1991	3,410	26,655	21,044	22,387	39,413
1992	3,354	26,282	20,591	22,564	40,046
1993	3,455	26,102	20,146	22,646	40,975
1994	3,428	25,821	19,809	22,648	41,877
1995	3,601	25,585	19,742	22,425	42,765
1996	3,650	25,376	19,927	21,996	43,605
1997	3,780	25,574	19,960	21,494	44,282
1998	3,984	26,155	19,863	20,999	44,802
1999	3,993	26,780	19,632	20,647	45,130
2000	4,062	27,387	19,300	20,610	45,183
2001	4,056	28,009	19,015	20,750	45,098
2002	4,049	28,553	18,949	20,849	44,797
Projected					
2003	4,098	28,997	19,218	20,741	44,420
2004	4,153	29,117	19,350	20,311	43,932
2005	4,157	29,241	19,804	19,885	43,651
2006	4,233	29,372	20,360	19,493	43,378
2007	4,316	29,616	20,811	19,382	42,929
2008	4,446	29,980	21,161	19,531	42,338
2009	4,429	30,342	21,362	19,873	41,672
2010	4,356	30,565	21,426	20,310	41,168
2011	4,293	30,692	21,462	20,849	40,889
2012	4,212	30,739	21,536	21,288	40,789
2013	4,168	30,671	21,682	21,630	40,794
2014	4,122	30,478	21,929	21,828	40,829

NOTE: Some data have been revised from previously published figures. Detail may not sum to totals because of rounding.

SOURCE: U.S. Department of Commerce, Bureau of the Census, *Current Population Estimates and Projections* (September 2004). (This table was prepared October 2004.)

Table B5. Actual and projected numbers for fall enrollment in public elementary and secondary schools, change in fall enrollment, the population, and fall enrollment as a proportion of the population: 1988–89 to 2013–14

School year ending	Fall enrollment (in thousands)	Change in fall enrollment (in thousands)	Population (in millions)	Fall enrollment as a ratio of the population
Actual				
1989	40,188	180	245.0	0.164
1990	40,543	355	247.3	0.164
1991	41,217	674	250.1	0.165
1992	42,047	830	253.5	0.166
1993	42,823	776	256.9	0.167
1994	43,465	642	260.3	0.167
1995	44,111	647	263.4	0.167
1996	44,840	729	266.6	0.168
1997	45,611	771	269.7	0.169
1998	46,127	516	272.9	0.169
1999	46,539	412	276.1	0.169
2000	46,857	319	279.3	0.168
2001	47,204	346	282.4	0.167
2002	47,672	468	285.3	0.167
2003	48,202	530	288.2	0.167
Projected				
2004	48,213	11	291.0	0.166
2005	48,270	57	293.0	0.165
2006	48,375	105	295.7	0.164
2007	48,574	199	298.4	0.163
2008	48,664	89	301.1	0.162
2009	48,696	32	303.8	0.160
2010	48,740	44	306.5	0.159
2011	48,842	102	309.2	0.158
2012	49,004	162	311.8	0.157
2013	49,248	244	314.5	0.157
2014	49,584	336	317.2	0.156

NOTE: Calculations were made using unrounded numbers. Some data have been revised from previously published figures.

SOURCE: U.S. Department of Commerce, Bureau of the Census, *Current Population Estimates and Projections* (September 2004); U.S. Department of Education, National Center for Education Statistics: Common Core of Data (CCD), "State Nonfiscal Survey of Public Elementary/Secondary Education," 1988–89 through 2002–03; and Elementary and Secondary Enrollment Model, 1972–2002. (This table was prepared October 2004.)

Table B6. Actual and alternative projected numbers for macroeconomic measures of the economy: Fiscal years 1988–89 to 2013–14

School year ending	Disposable income per capita ¹	Education revenue receipts from state sources per capita ²	Consumer Price Index	Rate of change for the inflation rate
Actual				
1989	\$22,035	\$563	0.666	0.109
1990	22,317	570	0.697	0.046
1991	22,253	573	0.735	0.145
1992	22,400	566	0.759	-0.418
1993	22,634	564	0.783	-0.021
1994	22,722	562	0.803	-0.159
1995	23,193	587	0.826	0.085
1996	23,446	604	0.848	-0.043
1997	23,933	622	0.873	0.043
1998	24,802	650	0.889	-0.369
1999	25,647	679	0.903	-0.038
2000	26,262	711	0.930	0.673
2001	26,819	735	0.962	0.187
2002	27,433	741	0.979	-0.487
2003	27,768	762	1.000	0.260
Middle alternative projections				
2004	28,466	780	1.018	-0.176
2005	29,185	801	1.030	-0.349
2006	29,815	818	1.045	0.181
2007	30,746	847	1.062	0.195
2008	31,394	865	1.085	0.246
2009	31,926	878	1.108	0.038
2010	32,461	891	1.134	0.097
2011	32,981	904	1.164	0.107
2012	33,523	919	1.196	0.044
2013	34,210	941	1.228	-0.008
2014	35,019	967	1.264	0.047
Low alternative projections				
2004	28,447	779	1.018	-0.177
2005	28,994	794	1.031	-0.333
2006	29,343	802	1.047	0.312
2007	30,056	823	1.069	0.286
2008	30,496	834	1.096	0.259
2009	30,847	841	1.126	0.053
2010	31,225	849	1.158	0.048
2011	31,634	858	1.195	0.113
2012	32,049	869	1.234	0.045
2013	32,630	886	1.276	0.020
2014	33,294	908	1.321	0.033
High alternative projections				
2004	28,477	780	1.018	-0.178
2005	29,371	807	1.030	-0.359
2006	30,327	836	1.044	0.186
2007	31,479	872	1.062	0.204
2008	32,264	895	1.084	0.269
2009	32,994	915	1.108	0.041
2010	33,735	935	1.136	0.149
2011	34,377	953	1.169	0.132
2012	34,979	970	1.200	-0.037
2013	35,809	996	1.231	-0.082
2014	36,825	1,030	1.262	0.015

¹In 2002–03 dollars based on the price deflator for personal consumption expenditures, Bureau of Labor Statistics, U.S. Department of Labor.

²In 2002–03 dollars based on the Consumer Price Index for all urban consumers, Bureau of Labor Statistics, U.S. Department of Labor.

NOTE: Calculations were made using unrounded numbers. Some data have been revised from previously published figures.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Common Core of Data (CCD), "National Public Education Financial Survey," 1988–89 through 2002–03; Revenue Receipts From State Sources Model, 1971–72 through 2001–02; and Global Insight, Inc., "U.S. Quarterly Model: February 2004 Long-Term Projections." (This table was prepared October 2004.)

Table B7. Actual and alternative projected numbers for measures of state and local government revenues: Fiscal years 1988–89 to 2013–14

School year ending	Personal tax and nontax payments per capita ¹	Indirect business taxes and tax accruals per capita ¹	Tax and nontax payments per capita ¹
Actual			
1989	\$680	\$2,032	\$2,712
1990	680	2,004	2,684
1991	672	1,962	2,634
1992	676	1,988	2,664
1993	686	2,014	2,700
1994	692	2,064	2,756
1995	704	2,105	2,809
1996	723	2,140	2,863
1997	742	2,167	2,908
1998	794	2,255	3,050
1999	828	2,317	3,144
2000	881	2,403	3,284
2001	903	2,393	3,296
2002	800	2,255	3,055
2003	764	2,222	2,985
Middle alternative projections			
2004	818	2,336	3,154
2005	859	2,465	3,323
2006	883	2,532	3,415
2007	900	2,599	3,499
2008	919	2,642	3,560
2009	938	2,673	3,611
2010	962	2,716	3,678
2011	990	2,766	3,757
2012	1,020	2,820	3,840
2013	1,054	2,885	3,939
2014	1,094	2,959	4,054
Low alternative projections			
2004	817	2,333	3,150
2005	852	2,432	3,284
2006	868	2,475	3,344
2007	880	2,531	3,411
2008	892	2,556	3,448
2009	905	2,573	3,479
2010	923	2,605	3,528
2011	946	2,643	3,589
2012	970	2,682	3,652
2013	997	2,727	3,724
2014	1,028	2,785	3,813
High alternative projections			
2004	819	2,341	3,160
2005	869	2,508	3,377
2006	906	2,616	3,522
2007	931	2,702	3,633
2008	966	2,775	3,741
2009	1,004	2,835	3,839
2010	1,037	2,897	3,934
2011	1,080	2,968	4,048
2012	1,123	3,037	4,160
2013	1,177	3,144	4,321
2014	1,244	3,272	4,515

¹In 2002–03 dollars based on the Consumer Price Index for all urban consumers, Bureau of Labor Statistics, U.S. Department of Labor.

NOTE: Calculations were made using unrounded numbers. Some data have been revised from previously published figures.

SOURCE: Global Insight, Inc., "U.S. Quarterly Model: February 2004 Long-Term-Projections." (This table was prepared October 2004.)

Appendix C

Data Sources

Sources and Comparability of Data

The information in this report was obtained from many sources, including federal and state agencies, private research organizations, and professional associations. The data were collected by many methods, including surveys of a universe (such as all colleges) or of a sample, and compilations of administrative records. Care should be used when comparing data from different sources. Differences in procedures, such as timing, phrasing of questions, and interviewer training, mean that the results from the different sources are not strictly comparable. More extensive documentation of one survey's procedures than of another's does not imply more problems with the data, only that more information is available on the survey.

Accuracy of Data

The accuracy of any statistic is determined by the joint effects of “sampling” and “nonsampling” errors. Estimates based on a sample will differ from the figures that would have been obtained if a complete census had been taken using the same survey instruments, instructions, and procedures. Besides sampling errors, both of the surveys, universe and sample, are subject to errors of design, reporting, and processing, and errors due to nonresponse. To the extent possible, these nonsampling errors are kept to a minimum by methods built into the survey procedures. In general, however, the effects of nonsampling errors are more difficult to gauge than those produced by sampling variability.

Sampling Errors

The standard error is the primary measure of sampling variability. It provides a specific range—with a stated confidence—within which a given estimate would lie if a complete census had been conducted. The chances that a complete census would differ from the sample by less than the standard error are about 68 out of 100. The chances that the difference would be less than 1.65 times the standard error are about 90 out of 100. The chances that the difference would be less than 1.96 times the standard error are about 95 out of 100.

The chances that it would be less than 2.58 times as large are about 99 out of 100.

The standard error can help assess how valid a comparison between two estimates might be. The standard error of a difference between two sample estimates that are uncorrelated is approximately equal to the square root of the sum of the squared standard errors of the estimates. The standard error (se) of the difference between sample estimate “a” and sample estimate “b” is

$$se_{a-b} = (se_a^2 + se_b^2)^{1/2}$$

Note that most of the standard errors in subsequent sections and in the original documents are approximations. That is, to derive estimates of standard errors that would be applicable to a wide variety of items and could be prepared at a moderate cost, a number of approximations were required. As a result, most of the standard errors presented provide a general order of magnitude rather than the exact standard error for any specific item.

Nonsampling Errors

Both universe and sample surveys are subject to nonsampling errors. Nonsampling errors are of two kinds—random and nonrandom. Random nonsampling errors may arise when respondents or interviewers interpret questions differently, when respondents must estimate values, or when coders, keyers, and other processors handle answers differently. Nonrandom nonsampling errors result from total nonresponse (no usable data obtained for a sampled unit), partial or item nonresponse (only a portion of a response may be usable), inability or unwillingness on the part of respondents to provide information, difficulty interpreting questions, mistakes in recording or keying data, errors of collection or processing, and overcoverage or undercoverage of the target universe. Random nonresponse errors usually, but not always, result in an understatement of sampling errors and thus an overstatement of the precision of survey estimates. Because estimating the magnitude of nonsampling errors would require special experiments or access to independent data, these magnitudes are seldom available.

To compensate for suspected nonrandom errors, adjustments of the sample estimates are often made. For example, adjustments are frequently made for nonresponse, both total and partial. Imputations are usually made separately within various groups of sample members that have similar survey characteristics. Imputation for item nonresponse is usually made by substituting for a missing item the response to that item of a respondent having characteristics similar to those of the respondent.

Although the magnitude of nonsampling errors in the data used in *Projections of Education Statistics* is frequently unknown, idiosyncrasies that have been identified are noted on the appropriate tables.

Federal Agency Sources

National Center for Education Statistics (NCES)

Common Core of Data

NCES uses the Common Core of Data (CCD) survey to acquire and maintain statistical data from each of the 50 states, the District of Columbia, the Bureau of Indian Affairs, Department of Defense Dependents' Schools (overseas), and the outlying areas. Information about staff and students is collected annually at the school, local education agency or school district (LEA), and state levels. Information about revenues and expenditures is also collected at the state and LEA levels.

Data are collected for a particular school year (July 1 through June 30) via survey instruments sent to the state education agencies during the school year. States have 1 year in which to modify the data originally submitted.

Since the CCD is a universe survey, the CCD information presented in this edition of the *Projections of Education Statistics* is not subject to sampling errors. However, nonsampling errors could come from two sources—nonreturn and inaccurate reporting. Almost all of the states submit the six CCD survey instruments each year, but submissions are sometimes incomplete or too late for publication.

Understandably, when 58 education agencies compile and submit data for approximately 95,000 public schools and 17,000 local school districts, misreporting can occur. Typically, this results from varying interpretations of NCES definitions and differing recordkeeping systems. NCES attempts to minimize these errors by working closely with the state education agencies through the National Forum on Education Statistics.

The state education agencies report data to NCES from data collected and edited in their regular reporting cycles. NCES encourages the agencies to incorporate

into their own survey systems the NCES items they do not already collect so that those items will also be available for the subsequent CCD survey. Over time, this has meant fewer missing data cells in each state's response, reducing the need to impute data.

NCES subjects data from the education agencies to a comprehensive edit. Where data are determined to be inconsistent, missing, or out of range, NCES contacts the education agencies for verification. NCES-prepared state summary forms are returned to the state education agencies for verification. States are also given an opportunity to revise their state-level aggregates from the previous survey cycle.

Further information on the CCD may be obtained from

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Private School Universe Survey

The purposes of Private School Survey (PSS) data collection activities are to build an accurate and complete list of private schools to serve as a sampling frame for NCES sample surveys of private schools, and to report data on the total number of private schools, teachers, and students in the survey universe. The PSS is conducted every 2 years, with collections in the 1989–90, 1991–92, 1993–94, 1995–96, 1997–98, 1999–2000, 2001–02, and 2003–04 school years.

The PSS produces data similar to that of the CCD for public schools and can be used for public-private comparisons. The data are useful for a variety of policy and research-relevant issues, such as the growth of religiously affiliated schools, the number of private high school graduates, the length of the school year for various private schools, and the number of private school students and teachers.

The target population for the universe survey consists of all private schools in the United States that meet NCES criteria of a school (e.g., a private school is an institution that provides instruction for any of grades K through 12, has one or more teachers to give instruction, is not administered by a public agency, and is not operated in a private home). The survey universe is composed of schools identified from a variety of sources. The main source is a list frame, initially developed for the 1989–90 PSS. The list is updated regularly, matching it with lists provided by nationwide private school associations, state departments of education, and other national guides and sources that list private schools. The other source is an area frame

search in approximately 120 geographic areas, conducted by the Bureau of the Census.

Further information on the PSS may be obtained from

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Integrated Postsecondary Education Data System

The Integrated Postsecondary Education Data System (IPEDS) surveys approximately 10,000 postsecondary institutions, including universities and colleges, as well as institutions offering technical and vocational education beyond the high school level. This survey, which began in 1986, replaced the Higher Education General Information Survey (HEGIS).

IPEDS consists of several integrated components that obtain information on who provides postsecondary education (institutions), who participates in it and completes it (students), what programs are offered and what programs are completed, and both the human and financial resources involved in the provision of institutionally based postsecondary education. Specifically, these components include Institutional Characteristics, including instructional activity; Fall Enrollment, including age and residence; Completions; Finance; Staff; Salaries of Full-Time Instructional Faculty; Student Financial Aid; and Graduation Rate.

The degree-granting institutions portion of this survey is a census of colleges awarding associates or higher degrees and that were eligible to participate in Title IV financial aid programs. Prior to 1993, data from the technical and vocational institutions were collected through a sample survey. Beginning in 1993, all data were gathered in a census of all postsecondary institutions. The IPEDS tabulations developed for this edition of *Projections of Education Statistics* are based on lists of all institutions and are not subject to sampling errors.

The definition of institutions generally thought of as offering college and university education has been changed in recent years. The old standard for higher education institutions included those institutions that had courses that led to an associate degree or higher, or were accepted for credit towards those degrees. The higher education institutions were accredited by an agency or association that was recognized by the U.S. Department of Education or recognized directly by the Secretary of Education. The current category includes institutions that award associate or higher level degrees that are eligible to participate in Title IV federal

financial aid programs. The impact of this change has generally not been large. For example, tables on faculty salaries and benefits were only affected to a very small extent. Also, degrees awarded at the bachelor's level or higher were not heavily affected. Most of the data on public 4-year colleges has been affected only to a minimal extent. The impact on enrollment in public 2-year colleges was noticeable in certain states, but relatively small at the national level. The largest impact has been on private 2-year college enrollment. Overall, enrollment for all institutions was about one-half of a percent higher for degree-granting institutions compared to the total for higher education institutions.

Prior to the establishment of IPEDS in 1986, HEGIS acquired and maintained statistical data on the characteristics and operations of institutions of higher education. Implemented in 1966, HEGIS was an annual universe survey of institutions accredited at the college level by an agency recognized by the Secretary of the U.S. Department of Education. These institutions were listed in the NCES publication *Education Directory, Colleges and Universities*.

HEGIS surveys solicited information concerning institutional characteristics, faculty salaries, finances, enrollment, and degrees. Since these surveys were distributed to all higher education institutions, the data presented are not subject to sampling error. However, they are subject to nonsampling error, the sources of which varied with the survey instrument. Information concerning the nonsampling error of the enrollment and degrees surveys draws extensively on the *HEGIS Post-Survey Validation Study* conducted in 1979.

Further information on IPEDS may be obtained from

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<http://nces.ed.gov/ipeds/>

Institutional Characteristics This survey provides the basis for the universe of institutions presented in the *Directory of Postsecondary Institutions*. The survey collects basic information necessary to classify the institutions, including control, level, and kinds of programs, and information on tuition, fees, and room and board charges. Beginning in 2000, the survey collected institutional pricing data from institutions with first-time, full-time, degree/certificate-seeking undergraduate students. Unduplicated full-year enrollment counts and instructional activity are now collected on the Fall Enrollment survey. The overall response rate was 99.2 percent for Title IV degree-granting institutions in 2002.

Further information may be obtained from

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Fall Enrollment This survey has been part of the HEGIS and IPEDS series since 1966. The enrollment survey response rate is relatively high. The 2002 overall response rate was 99.6 percent for degree-granting institutions. Beginning in 2000, the data collection method was web-based, replacing the paper survey forms that had been used in past years. Imputation methods and response bias analysis for the 2001–02 survey are discussed in *Enrollment in Postsecondary Institutions, Fall 2002 and Financial Statistics, Fiscal Year 2002* (NCES 2005–168). Major sources of nonsampling error for this survey, as identified in the 1979 report, were classification problems, the unavailability of needed data, interpretation of definitions, the survey due date, and operational errors. Of these, the classification of students appears to have been the main source of error. Institutions had problems in correctly classifying first-time freshmen and other first-time students for both full-time and part-time categories. These problems occurred most often at 2-year institutions (private and public) and private 4-year institutions. In the 1977–78 HEGIS validation studies, the classification problem led to an estimated overcount of 11,000 full-time students and an undercount of 19,000 part-time students. Although the ratio of error to the grand total was quite small (less than 1 percent), the percentage of errors was as high as 5 percent for detailed student levels and even higher at certain aggregation levels.

Beginning with fall 1986, the survey system was redesigned with the introduction of IPEDS (see above). The survey allows (in alternating years) for the collection of age and residence data. In 2000, the Fall Enrollment survey collected the instructional activity and unduplicated headcount data, which are needed to compute a standardized, full-time-equivalent (FTE) enrollment statistic for the entire academic year. Starting in 2001, unduplicated headcounts by level of student, and by race/ethnicity and gender of student were also requested, as well as the total number of students in the entering class.

Further information may be obtained from

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Completions This survey was part of the HEGIS series throughout its existence. However, the degree classification taxonomy was revised in 1970–71, 1982–83, and 1991–92. Collection of degree data has been maintained through the IPEDS system.

Though information from survey years 1970–71 through 1981–82 is directly comparable, care must be taken if information before or after that period is included in any comparison. The nonresponse rate did not appear to be a significant source of nonsampling error for this survey. The return rate over the years has been high, with the degree-granting institutions response rate for the 2001–02 survey at 98.9 percent. The overall response rate for the non-degree-granting institutions was 93.2 percent in 2001–02. Because of the high return rate for the degree-granting institutions, nonsampling error caused by imputation was also minimal. Imputation methods and response bias analysis for the 2001–02 survey are discussed in *Postsecondary Institutions in the United States: Fall 2002 and Degrees and Other Awards Conferred: 2001–02* (NCES 2004–154).

The major sources of nonsampling error for this survey were differences between the NCES program taxonomy and taxonomies used by the colleges, classification of double majors, operational problems, and survey timing. In the 1979 HEGIS validation study, these sources of nonsampling error contributed to an error rate of 0.3 percent overreporting of bachelor's degrees and 1.3 percent overreporting of master's degrees. The differences, however, varied greatly among fields. Over 50 percent of the fields selected for the validation study had no errors identified. Categories of fields that had large differences were business and management, education, engineering, letters, and psychology. It was also shown that differences in proportion to the published figures were less than 1 percent for most of the selected fields that had some errors. Exceptions to these were master's and Ph.D. programs in labor and industrial relations (20 percent and 8 percent); bachelor's and master's programs in art education (3 percent and 4 percent); bachelor's and Ph.D. programs in business and commerce, and in distributive education (5 percent and 9 percent); master's programs in philosophy (8 percent); and Ph.D. programs in psychology (11 percent).

Further information on IPEDS Completions surveys may be obtained from

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Financial Statistics This survey was part of the HEGIS series and has been continued under the IPEDS system. Changes were made in the financial survey instruments in fiscal years (FY) 1976, 1982, and 1987. The FY 76 survey instrument contained numerous revisions to earlier survey forms and made direct comparisons of line items very difficult. Beginning in FY 82, Pell Grant data were collected in the categories of federal restricted grants and contracts revenues, and restricted scholarships and fellowships expenditures. The introduction of IPEDS in the FY 87 survey included several important changes to the survey instrument and data processing procedures. While these changes were significant, considerable effort has been made to present only comparable information on trends in this report and to note inconsistencies. Finance tables for this publication have been adjusted by subtracting the largely duplicative Pell Grant amounts from the later data to maintain comparability with pre-FY 82 data.

Possible sources of nonsampling error in the financial statistics include nonresponse, imputation, and misclassification. The response rate has been about 85 to 90 percent for most years. The response rate for the FY 2002 survey was 98.7 percent for degree-granting institutions. Because of the higher response rate for public colleges (99.7 percent for public 4-year and 98.5 percent for public 2-year, compared to 98.7 percent for not-for-profit 4-year and 98.4 percent for not-for-profit 2-year), it is probable that the public colleges' data are more accurate than the data for private colleges. Imputation methods and response bias analysis for the 2001–02 survey are discussed in *Enrollment in Postsecondary Institutions, Fall 2002 and Financial Statistics, Fiscal Year 2002* (NCES 2005–168).

Two general methods of imputation were used in HEGIS. If the prior year's data were available for a nonresponding institution, these data were inflated using the Higher Education Price Index and adjusted according to changes in enrollments. If no previous year's data were available, current data were used from peer institutions selected for location (state or region), control, level, and enrollment size. In most cases, estimates for nonreporting institutions in IPEDS were made using data from peer institutions.

Beginning with FY 87, the IPEDS survey system included all postsecondary institutions, but maintained comparability with earlier surveys by allowing 2- and 4-year institutions to be tabulated separately. For FY 87 through FY 91, in order to maintain comparability with

the historical time series of HEGIS institutions, data were combined from two of the three different survey forms that make up the IPEDS survey system. The vast majority of the data were tabulated from form 1, which was used to collect information from public and private not-for-profit 2- and 4-year colleges. Form 2, a condensed form, was used to gather data from 2-year for-profit institutions. Because of the differences in the data requested on the two forms, several assumptions were made about the form 2 reports so that their figures could be included in the degree-granting institutions totals.

In IPEDS, the form 2 institutions were not asked to separate appropriations from grants and contracts, nor state from local sources of funding. For the form 2 institutions, all the federal revenues were assumed to be federal grants and contracts, and all of the state and local revenues were assumed to be restricted state grants and contracts. All other form 2 sources of revenue, except for tuition and fees, and sales and services of educational activities, were included under "other." Similar adjustments were made to the expenditure accounts. The form 2 institutions reported instruction and scholarship and fellowship expenditures only. All other educational and general expenditures were allocated to academic support.

To reduce reporting error, NCES uses national standards for reporting finance statistics. These standards are contained in *College and University Business Administration: Administrative Services (1974 Edition)*, and the *Financial Accounting and Reporting Manual for Higher Education (1990 Edition)*, published by the National Association of College and University Business Officers; *Audits of Colleges and Universities* (as amended August 31, 1974), by the American Institute of Certified Public Accountants; and *HEGIS Financial Reporting Guide (1980)*, by NCES. Wherever possible, definitions and formats in the survey form are consistent with those in these four accounting texts.

Further information on IPEDS Financial Statistics surveys may be obtained from

Cathy Statham
Postsecondary Institutional Studies Program (PSD)
National Center for Education Statistics
1990 K Street NW
Washington, DC 20006
Cathy.Statham@ed.gov
<http://nces.ed.gov/ipeds/>

Bureau of the Census

Current Population Survey

Prior to July 2001, estimates of school enrollment rates, as well as social and economic characteristics of students, were based on data collected in the Census

Bureau's monthly household survey of about 50,000 dwelling units. Beginning in July 2001, this sample was expanded to 60,000 dwelling units. The monthly Current Population Survey (CPS) sample consists of 754 areas comprising 2,007 geographic areas, independent cities, and minor civil divisions throughout the 50 states and the District of Columbia. The samples are initially selected based on the decennial census files and are periodically updated to reflect new housing construction.

The monthly CPS deals primarily with labor force data for the civilian noninstitutional population (i.e., excluding military personnel and their families living on post and inmates of institutions). In addition, in October of each year, supplemental questions are asked about highest grade completed, level and grade of current enrollment, attendance status, number and type of courses, degree or certificate objective, and type of organization offering instruction for each member of the household. In March of each year, supplemental questions on income are asked. The responses to these questions are combined with answers to two questions on educational attainment: highest grade of school ever attended, and whether that grade was completed.

The estimation procedure employed for monthly CPS data involves inflating weighted sample results to independent estimates of characteristics of the civilian noninstitutional population in the United States by age, sex, and race. These independent estimates are based on statistics from decennial censuses; statistics on births, deaths, immigration, and emigration; and statistics on the population in the armed services. Generalized standard error tables are provided in the *Current Population Reports*. The data are subject to both nonsampling and sampling errors.

Caution should also be used when comparing newer data, which reflect 1990 census-based population controls, with data from March 1993 and earlier years, which reflect 1980 or earlier census-based population controls. This change in population controls had relatively little impact on summary measures, such as means, medians, and percentage distributions. It does, however, have a significant impact on levels. For example, use of 1990- based population controls results in about a 1 percent increase in the civilian noninstitutional population and in the number of families and households. Thus, estimates of levels for data collected in 1994 and later years will differ from those for earlier years by more than what could be attributed to actual changes in the population. These differences could be disproportionately greater for certain subpopulation groups than for the total population.

Further information on CPS may be obtained from

Education and Social Stratification Branch
Population Division
Bureau of the Census

U.S. Department of Commerce
Washington, DC 20233
<http://www.bls.census.gov/cps/cpsmain.htm>

School Enrollment Each October, the Current Population Survey (CPS) includes supplemental questions on the enrollment status of the population 3 years old and over, in addition to the monthly basic survey on labor force participation. Prior to 2001, the October supplement consisted of approximately 47,000 interviewed households. Beginning with the October 2001 supplement, the sample was expanded by 9,000 to a total of approximately 56,000 interviewed households. The main sources of nonsampling variability in the responses to the supplement are those inherent in the survey instrument. The question of current enrollment may not be answered accurately for various reasons. Some respondents may not know current grade information for every student in the household, a problem especially prevalent for households with members in college or in nursery school. Confusion over college credits or hours taken by a student may make it difficult to determine the year in which the student is enrolled. Problems may occur with the definition of nursery school (a group or class organized to provide educational experiences for children), where respondents' interpretations of "educational experiences" vary.

For the October 2001 basic CPS, the nonresponse rate was 6.7 percent, and for the school enrollment supplement, the nonresponse rate was an additional 3.6 percent, for a total supplement nonresponse rate of 10.1 percent.

Further information on CPS methodology may be obtained from

<http://www.bls.census.gov/cps/cpsmain.htm>

Further information on CPS "School Enrollment" may be obtained from

Education and Social Stratification Branch
Bureau of the Census
U.S. Department of Commerce
Washington, DC 20233
<http://www.census.gov/population/www/socdemo/school.html>

State Population Projections. These state population projections were prepared using a cohort-component method by which each component of population change—births, deaths, state-to-state migration flows, international in-migration, and international out-migration—was projected separately for each birth cohort by sex, race, and Hispanic origin. The basic framework was the same as in past Census Bureau projections.

Detailed components necessary to create the projections were obtained from vital statistics, administrative records, census data, and national projections.

The cohort-component method is based on the traditional demographic accounting system:

$$P_1 = P_0 + B - D + DIM - DOM + IIM - IOM$$

where:

- P_1 = population at the end of the period
- P_0 = population at the beginning of the period
- B = births during the period
- D = deaths during the period
- DIM = domestic in-migration during the period
- DOM = domestic out-migration during the period
- IIM = international in-migration during the period
- IOM = international out-migration during the period

To generate population projections with this model, the Census Bureau created separate datasets for each of these components. In general, the assumptions concerning the future levels of fertility, mortality, and international migration are consistent with the assumptions developed for the national population projections of the Census Bureau.

Once the data for each component were developed, it was a relatively straightforward process to apply the cohort-component method and produce the projections. For each projection year, the base population for each state was disaggregated into eight race and Hispanic categories (non-Hispanic White; non-Hispanic Black; non-Hispanic American Indian, Eskimo, and Aleut; non-Hispanic Asian and Pacific Islander; Hispanic White; Hispanic Black; Hispanic American Indian, Eskimo, and Aleut; and Hispanic Asian and Pacific Islander), by sex, and single year of age (ages 0 to 85+). The next step was to survive each age-sex-race-ethnic group forward 1 year using the pertinent survival rate. The internal redistribution of the population was accomplished by applying the appropriate state-to-state migration rates to the survived population in each state. The projected out-migrants were subtracted from the state of origin and added to the state of destination (as in-migrants). Next, the appropriate number of immigrants from abroad was added to each group. The population under age 1 was created by applying the appropriate age-race-ethnic-specific birth rates to females of childbearing age. The number of births by sex and race/ethnicity were survived forward and

exposed to the appropriate migration rate to yield the population under age 1. The final results of the projection process were adjusted to be consistent with the national population projections by single years of age, sex, race, and Hispanic origin. The entire process was then repeated for each year of the projection.

More information is available in the Census Bureau Population Paper Listing 47 (PPL-47) and Current Population Report P25-1131. These reports may be obtained from

Statistical Information Staff
Bureau of the Census
U.S. Department of Commerce
Washington, DC 20233
(301) 763-3030
<http://www.census.gov>

Other Sources

National Education Association

Estimates of School Statistics

The National Education Association (NEA) reports enrollment, teacher, revenue, and expenditure data in its annual publication *Estimates of School Statistics*. Each year, NEA prepares regression-based estimates of financial and other education statistics and submits them to the states for verification. Generally, about 30 states adjust these estimates based on their own data. These preliminary data are published by NEA along with revised data from previous years. States are asked to revise previously submitted data as final figures become available. The most recent publication contains all changes reported to the NEA.

Additional information is available from

National Education Association—Research
1201 16th Street NW
Washington, DC 20036
<http://www.nea.org>

Global Insight, Inc.

Global Insight, Inc. provides an information system that includes databases of economic and financial information: simulation and planning models; regular publications and special studies; data retrieval and management systems; and access to experts on economic, financial, industrial, and market activities. One service is the Global Insight Model of the U.S. Economy, which contains annual projections of U.S. economic and financial conditions, including forecasts for the federal government, incomes, population, prices

and wages, and state and local governments, over a long-term (10- to 25-year) forecast period.

Additional information is available from

Global Insight, Inc.
1000 Winter Street Suite 4300N
Waltham, MA 02451-124
<http://www.globalinsight.com/>

Appendix D

Glossary

Data Terms

Associate's degree: A degree granted for the successful completion of a subbaccalaureate program of studies, usually requiring at least 2 years (or the equivalent) of full-time college-level study. This term includes degrees granted in a cooperative or work-study program.

Average daily attendance (ADA): The aggregate attendance of a school during a reporting period (normally a school year) divided by the number of days school is in session during this period. Only days on which the pupils are under the guidance and direction of teachers should be considered days in session.

Average daily membership (ADM): The aggregate membership of a school during a reporting period (normally a school year) divided by the number of days school is in session during this period. Only days on which the pupils are under the guidance and direction of teachers should be considered as days in session. The ADM for groups of schools having varying lengths of terms is the average of the ADMs obtained for the individual schools.

Bachelor's degree: A degree granted for the successful completion of a baccalaureate program of studies, usually requiring at least 4 years (or the equivalent) of full-time college-level study. This term includes degrees granted in a cooperative or work-study program.

Classroom teacher: A staff member assigned the professional activities of instructing pupils in self-contained classes or courses, or in classroom situations. Usually expressed in full-time-equivalents.

Cohort: A group of individuals that have a statistical factor in common (e.g., year of birth).

College: A postsecondary school that offers a general or liberal arts education, usually leading to an associate's, bachelor's, master's, doctor's, or first-professional degree. Junior colleges and community colleges are included in this term.

Constant dollars: Dollar amounts that have been adjusted by means of price and cost indexes to eliminate inflationary factors and allow direct comparison across years.

Consumer Price Index (CPI): This price index measures the average change in the cost of a fixed-market basket of goods and services purchased by consumers.

Current dollars: Dollar amounts that have not been adjusted to compensate for inflation.

Current expenditures (elementary/secondary): The expenditures for operating local public schools, excluding capital outlay and interest on school debt. These expenditures include such items as salaries for school personnel, fixed charges, student transportation, school books and materials, and energy costs.

Current expenditures per pupil in average daily attendance: Current expenditures for the regular school term divided by the ADA of full-time pupils (or full-time-equivalency of pupils) during the term. See also *Current expenditures* and *Average daily attendance*.

Current-fund expenditures (higher education): Money spent to meet current operating costs, including salaries, wages, utilities, student services, public services, research libraries, scholarships and fellowships, auxiliary enterprises, hospitals, and independent operations. Excludes loans, capital expenditures, and investments.

Current Population Survey: See appendix C, Data Sources.

Degree-granting institutions: Postsecondary institutions that are eligible for Title IV federal financial aid programs and that grant an associate's or higher degree. For an institution to be eligible to participate in Title IV financial aid programs it must offer a program of at least 300 clock hours in length, have accreditation recognized by the U.S. Department of Education, have been in business for at least 2

years, and have signed a participation agreement with the Department.

Disposable income: Current income received by persons less their contributions for social insurance, personal tax, and nontax payments. It is the income available to persons for spending and saving. Nontax payments include passport fees, fines and penalties, donations, and tuitions and fees paid to schools and hospitals operated mainly by the government. See also *Personal income*.

Doctor's degree: An earned degree carrying the title of doctor. The Doctor of Philosophy degree (Ph.D.) is the highest academic degree and requires mastery within a field of knowledge and demonstrated ability to perform scholarly research. Other doctorates are awarded for fulfilling specialized requirements in professional fields, such as education (Ed.D.), musical arts (D.M.A.), business administration (D.B.A.), and engineering (D.Eng. or D.E.S.). Many doctor's degrees in both academic and professional fields require an earned master's degree as a prerequisite. First-professional degrees, such as M.D. and D.D.S., are not included under this heading.

Educational and general expenditures: The sum of current funds expenditures on instruction, research, public service, academic support, student services, institutional support, operation and maintenance of plant, and awards from restricted and unrestricted funds.

Elementary school: A school classified as elementary by state and local practice and composed of any span of grades not above grade 8. A preschool or kindergarten school is included under this heading only if it is an integral part of an elementary school or a regularly established school system.

Elementary and secondary schools: As used in this publication, includes only regular schools, that is, schools that are part of state and local school systems and also most private elementary and secondary schools, both religiously affiliated and nonsectarian. Schools not included in this term are subcollegiate departments of institutions of higher education, residential schools for exceptional children, federal schools for Indians, and federal schools on military posts and other federal installations.

Enrollment: The number of students registered in a given school unit at a given time, generally in the fall of a year.

Expenditures: Charges incurred, whether paid or unpaid, that are presumed to benefit the current fiscal year. For elementary and secondary schools, these

include all charges for current outlays plus capital outlays and interest on school debt. For institutions of higher education, these include current outlays plus capital outlays. For government, these include charges net of recoveries and other correcting transactions other than for retirement of debt, investment in securities, or extension of credit. Government expenditures include only external transactions, such as the provision of perquisites or other payments in kind. Aggregates for groups of governments exclude intergovernmental transactions.

Expenditures per pupil: Charges incurred for a particular period of time divided by a student unit of measure, such as average daily attendance or average daily membership.

First-professional degree: A degree that signifies both completion of the academic requirements for beginning practice in a given profession and a level of professional skill beyond that normally required for a bachelor's degree. This degree is based on a program requiring at least 2 academic years of work before entrance and a total of at least 6 academic years of work to complete the degree program, including both prior required college work and the professional program itself. By NCES definition, first-professional degrees are awarded in the fields of dentistry (D.D.S. or D.M.D.), medicine (M.D.), optometry (O.D.), osteopathic medicine (D.O.), pharmacy (D.Pharm.), podiatry (D.P.M.), veterinary medicine (D.V.M.), chiropractic (D.C. or D.C.M.), law (LL.B. or J.D.), and theological professions (M.Div. or M.H.L.).

First-professional enrollment: The number of students enrolled in a professional school or program that requires at least 2 years of academic college work for entrance and a total of at least 6 years for a degree. By NCES definition, first-professional enrollment includes only students in certain programs. (See *First-professional degree* for a list of programs.)

Full-time enrollment: Undergraduate—A student enrolled for 12 or more semester credits, or 12 or more quarter credits, or 24 or more contact hours a week each term. Graduate—A student enrolled for 9 or more semester credits, or 9 or more quarter credits, or a student involved in thesis or dissertation preparation that is considered full time by the institution. First-professional—As defined by the institution.

Full-time-equivalent (FTE) enrollment: For institutions of higher education, enrollment of full-time students, plus the FTE of part-time students as reported by institutions.

Full-time worker: In educational institutions, an employee whose position requires being on the job on school days throughout the school year at least the number of hours the schools are in session; for higher education, a member of an educational institution's staff who is employed full time.

Graduate: An individual who has received formal recognition for the successful completion of a prescribed program of studies.

Graduate enrollment: The number of students who hold the bachelor's or first-professional degree, or the equivalent, and who are working toward a master's or doctor's degree. First-professional students are counted separately. These enrollment data measure those students who are registered at a particular time during the fall. At some institutions, graduate enrollment also includes students who are in postbaccalaureate classes but not in degree programs.

High school: A secondary school offering the final years of high school work necessary for graduation, usually including grades 10, 11, and 12 (in a 6-3-3 plan) or grades 9, 10, 11, and 12 (in a 6-2-4 plan).

Higher education: Study beyond secondary school at an institution that offers programs terminating in an associate's, baccalaureate, or higher degree.

Higher education institutions (traditional classifications):

4-year institution: An institution legally authorized to offer and offering at least a 4-year program of college-level studies wholly or principally creditable toward a bachelor's degree. A university is a postsecondary institution that typically includes one or more graduate professional schools.

2-year institution: An institution legally authorized to offer and offering at least a 2-year program of college-level studies that terminates in an associate's degree or is principally creditable toward a baccalaureate.

See also *Degree-granting institutions* and *Postsecondary education*.

Higher Education Price Index: A price index that measures average changes in the prices of goods and services purchased by colleges and universities through current-fund expenditures and educational and general expenditures (excluding expenditures for sponsored research and auxiliary enterprises).

Instructional staff: Full-time-equivalent number of positions, not the number of individuals occupying the positions during the school year. In local schools, it includes all public elementary and secondary (junior and senior high) day-school positions that are in the nature of teaching or the improvement of the teaching-learning situation. This includes consultants or supervisors of instruction, principals, teachers, guidance personnel, librarians, psychological personnel, and other instructional staff. This excludes administrative staff, attendance personnel, clerical personnel, and junior college staff.

Master's degree: A degree awarded for successful completion of a program generally requiring 1 or 2 years of full-time college-level study beyond the bachelor's degree. One type of master's degree, including the Master of Arts degree (M.A.) and the Master of Science degree (M.S.), is awarded in the liberal arts and sciences for advanced scholarship in a subject field or discipline and demonstrated ability to perform scholarly research. A second type of master's degree is awarded for the completion of a professionally oriented program (e.g., an M.Ed. in education, an M.B.A. in business administration, an M.F.A. in fine arts, an M.M. in music, an M.S.W. in social work, or an M.P.A. in public administration). A third type of master's degree is awarded in professional fields for study beyond the first-professional degree (e.g., the Master of Laws (LL.M.) and Master of Science in various medical specializations).

Part-time enrollment: Undergraduate—A student enrolled for either 11 semester credits or less, or 11 quarter credits or less, or less than 24 contact hours a week each term. Graduate—A student enrolled for either 8 semester credits or less, or 8 quarter credits or less. First-professional—As defined by the institution.

Personal income: Current income received by persons from all sources minus their personal contributions for social insurance. Classified as "persons" are individuals (including owners of unincorporated firms), nonprofit institutions serving individuals, private trust funds, and private noninsured welfare funds. Personal income includes transfers (payments not resulting from current production) from government and business such as social security benefits, military pensions, and so forth, but excludes transfers among persons.

Postbaccalaureate enrollment: The number of graduate and first-professional students working toward advanced degrees and students enrolled in graduate-level classes but not enrolled in degree programs. See also *Graduate enrollment* and *First-professional enrollment*.

Postsecondary education: The provision of formal instructional programs with a curriculum designed primarily for students who have completed the requirements for a high school diploma or equivalent. This includes programs of an academic, vocational, and continuing professional education purpose, and excludes avocational and adult basic education programs.

Private institution: A school or institution that is controlled by an individual or agency other than a state, a subdivision of a state, or the federal government (i.e., usually supported primarily by other than public funds) and the operation of whose program rests with other than publicly elected or appointed officials.

Property tax: The sum of money collected from a tax levied against the value of property.

Public school or institution: A school or institution controlled and operated by publicly elected or appointed officials, and generally deriving its primary support from public funds.

Pupil/teacher ratio: The enrollment of pupils at a given period of time, divided by the full-time-equivalent number of classroom teachers serving these pupils during the same period.

Revenues: All funds received from external sources, net of refunds and correcting transactions. Noncash transactions such as receipt of services, commodities, or other receipts "in kind" are excluded, as are funds received from the issuance of debt, liquidation of investments, or nonroutine sale of property.

Revenue receipts: Additions to assets that do not incur an obligation that must be met at some future date and do not represent exchanges of property for money. Assets must be available for expenditures.

Salary: The total amount regularly paid or stipulated to be paid to an individual, before deductions, for personal services rendered while on the payroll of a business or organization.

School: A division of the school system consisting of students in one or more grades or other identifiable groups and organized to give instruction of a defined type. One school may share a building with another school or one school may be housed in several buildings.

Secondary instructional level: The general level of instruction provided for pupils in secondary schools

(generally covering grades 7 through 12 or 9 through 12), and any instruction of a comparable nature and difficulty provided for adults and youth beyond the age of compulsory school attendance.

Secondary school: A school including any span of grades beginning with the next grade following elementary or middle school (usually 7, 8, or 9) and ending with or below grade 12. Both junior high schools and senior high schools are included.

Senior high school: A secondary school offering the final years of high school work necessary for graduation.

Student: An individual for whom instruction is provided in an educational program under the jurisdiction of a school, school system, or other educational institution. No distinction is made between the terms "student" and "pupil," although "student" may refer to one receiving instruction at any level while "pupil" refers only to one attending school at the elementary or secondary level. The term "student" is used to include individuals at all instructional levels. A student may receive instruction in a school facility or in another location, such as at home or in a hospital. Instruction may be provided by direct student-teacher interaction or by some other approved medium, such as television, radio, telephone, or correspondence.

Tax base: The collective value of sales, assets, and income components against which a tax is levied.

Total expenditures per pupil in average daily attendance (ADA): Includes all expenditures allocable to per pupil costs divided by ADA. These allocable expenditures include current expenditures for regular school programs, interest on school debt, and capital outlay. Beginning in 1980–81, expenditures for administration by state governments were excluded and expenditures for other programs (summer schools, community colleges, and private schools) were included.

Unclassified students: Students who are not candidates for a degree or other formal award, although they are taking higher education courses for credit in regular classes with other students.

Undergraduate students: Students registered at an institution of higher education who are working in a program leading to a baccalaureate or other formal award below the baccalaureate, such as an associate's degree.

Statistical Terms

Autocorrelation: Correlation of the error terms from different observations of the same variable. Also called *serial correlation*.

Degrees of freedom: The number of free or linearly independent sample observations used in the calculation of a statistic. In a time series regression with t time periods and k independent variables including a constant term, there would be t minus k degrees of freedom.

Dependent variable: A mathematical variable whose value is determined by that of one or more other variables in a function. In regression analysis, when a random variable, y , is expressed as a function of variables x_1, x_2, \dots , plus a stochastic term, then y is known as the "dependent variable."

Double exponential smoothing: A method that takes a single smoothed average component of demand and smoothes it a second time to allow for estimation of a trend effect.

Durbin-Watson statistic: A statistic testing the independence of errors in least squares regression against the alternative of first-order serial correlation. The statistic is a simple linear transformation of the first-order serial correlation of residuals and, although its distribution is unknown, it is tested by bounding statistics that follow R. L. Anderson's distribution.

Econometrics: The quantitative examination of economic trends and relationships using statistical techniques, and the development, examination, and refinement of those techniques.

Estimate: A numerical value obtained from a statistical sample and assigned to a population parameter. The particular value yielded by an estimator in a given set of circumstances or the rule by which such particular values are calculated.

Estimating equation: An equation involving observed quantities and an unknown that serves to estimate the latter.

Estimation: Estimation is concerned with inference about the numerical value of unknown population values from incomplete data, such as a sample. If a single figure is calculated for each unknown parameter, the process is called point estimation. If an interval is calculated within which the parameter is likely, in some sense, to lie, the process is called interval estimation.

Exogenous variable: Variable for which the values are determined outside the model but that influence the model.

Exponential smoothing: A method used in time series to smooth or to predict a series. There are various forms, but all are based on the supposition that more remote history has less importance than more recent history.

First-order serial correlation: When errors in one time period are correlated directly with errors in the ensuing time period. Also called *autocorrelation*.

Forecast: An estimate of the future based on rational study and analysis of available pertinent data, as opposed to subjective prediction.

Forecast horizon: The number of time periods into the future that are forecasted. Forecasts for next year are said to have a 1-year forecast horizon.

Forecasting: Assessing the magnitude that a quantity will assume at some future point in time, as distinct from "estimation," which attempts to assess the magnitude of an already existent quantity.

Function: A mathematical correspondence that assigns exactly one element of one set to each element of the same or another set. A variable that depends on and varies with another.

Functional form: A mathematical statement of the relationship among the variables in a model.

Independent variable: In regression analysis, a random variable, y , is expressed as a function of variables x_1, x_2, \dots , plus a stochastic term, the x 's are known as "independent variables."

Interpolation: See *Linear interpolation*.

Linear interpolation: A method that allows the prediction of an unknown value if any two particular values on the same scale are known and the rate of change is assumed constant.

Lag: An event occurring at time $t + k$ ($k > 0$) is said to lag behind an event occurring at time t , the extent of the lag being k . An event occurring k time periods before another may be regarded as having a negative lag.

Mean absolute percentage error (MAPE): The average value of the absolute value of errors expressed in percentage terms.

Model: A system of postulates, data, and inferences presented as a mathematical description of a phenomenon, such as an actual system or process. The actual phenomenon is represented by the model in order to explain, predict, and control it.

Ordinary least squares (OLS): The estimator that minimizes the sum of squared residuals.

Parameter: A quantity that describes a statistical population.

Projection: In relation to a time series, an estimate of future values based on a current trend.

R²: The coefficient of determination; the square of the correlation coefficient between the dependent variable and its OLS estimate.

\bar{R}^2 (also called the adjusted R²): The coefficient of determination adjusted for the degrees of freedom.

Regression analysis: A statistical technique for investigating and modeling the relationship between variables.

Rho: A measure of the correlation coefficient between errors in time period t and time period t minus 1.

Serial correlation: Correlation of the error terms from different observations of the same variable. Also called *autocorrelation*.

Standard error of estimate: An expression for the standard deviation of the observed values about a regression line. An estimate of the variation likely to be encountered in making predictions from the regression equation.

Time series: A set of ordered observations on a quantitative characteristic of an individual or collective phenomenon taken at different points in time. Usually the observations are successive and equally spaced in time.

Time series analysis: The branch of quantitative forecasting in which data for one variable are examined for patterns of trend, seasonality, and cycle.

Variable: A quantity that may assume any one of a set of values.