Technical Appendixes

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Appendix A
Projection Methodology

Since its inception in 1964, the *Projection of Education Statistics* series has been providing projections of key education statistics to policy makers, educators, researchers, the press, and the general public. This edition, the *Projections of Education Statistics to 2018*, is the thirty-seventh in the series. It provides projections of enrollment, graduates, teachers, and expenditures.

The general methodological procedure for *Projections of Education Statistics to 2018* 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 2007. This enrollment rate was then projected through the year 2018 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.

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

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 higher smoothing constants, weights for earlier observations decrease more rapidly than for lower smoothing constants.

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 for most variables in this report are collected 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.

Multiple linear regression also is 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 equations in this appendix should be viewed as forecasting rather than structural equations, as the limitations of time and available data precluded the building of large-scale, structural models. The particular equations shown were selected on the basis of their statistical properties, such as coefficients of determination (R^2s), the t-statistics of the coefficients, the Durbin-Watson statistic, the Breusch-Godfrey Serial Correlation LM test statistic, and residual plots.

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 X will lead to a given percent change in 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 Makridakis, Wheelwright, and Hyndman (1998).

Assumptions

All projections are based on underlying assumptions, and it is important that users of projections understand these 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 A-1.

For some projections, middle, low, 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.

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.

The future fertility rate assumption along with corresponding projections of females, determine projections of the number of births, a 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 graduated from high school. 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.

The key economic factors of 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. Age-specific unemployment rates are likely to increase during a weak or pessimistic economy, with the result that the estimated opportunity costs will be lower. This will have a positive impact on higher education enrollment, as 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 can be lower than the low alternative projections in the short term. 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.

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 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 from the "U.S. Quarterly Model: November 2008: Long-Term-Projections" of the economic consulting firm IHS Global Insight. (See supplemental table B-6 for the projections of disposable income per capita.)

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. 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 over past projections in percentage terms. For example, the mean absolute percentage errors of public school enrollment in grades PK–12 for lead times of 1, 2, 5, and 10 years were 0.3, 0.6, 1.3, and 2.3 percent, respectively. For more information on mean absolute percentage errors, see table A-2.

Table A-1. Summary of forecast assumptions to 2018

Variable	Middle alternative	Low alternative	High alternative
Demographic assumptions			
Population	Projections are consistent with the Census Bureau middle series estimates[1]	Same as middle alternative	Same as middle alternative
18- to 24-year-old population	Census Bureau middle series projection: average annual growth rate of -0.3%	Same as middle alternative	Same as middle alternative
25- to 29-year-old population	Census Bureau middle series projection: average annual growth rate of 0.7%	Same as middle alternative	Same as middle alternative
30- to 34-year-old population	Census Bureau middle series projection: average annual growth rate of 1.3%	Same as middle alternative	Same as middle alternative
35- to 44-year-old population	Census Bureau middle series projection: average annual growth rate of -0.1%	Same as middle alternative	Same as middle alternative
Economic assumptions			
Disposable income per capita in constant dollars	Annual percent changes range between 0.1% and 2.9% with an annual growth rate of 1.7%	Annual percent changes range between -1.3% and 2.8% with an annual growth rate of 1.4%	Annual percent changes range between 1.2% and 3.1% with an annual growth rate of 2.0%
Education revenue receipts from state sources per capita in constant dollars	Annual percent changes range between 0.0% and 3.6% with an annual growth rate of 2.3%	Annual percent changes range between -1.7% and 3.6% with an annual growth rate of 1.8%	Annual percent changes range between 1.1% and 3.9% with an annual growth rate of 2.7%
Inflation rate	Inflation rate ranges between 0.2% and 3.7%	Inflation rate ranges between -0.7% and 3.7%	Inflation rate ranges between 1.3% and 3.7%
Unemployment rate (men)			
Ages 18 and 19	Remains between 17.2% and 26.0%	Remains between 21.2% and 28.4%	Remains between 15.2% and 23.2%
Ages 20 to 24	Remains between 9.8% and 15.5%	Remains between 12.3% and 17.2%	Remains between 8.6% and 13.6%
Age 25 and over	Remains between 3.9% and 6.5%	Remains between 5.0% and 7.3%	Remains between 3.4% and 5.6%
Unemployment rate (women)			
Ages 18 and 19	Remains between 12.9% and 18.5%	Remains between 15.0% and 19.9%	Remains between 11.5% and 16.8%
Ages 20 to 24	Remains between 7.7% and 11.4%	Remains between 9.1% and 12.4%	Remains between 6.8% and 10.3%
Age 25 and over	Remains between 3.9% and 5.8%	Remains between 4.6% and 6.4%	Remains between 3.4% and 5.2%

[1]As the Census projections were not updated to reflect 2008 Census Bureau population estimates, the Census Bureau age-specific population projections for each year were adjusted by multiplying the ratio of the total Census Bureau estimate for 2008 to the total Census Bureau projection for 2008.
NOTE: For the economic assumptions and the unemployment rate variables, the names of the three scenarios, middle, low, and high, indicate the long-run trends of the economy over the forecast period.
SOURCE: U.S. Department of Commerce, Census Bureau, Population Estimates, retrieved October 27, 2008, from http://www.census.gov/popest/national/asrh/2006_nat_af.html; and Population Projections, retrieved October 29, 2008, from http://www.census.gov/ipc/www/usinterimproj/; and IHS Global Insight, "U.S. Quarterly Model: November 2008." (This table was prepared February 2009.)

Table A-2. Mean absolute percentage errors (MAPEs), by lead time for selected statistics in all public elementary and secondary schools and degree-granting institutions: 2008

	Lead time (years)									
Statistic	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Public elementary and secondary schools										
Prekindergarten–12 enrollment	0.3	0.6	0.8	1.1	1.3	1.5	1.7	1.8	2.0	2.3
Prekindergarten–8 enrollment	0.4	0.6	0.9	1.2	1.4	1.7	2.0	2.3	2.7	3.1
9–12 enrollment	0.4	0.7	1.0	1.2	1.4	1.6	2.0	2.2	2.2	2.2
High school graduates	1.0	0.9	1.6	1.8	1.8	2.2	2.8	3.6	3.9	3.8
Elementary and secondary teachers[1]	1.0	1.5	1.8	2.5	3.2	3.3	3.9	4.4	5.5	6.1
Total current expenditures[2]	1.3	2.1	2.2	2.3	2.8	3.6	4.2	4.4	4.5	4.5
Current expenditures per pupil in fall enrollment[2]	1.3	2.0	2.1	2.3	3.1	4.0	4.6	5.2	5.8	5.8
Degree-granting institutions										
Total enrollment	1.3	2.2	2.7	3.3	4.6	6.4	8.0	9.2	9.8	10.4
Men	1.5	2.7	3.2	3.8	5.2	6.7	8.1	9.4	9.6	10.3
Women	1.4	2.2	3.0	3.2	4.2	6.2	7.9	9.0	10.0	10.4
4-year institutions	1.4	2.2	3.0	3.8	5.3	6.9	8.8	10.0	11.2	12.4
2-year institutions	2.1	3.5	4.0	4.3	4.8	5.6	6.6	7.7	7.5	6.9
Associate's degrees	2.1	3.3	3.6	5.1	6.0	7.2	9.3	11.4	13.8	15.6
Bachelor's degrees	0.9	1.9	2.9	4.1	6.0	7.7	9.1	10.2	12.0	13.5
Master's degrees	1.5	3.5	6.4	9.2	12.4	15.0	17.9	20.0	22.6	25.0
Doctor's degrees	3.4	5.5	5.4	6.6	6.1	7.2	8.4	8.2	10.3	11.9
First-professional degrees	1.3	1.7	1.7	2.7	5.1	6.0	8.3	10.0	11.4	13.8

[1]Data for teachers expressed in full-time equivalents.
[2]In 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 over past projections of the absolute values of errors expressed in percentage terms. MAPEs for PK-12 enrollments were calculated using the last 25 editions of *Projections of Education Statistics*. MAPEs for high school graduates were calculated from the past 17 editions of *Projections of Education Statistics*. MAPEs for teachers were calculated from the past 18 editions containing teachers projections and MAPEs for current expenditures were calculated using projections from the last 18 editions containing current expenditure projections. MAPEs for degree-granting institution enrollments and earned degrees were calculated using the last 11 and 12 editions, respectively. 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 December 2008.)

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 projects age-specific rates by sex and student levels.

Enrollment data for degree-granting institutions presented in this report are derived from both NCES aggregate enrollment counts and the U.S. Census Bureau age-specific enrollment counts. Specifically, the most detailed level of enrollment data (by age, sex, enrollment status, control of institution, type of institution, and level enrolled) were iteratively changed using proportions that are based on more highly aggregated NCES enrollment numbers to ensure that the sum across these most detailed level of enrollment data equal the more highly aggregated NCES enrollment numbers that do not include age.

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 younger teens. 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 A-3 shows enrollment rates for 2007 and middle alternative projected enrollment rates for 2013 and 2018. Table A-4 shows the estimated equations used to project the enrollments for men by attendance status. Table A-5 shows the estimated equations used to project enrollment rates for women by attendance status. The particular equations shown were selected on the basis of their statistical properties, such as coefficients of determination (R^2s), the t-statistics of the coefficients, the Durbin-Watson statistic, the Breusch-Godfrey Serial Correlation LM test statistic, and residual plots.

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

The second stage of EDMOD projects enrollment in public elementary and secondary schools by grade group and by organizational level. Public enrollments by age were based on enrollment rate projections for grade classifications of 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 A-6 shows the public school enrollment rates, and table A-7 shows the public school grade progression rates for 2006 and projections for 2007 through 2018. The projected rates in tables A-6 and A-7 were used to compute the projections of enrollments in elementary and secondary schools, by grade, shown in table 3.

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 2008 through 2018 are shown in tables A-8 and A-9, along with actual values for 2007. 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 A-8 and A-9 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 2008 through 2018 are shown in table A-10, along with actual percents for 2007. 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 2007 and projections for 2008 through 2018 are shown in table A-11. The projected rates in table A-11 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. The full-time-equivalent enrollment measures enrollment as if students were enrolled full time for one academic year, and equals the sum of full-time enrollment and full-time-equivalent of part-time enrollment. The full-time-equivalent of part-time enrollment was estimated as a percentage of part-time enrollment. In EDMOD, the full-time-equivalent of part-time enrollment was calculated using different percentages for enrollment category by level enrolled and by type and control of institution. Actual percents for 2007 and projections for 2008 and 2018 are shown in table A-12.

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.

College Enrollment, by Sex, Attendance Status, Age Group, and Race/Ethnicity

The fifth stage of EDMOD projects enrollments in degree-granting institutions by age, sex, attendance status, and race/ethnicity. The race/ethnicity groups projected include the following: White; Black; Hispanic; Asian or Pacific Islander; American Indian/Alaska Native; and Non-resident alien. (See Glossary for definition of race/ethnicity categories.) Enrollment projections are based on projected enrollment rates by age, sex, attendance status, and race/ethnicity 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. With the exception of American Indian/Alaska Native and Non-resident alien, all race/ethnicity groups were projected by taking into account the most recent trends, as well as the effects of economic conditions and demographic changes. Due to the nature of the historical data, American Indian/Alaska Native enrollments were projected using single exponential smoothing and Non-resident alien enrollments were projected using patterns in recent historical growth.

Enrollments by sex, race/ethnicity and age from the U.S. Census Bureau were adjusted to NCES totals by sex and race/ethnicity to compute rates for 1981 through 2007. As with the first stage of EDMOD, the fifth stage consists of age-specific enrollment models for each sex-race/ethnicity group in which enrollment rates are projected and applied to age-specific population projections by sex and race/ethnicity from the U.S. Census Bureau. The final set of projected rates by age, sex, attendance status, and race/ethnicity were controlled to the stage one enrollment rates by age, sex, and attendance status to ensure consistency across stages. Specifically, the most detailed levels of enrollment data (by age, sex, enrollment status, and race/ethnicity) were iteratively changed using proportions that are based on more highly aggregated NCES enrollment numbers to ensure that the sums across these most detailed levels of enrollment data equal the more highly aggregated NCES enrollment numbers that do not include age.

Stage five consists of 16 individual pooled time series models—one for each attendance status - sex - race/ethnicity combination—that are each pooled across age. As with the stage one postsecondary level projections, projections of full-time and part-time college enrollments by race/ethnicity were considered only for ages 16 and over. Within each model, 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. Tables A-14 through A-21 show the estimated equations used to project the enrollments for each racial/ethnic and sex category.

Accuracy of Projections

An analysis of projection errors from the past 25 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 PK–12 were 0.3, 0.6, 1.3, and 2.3 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 PK–8, the MAPEs for lead times of 1, 2, 5, and 10 years out were 0.4, 0.6, 1.4, and 3.1 percent, respectively, while those for projections of public school enrollment in grades 9–12 were 0.4, 0.7, 1.4, and 2.2 percent for the same lead times.

For projections of total enrollment in degree-granting institutions, an analysis of projection errors based on the past 10 editions of *Projections of Education Statistics* indicates that the MAPEs for lead times of 1, 2, 5, and 10 years were 1.3, 2.2, 4.6, and 10.4 percent, respectively. For the 1-year-out prediction, this means that one would expect the projection to be within 1.3 percent of the actual value, on the average. For more information on MAPEs, see table A-2, page 88.

Basic Methodology

The notation and equations that follow describe the basic models used to project public elementary and secondary enrollment (the grade progression method).[1]

Public Elementary and Secondary Enrollment

Let:

i = Subscript denoting age

j = Subscript denoting grade

t = Subscript denoting time

N_t = Enrollment at the nursery level

K_t = Enrollment at the 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

RN_t = Enrollment rate for nursery

RK_t = Enrollment rate for 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

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:

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

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

where:

$$N_t = RN_t\left(P_{5t}\right)$$

$$K_t = RK_t\left(P_{5t}\right)$$

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

[1]In the previous three editions of this report, there was an inconsistency between the methodological description and the actual methodology used to produce the projections of enrollment at the nursery and kindergarten levels. Historically, the nursery enrollment counts had been underreported by states. Due to this problem, a single parameter was used for the enrollment rate at the nursery and kindergarten levels. Some years ago there was an improvement in the source data. Hence, beginning with the *Projections of Education Statistics to 2015*, there was a change in the methodology from a single parameter to two parameters (nursery and kindergarten separate); however, the methodology section had not reflected this change. No changes have been detected in the projections due to this change in methodology.

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

$$G_{1t} = RG_{it}\left(P_{6t}\right)$$

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

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:

$$E_{ijkt} = R_{ijkt}\left(P_{ijt}\right)$$

Enrollment in Degree-Granting Institutions by Race/Ethnicity

Projections for degree-granting institutions by sex and attendance status of student were further disaggregated by race/ethnicity. 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

l = Subscript denoting race/ethnicity

E_{ijklt} = Enrollment of students age i by sex, attendance status, and race/ethnicity

P_{ijlt} = Population age i by sex and race/ethnicity

R_{ijklt} = Enrollment rate for students age i by sex, attendance status, and race/ethnicity

T_{ijklt} = Total enrollment for a particular subset of students by race/ethnicity: full-time men, full-time women, part-time men, part-time women

Then:

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

where:

$$E_{iiklt} = R_{iiklt}\left(P_{iilt}\right)$$

First-time Freshmen Enrollment in Degree-Granting Institutions

Projections of first-time freshman enrollment in degree-granting institutions were derived in the following manner. From 1975 to 2007, the ratio of first-time freshman enrollment to undergraduate enrollment was calculated for males and females. These ratios were projected using single exponential smoothing with a smoothing constant of $\alpha = 0.4$, yielding a constant value over the projection period. This constant value was then applied to projections of undergraduate enrollment by sex to yield projections of first-time freshman enrollment. This method assumes that the future pattern in the trend of first-time freshman enrollment will be the same as that for undergraduate enrollment.

Private School Enrollment

This edition is the seventh 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 biennial NCES Private School Universe Survey (PSS), which is collected in the fall of odd numbered years, were used to develop these projections. Private school enrollment data for alternate years without a PSS collection were estimated using data from the PSS. In addition, population estimates for 1989 to 2007 and population projections for 2008 to 2018 from the U.S. Census Bureau were used to develop the projections.

Prekindergarten, 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. 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. 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 2006 levels. To obtain projections of total enrollment, projections of enrollments for the individual grades (prekindergarten 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 long-term model performance. As additional data become available, MAPEs can then be calculated.

State Level

This edition contains projected trends in public elementary and secondary enrollment by grade level from 2007 to the year 2018 for each of the 50 states and the District of Columbia.

Public school enrollment data from the NCES Common Core of Data survey for 1980 to 2006 were used to develop these projections. This survey does not collect enrollment data for private schools.

Population estimates for 1980 to 2007 and population projections for 2008 to 2018 from the U.S. Census Bureau were used to develop the enrollment projections. The set of population projections used in this year's *Projections of Education Statistics to 2018* are the Census Bureau's set of interim state-level population projections (April 2005). This set of state-level projections corresponds to the Census Bureau's interim national population projections, which were released earlier in May 2004.

Table A-13 describes the number of years, projection methods, and smoothing constants used to project enrollments in public schools. Also included in table A-13 is the procedure for choosing the different smoothing constants for the time-series models. All jurisdictions were projected using the same single exponential smoothing parameter.

As with the national enrollment projections, projections of enrollment in public elementary and secondary schools by state primarily used the grade progression rate method. As with the national projections, prekindergarten, 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 2006 levels. To obtain projections of total enrollment, projections of enrollments for the individual grades (prekindergarten 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 unanticipated 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 projections of state enrollments were adjusted to sum to the national projections of public school PK–12, PK–8, and 9–12 enrollments shown in table 1. This was done through the use of ratio adjustments in which all the states' enrollment projections for each grade level were multiplied by the ratio of the national enrollment projection for that grade level to the sum of the state enrollment projections for that grade level. For details on the methods used to develop the national projections for this statistic, see the section on national enrollment projections in this appendix.

Regional Projections

For each region, the enrollment projections equaled the sum of enrollment projections within its region.

Table A-3. Actual and middle alternative projected numbers for college enrollment rates, by sex, attendance status, and age: Fall 2007, 2013, and 2018

Sex, attendance status, and age	Actual 2007	Projected	
		2013	2018
Men			
Full-time			
16 years old	0.2	0.3	0.3
17 years old	2.1	2.1	2.2
18 years old	28.4	30.5	32.1
19 years old	42.0	39.8	41.5
20 years old	32.4	34.9	36.5
21 years old	29.3	32.2	33.7
22 years old	19.4	22.1	23.3
23 years old	13.9	14.1	15.0
24 years old	12.3	11.0	11.7
25 to 29 years old	5.4	5.4	5.8
30 to 34 years old	2.3	2.5	2.7
35 to 44 years old	1.3	1.4	1.5
Part-time			
16 years old	#	0.1	0.1
17 years old	0.7	0.9	0.9
18 years old	6.5	5.6	5.5
19 years old	6.1	6.5	6.4
20 years old	8.3	7.5	7.4
21 years old	5.0	6.5	6.5
22 years old	9.5	9.6	9.6
23 years old	7.6	7.7	7.7
24 years old	7.5	7.6	7.7
25 to 29 years old	4.0	4.6	4.6
30 to 34 years old	4.3	4.3	4.4
35 to 44 years old	3.7	3.8	3.8
Women			
Full-time			
16 years old	0.5	0.5	0.5
17 years old	3.8	1.7	2.1
18 years old	44.3	44.7	49.6
19 years old	45.3	51.1	55.8
20 years old	43.9	47.1	51.7
21 years old	38.5	41.1	45.7
22 years old	22.5	25.5	29.3
23 years old	18.1	19.1	22.2
24 years old	14.5	14.5	16.3
25 to 29 years old	6.6	7.3	7.6
30 to 34 years old	3.3	3.7	4.0
35 to 44 years old	2.3	2.8	3.0
Part-time			
16 years old	0.2	0.2	0.2
17 years old	0.2	0.8	0.8
18 years old	5.3	5.5	5.4
19 years old	10.6	10.1	9.8
20 years old	12.9	11.9	11.6
21 years old	9.3	10.1	10.0
22 years old	10.7	10.9	11.1
23 years old	11.9	11.9	12.3
24 years old	11.0	11.5	12.1
25 to 29 years old	8.0	8.2	8.8
30 to 34 years old	4.7	5.1	5.5
35 to 44 years old	6.7	7.1	7.7

Rounds to zero.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System, Spring 2008; Enrollment in Degree-Granting Institutions Model, 1980–2007; and U.S. Department of Commerce, Census Bureau, Current Population Reports, "Social and Economic Characteristics of Students," 2007. (This table was prepared November 2008.)

Table A-4. Estimated equations and model statistics 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					
Intercept term for 17-year-olds	-5.92	0.268	-22.12	0.99	2.2*
Intercept term for 18-year-olds	-3.24	0.208	-15.56		
Intercept term for 19-year-olds	-2.98	0.177	-16.83		
Intercept term for 20-year-olds	-3.14	0.179	-17.60		
Intercept term for 21-year-olds	-3.26	0.181	-17.99		
Intercept term for 22-year-olds	-3.76	0.181	-20.82		
Intercept term for 23-year-olds	-4.18	0.178	-23.47		
Intercept term for 24-year-olds	-4.47	0.188	-23.82		
Intercept term for 25- to 29-year-olds	-5.27	0.201	-26.25		
Intercept term for 30- to 34-year-olds	-6.22	0.198	-31.41		
Intercept term for 35- to 44-year-olds	-6.84	0.192	-35.69		
Log of three-period weighted average of per capita disposable income in 2000 dollars, using the present period and the previous two periods	0.45	0.033	13.38		
Log unemployment rate for women	0.10	0.038	2.70		
Autocorrelation coefficient for 17-year-olds	0.73	0.090	8.14		
Autocorrelation coefficient for 18-year-olds	0.82	0.069	11.89		
Autocorrelation coefficient for 19-year-olds	0.30	0.147	2.03		
Autocorrelation coefficient for 20-year-olds	0.37	0.120	3.07		
Autocorrelation coefficient for 21-year-olds	0.49	0.130	3.74		
Autocorrelation coefficient for 22-year-olds	0.40	0.141	2.82		
Autocorrelation coefficient for 23-year-olds	0.10	0.132	0.79		
Autocorrelation coefficient for 24-year-olds	0.64	0.102	6.24		
Autocorrelation coefficient for 25- to 29-year-olds	0.78	0.073	10.67		
Autocorrelation coefficient for 30- to 34-year-olds	0.65	0.099	6.56		
Autocorrelation coefficient for 35- to 44-year-olds	0.42	0.100	4.19		
Part-time					
Intercept term for 17-year-olds	-6.52	0.785	-8.30	0.89	1.7*
Intercept term for 18-year-olds	-3.01	0.116	-25.85		
Intercept term for 19-year-olds	-2.74	0.126	-21.68		
Intercept term for 20-year-olds	-2.64	0.117	-22.51		
Intercept term for 21-year-olds	-2.76	0.118	-23.45		
Intercept term for 22-year-olds	-2.63	0.118	-22.30		
Intercept term for 23-year-olds	-2.90	0.115	-25.17		
Intercept term for 24-year-olds	-3.11	0.120	-25.81		
Intercept term for 25- to 29-year-olds	-3.19	0.115	-27.80		
Intercept term for 30- to 34-year-olds	-3.58	0.116	-30.87		
Intercept term for 35- to 44-year-olds	-3.66	0.112	-32.66		
Log of three-period weighted average of per capita disposable income in 2000 dollars, using the present period and the previous two periods	0.06	0.020	3.07		

* p<.05.

R^2 = Coefficient of determination.

D.W. statistic = Durbin-Watson statistic, a test for autocorrelation among regression residuals. For more details see Johnson, J., and Dinardo, J. (1996). *Econometric Methods*. New York: McGraw-Hill.

NOTE: The regression method used to estimate the full-time equation was the pooled seemingly unrelated regression method with a first-order autocorrelation correction. The regression method used to estimate the part-time equation was the pooled seemingly unrelated regression method. The time period used to estimate the full-time equation is from 1973 to 2007 and the number of observations is 385. The time period used to estimate the part-time equation is from 1975 to 2007 and the number of observations is 363. For additional information, see Intriligator, M.D. (1978). *Econometric Models, Techniques, & Applications*. New Jersey: Prentice-Hall, Inc., pp. 165-173.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Enrollment in Degree-Granting Institutions Model, 1973–2007. (This table was prepared February 2009.)

Table A-5. Estimated equations and model statistics 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					
Intercept term for 17-year-olds	-11.15	3.706	-3.01	0.99	2.39*
Intercept term for 18-year-olds	-6.98	0.279	-25.03		
Intercept term for 19-year-olds	-6.79	0.210	-32.37		
Intercept term for 20-year-olds	-6.96	0.204	-34.13		
Intercept term for 21-year-olds	-7.18	0.203	-35.35		
Intercept term for 22-year-olds	-7.92	0.222	-35.63		
Intercept term for 23-year-olds	-8.34	0.213	-39.09		
Intercept term for 24-year-olds	-8.62	0.205	-42.04		
Intercept term for 25- to 29-year-olds	-9.34	0.208	-44.94		
Intercept term for 30- to 34-year-olds	-10.05	0.205	-48.98		
Intercept term for 35- to 44-year-olds	-10.30	0.202	-50.93		
Log of three-period weighted average of per capita disposable income in 2000 dollars, using the present period and the previous two periods	1.22	0.047	26.05		
Log unemployment rate for women	0.23	0.061	3.73		
Autocorrelation coefficient for 17-year-olds	0.97	0.051	19.24		
Autocorrelation coefficient for 18-year-olds	0.87	0.067	12.95		
Autocorrelation coefficient for 19-year-olds	0.39	0.134	2.90		
Autocorrelation coefficient for 20-year-olds	0.39	0.137	2.87		
Autocorrelation coefficient for 21-year-olds	0.35	0.128	2.73		
Autocorrelation coefficient for 22-year-olds	0.73	0.075	9.67		
Autocorrelation coefficient for 23-year-olds	0.65	0.091	7.15		
Autocorrelation coefficient for 24-year-olds	0.36	0.110	3.24		
Autocorrelation coefficient for 25- to 29-year-olds	0.65	0.084	7.67		
Autocorrelation coefficient for 30- to 34-year-olds	0.45	0.127	3.55		
Autocorrelation coefficient for 35- to 44-year-olds	0.07	0.120	0.56		
Part-time					
Intercept term for 17-year-olds	-7.37	0.480	-15.35	0.90	2.34*
Intercept term for 18-year-olds	-4.57	0.290	-15.75		
Intercept term for 19-year-olds	-4.04	0.533	-7.57		
Intercept term for 20-year-olds	-4.26	0.321	-13.28		
Intercept term for 21-year-olds	-4.40	0.326	-13.51		
Intercept term for 22-year-olds	-4.36	0.288	-15.12		
Intercept term for 23-year-olds	-4.61	0.297	-15.53		
Intercept term for 24-year-olds	-4.72	0.324	-14.57		
Intercept term for 25- to 29-year-olds	-4.93	0.286	-17.24		
Intercept term for 30- to 34-year-olds	-5.18	0.300	-17.30		
Intercept term for 35- to 44-year-olds	-4.94	0.288	-17.17		
Log of three-period weighted average of per capita disposable income in 2000 dollars, using the present period and the previous two periods	0.40	0.051	7.97		
Autocorrelation coefficient for 17-year-olds	0.42	0.124	3.40		
Autocorrelation coefficient for 18-year-olds	0.43	0.168	2.54		
Autocorrelation coefficient for 19-year-olds	0.90	0.073	12.29		
Autocorrelation coefficient for 20-year-olds	0.66	0.128	5.18		
Autocorrelation coefficient for 21-year-olds	0.76	0.080	9.61		
Autocorrelation coefficient for 22-year-olds	0.36	0.147	2.47		
Autocorrelation coefficient for 23-year-olds	0.54	0.126	4.29		
Autocorrelation coefficient for 24-year-olds	0.78	0.097	7.99		
Autocorrelation coefficient for 25- to 29-year-olds	0.51	0.123	4.16		
Autocorrelation coefficient for 30- to 34-year-olds	0.82	0.080	10.24		
Autocorrelation coefficient for 35- to 44-year-olds	0.62	0.085	7.25		

* $p<.05$.

R^2 = Coefficient of determination.

D.W. statistic = Durbin-Watson statistic, a test for autocorrelation among regression residuals. For more details see Johnson, J., and Dinardo, J. (1996). *Econometric Methods*. New York: McGraw-Hill.

NOTE: The regression method used to estimate the full-time and part-time equations was the pooled seemingly unrelated regression method with a first-order autocorrelation correction. The time period used to estimate the equations is from 1973 to 2007. The number of observations is 385. For additional information, see Intriligator, M.D. (1978). *Econometric Models, Techniques, & Applications*. New Jersey: Prentice-Hall, Inc., pp. 165-173.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Enrollment in Degree-Granting Institutions Model, 1980–2007. (This table was prepared February 2009.)

Table A-6. Actual and projected numbers for national enrollment rates in public schools, by grade level: Fall 2006, and 2007 through 2018

Grade level	Actual 2006	Projected 2007 through 2018
Prekindergarten	26.4	26.4
Kindergarten	89.1	89.1
Grade 1	95.7	95.7
Elementary ungraded	0.5	0.5
Secondary ungraded	0.5	0.5

NOTE: 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. Projected values for 2007 through 2018 were held constant at the actual values for 2006.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Common Core of Data (CCD), "State Nonfiscal Survey of Public Elementary/Secondary Education," 2006–07; and National Elementary and Secondary Enrollment Model, 1972–2006. (This table was prepared November 2008.)

Table A-7. Actual and projected numbers for national public school grade progression rates: Fall 2006, and 2007 through 2018

Grade	Actual 2006	Projected 2007 through 2018
1 to 2	98.6	98.6
2 to 3	100.6	100.7
3 to 4	100.0	100.0
4 to 5	100.7	100.6
5 to 6	100.7	101.1
6 to 7	101.2	101.3
7 to 8	99.7	99.6
8 to 9	112.0	112.3
9 to 10	90.5	90.1
10 to 11	91.8	91.7
11 to 12	94.8	94.4

SOURCE: U.S. Department of Education, National Center for Education Statistics, Common Core of Data (CCD), "State Nonfiscal Survey of Public Elementary/Secondary Education," 2006–07; and National Elementary and Secondary Enrollment Model, 1972–2006. (This table was prepared November 2008.)

Table A-8. Actual and projected numbers for the percentage distribution of full-time students at degree-granting institutions, by sex and age group: Fall 2007, and 2008 through 2018

	Men		Women	
Age and institution type	**Actual 2007**	**Projected 2008 through 2018**	**Actual 2007**	**Projected 2008 through 2018**
18 and 19 years old				
Undergraduate, 4-year institutions	65.9	65.3	68.7	68.4
Undergraduate, 2-year institutions	33.7	34.4	31.1	31.3
Postbaccalaureate, 4-year institutions	0.4	0.3	0.2	0.3
20 and 21 years old				
Undergraduate, 4-year institutions	80.2	78.1	79.4	79.1
Undergraduate, 2-year institutions	18.3	20.0	19.0	19.0
Postbaccalaureate, 4-year institutions	1.5	1.9	1.6	2.0
22 to 24 years old				
Undergraduate, 4-year institutions	61.4	64.9	60.2	60.3
Undergraduate, 2-year institutions	18.6	16.8	17.3	17.2
Postbaccalaureate, 4-year institutions	20.0	18.3	22.5	22.5
25 to 29 years old				
Undergraduate, 4-year institutions	47.5	43.6	40.8	40.7
Undergraduate, 2-year institutions	17.3	17.8	22.1	23.5
Postbaccalaureate, 4-year institutions	35.3	38.7	37.0	35.8
30 to 34 years old				
Undergraduate, 4-year institutions	35.2	34.9	40.0	38.9
Undergraduate, 2-year institutions	24.3	21.3	28.8	31.7
Postbaccalaureate, 4-year institutions	40.5	43.8	31.3	29.4
35 years and over				
Undergraduate, 4-year institutions	39.4	40.3	41.7	40.9
Undergraduate, 2-year institutions	23.2	25.9	26.8	30.4
Postbaccalaureate, 4-year institutions	37.5	33.8	31.5	28.7

NOTE: Detail may not sum to totals because of rounding.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System, Spring 2008; Enrollment in Degree-Granting Institutions Model, 1973–2007; and U.S. Department of Commerce, Census Bureau, Current Population Reports, "Social and Economic Characteristics of Students," 2007. (This table was prepared November 2008.)

Table A-9. Actual and projected numbers for the percentage distribution of part-time students at degree-granting institutions, by sex and age group: Fall 2007, and 2008 through 2018

	Men		Women	
Institution type and age	**Actual 2007**	**Projected 2008 through 2018**	**Actual 2007**	**Projected 2008 through 2018**
18 and 19 years old				
Undergraduate, 4-year institutions	20.9	20.8	26.3	22.4
Undergraduate, 2-year institutions	79.2	79.2	73.6	77.4
Postbaccalaureate, 4-year institutions	#	#	0.1	0.2
20 and 21 years old				
Undergraduate, 4-year institutions	38.0	31.3	29.7	32.2
Undergraduate, 2-year institutions	61.3	68.1	70.2	67.1
Postbaccalaureate, 4-year institutions	0.8	0.6	0.1	0.6
22 to 24 years old				
Undergraduate, 4-year institutions	30.0	32.5	26.0	27.6
Undergraduate, 2-year institutions	64.6	59.5	58.2	59.1
Postbaccalaureate, 4-year institutions	5.4	8.0	15.8	13.4
25 to 29 years old				
Undergraduate, 4-year institutions	23.1	26.1	26.2	24.2
Undergraduate, 2-year institutions	53.1	52.7	50.9	52.7
Postbaccalaureate, 4-year institutions	23.7	21.1	22.9	23.2
30 to 34 years old				
Undergraduate, 4-year institutions	19.8	22.1	25.0	24.0
Undergraduate, 2-year institutions	55.6	50.5	50.9	51.8
Postbaccalaureate, 4-year institutions	24.6	27.4	24.1	24.2
35 years and over				
Undergraduate, 4-year institutions	28.9	24.6	24.7	23.8
Undergraduate, 2-year institutions	44.2	48.7	50.9	51.7
Postbaccalaureate, 4-year institutions	26.9	26.8	24.4	24.5

Rounds to zero.
NOTE: Detail may not sum to totals because of rounding.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System, Spring 2008; Enrollment in Degree-Granting Institutions Model, 1973–2007; and U.S. Department of Commerce, Census Bureau, Current Population Reports, "Social and Economic Characteristics of Students," 2007. (This table was prepared January 2009.)

Table A-10. Actual and projected numbers for enrollment in public degree-granting institutions as a percent of total enrollment, by sex, attendance status, level enrolled, and type of institution: Fall 2007, and 2008 through 2018

	Men		Women	
Enrollment category	Actual 2007	Projected 2008 through 2018	Actual 2007	Projected 2008 through 2018
Full-time, undergraduate, 4-year institutions	65.6	65.8	62.1	63.0
Part-time, undergraduate, 4-year institutions	70.6	70.5	67.2	67.5
Full-time, undergraduate, 2-year institutions	92.3	91.8	89.4	89.6
Part-time, undergraduate, 2-year institutions	99.2	99.2	98.7	98.7
Full-time, postbaccalaureate, 4-year institutions	49.6	49.6	47.5	47.5
Part-time, postbaccalaureate, 4-year institutions	53.3	53.3	55.1	55.1

SOURCE: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System, Spring 2008; and Enrollment in Degree-Granting Institutions Model, 1973–2007. (This table was prepared January 2009.)

Table A-11. Actual and projected numbers for graduate enrollment in degree-granting institutions as a percent of total postbaccalaureate enrollment, by sex, attendance status, and control of institution: Fall 2007, and 2008 through 2018

	Men		Women	
Enrollment category	Actual 2007	Projected 2008 through 2018	Actual 2007	Projected 2008 through 2018
Full-time, 4-year, public	79.2	79.2	81.2	81.2
Part-time, 4-year, public	98.7	98.7	99.2	99.2
Full-time, 4-year, private	70.5	70.5	79.4	79.4
Part-time, 4-year, private	92.7	92.7	96.4	96.4

NOTE: Projected values for 2008 through 2018 were held constant at the actual values for 2007.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System, Spring 2008; and Enrollment in Degree-Granting Institutions Model, 1973–2007. (This table was prepared January 2009.)

Table A-12. Actual and projected numbers for full-time-equivalent enrollment of part-time students in degree-granting institutions as a percent of part-time enrollment, by type and control of institution, and level enrolled: Fall 2007, and 2008 through 2018

Enrollment category	Actual 2007	Projected 2008 through 2018
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	60.0	59.9
Private, 4-year, first-professional	54.6	54.6

NOTE: Projected values for 2008 through 2018 were held constant at the actual values for 2007.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System, Spring 2008; and Enrollment in Degree-Granting Institutions Model, 1973–2007. (This table was prepared January 2009.)

Table A-13. 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 (1972–2006)	Projection method	Smoothing constant	Basis for smoothing constant
Grade progression rates	34	Single exponential smoothing	0.4	Empirical research
Graduates divided by grade 12 enrollment	34	Single exponential smoothing	0.4	Empirical research

SOURCE: U.S. Department of Education, National Center for Education Statistics, State Public Elementary and Secondary Enrollment Model, 1972–2006; and State Public High School Graduates Model, 1972–73 through 2005–06. (This table was prepared November 2008.)

Table A-14. Estimated equations and model statistics for full-time and part-time college enrollment rates of White men

Independent variable	Coefficient	Standard error	T-statistic	R^2	D.W. statistic
Full-time					
Intercept term for 17-year-olds	-7.99	0.163	-48.93	0.99	1.67*
Intercept term for 18-year-olds	-5.02	0.134	-37.55		
Intercept term for 19-year-olds	-4.78	0.130	-36.65		
Intercept term for 20-year-olds	-5.00	0.131	-38.28		
Intercept term for 21-year-olds	-5.13	0.131	-39.25		
Intercept term for 22-year-olds	-5.64	0.133	-42.48		
Intercept term for 23-year-olds	-6.15	0.131	-46.98		
Intercept term for 24-year-olds	-6.52	0.132	-49.20		
Intercept term for 25- to 29-year-olds	-7.43	0.131	-56.74		
Intercept term for 30- to 34-year-olds	-8.48	0.134	-63.14		
Intercept term for 35- to 44-year-olds	-9.10	0.137	-66.40		
Log of White per capita disposable income in current dollars	0.23	0.007	33.78		
Part-time					
Intercept term for 17-year-olds	-6.07	0.870	-6.97	0.99	1.74*
Intercept term for 18-year-olds	-1.67	0.125	-13.38		
Intercept term for 19-year-olds	-1.38	0.135	-10.20		
Intercept term for 20-year-olds	-1.31	0.122	-10.77		
Intercept term for 21-year-olds	-1.44	0.125	-11.49		
Intercept term for 22-year-olds	-1.37	0.125	-10.88		
Intercept term for 23-year-olds	-1.62	0.120	-13.53		
Intercept term for 24-year-olds	-1.82	0.123	-14.81		
Intercept term for 25- to 29-year-olds	-1.93	0.118	-16.29		
Intercept term for 30- to 34-year-olds	-2.36	0.121	-19.54		
Intercept term for 35- to 44-year-olds	-2.41	0.116	-20.88		
Log of real total private compensation employment cost index	1.15	0.150	7.66		

* $p<.05$.

R^2 = Coefficient of determination.

D.W. statistic = Durbin-Watson statistic, a test for autocorrelation among regression residuals. For more details see Johnson, J., and Dinardo, J. (1996). *Econometric Methods*. New York: McGraw-Hill.

NOTE: The regression method used to estimate the full-time and part-time equations was the pooled seemingly unrelated regression method. The time period used to estimate the equations is from 1980 to 2007. The number of observations is 308. For additional information, see Intriligator, M.D. (1978). *Econometric Models, Techniques, & Applications*. New Jersey: Prentice-Hall, Inc., pp. 165-173. Race categories exclude persons of Hispanic ethnicity.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Enrollment in Degree-Granting Institutions by Race/Ethnicity Model, 1980–2007. (This table was prepared February 2009.)

Table A-15. Estimated equations and model statistics for full-time and part-time college enrollment rates of White women

Independent variable	Coefficient	Standard error	T-statistic	R^2	D.W. statistic
Full-time					
Intercept term for 17-year-olds	-12.67	0.265	-47.90	0.99	1.84*
Intercept term for 18-year-olds	-9.76	0.245	-39.85		
Intercept term for 19-year-olds	-9.64	0.243	-39.60		
Intercept term for 20-year-olds	-9.90	0.244	-40.62		
Intercept term for 21-year-olds	-10.16	0.244	-41.68		
Intercept term for 22-year-olds	-10.95	0.246	-44.47		
Intercept term for 23-year-olds	-11.44	0.245	-46.69		
Intercept term for 24-year-olds	-11.74	0.244	-48.10		
Intercept term for 25- to 29-year-olds	-12.65	0.244	-51.85		
Intercept term for 30- to 34-year-olds	-13.35	0.244	-54.68		
Intercept term for 35- to 44-year-olds	-13.54	0.244	-55.52		
Log of White per capita disposable income in current dollars	0.49	0.013	39.19		
Part-time					
Intercept term for 17-year-olds	-8.77	0.415	-21.15	0.77	1.79*
Intercept term for 18-year-olds	-4.85	0.258	-18.79		
Intercept term for 19-year-olds	-4.53	0.262	-17.26		
Intercept term for 20-year-olds	-4.49	0.259	-17.31		
Intercept term for 21-year-olds	-4.70	0.259	-18.13		
Intercept term for 22-year-olds	-4.63	0.257	-18.06		
Intercept term for 23-year-olds	-4.91	0.257	-19.10		
Intercept term for 24-year-olds	-5.07	0.258	-19.64		
Intercept term for 25- to 29-year-olds	-5.20	0.254	-20.46		
Intercept term for 30- to 34-year-olds	-5.53	0.256	-21.60		
Intercept term for 35- to 44-year-olds	-5.22	0.254	-20.52		
Log of White per capita disposable income in current dollars	0.14	0.013	10.35		

* p<.05.

R^2 = Coefficient of determination.

D.W. statistic = Durbin-Watson statistic, a test for autocorrelation among regression residuals. For more details see Johnson, J., and Dinardo, J. (1996). *Econometric Methods*. New York: McGraw-Hill.

NOTE: The regression method used to estimate the full-time and part-time equations was the pooled seemingly unrelated regression method. The time period used to estimate the equations is from 1980 to 2007. The number of observations is 308. For additional information, see Intriligator, M.D. (1978). *Econometric Models, Techniques, & Applications*. New Jersey: Prentice-Hall, Inc., pp. 165-173. Race categories exclude persons of Hispanic ethnicity.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Enrollment in Degree-Granting Institutions by Race/Ethnicity Model, 1980–2007. (This table was prepared February 2009.)

Table A-16. Estimated equations and model statistics for full-time and part-time college enrollment rates of Black men

Independent variable	Coefficient	Standard error	T-statistic	R^2	D.W. statistic
Full-time					
Intercept term for 17-year-olds	-9.54	0.430	-22.17	0.97	1.93*
Intercept term for 18-year-olds	-7.33	0.423	-17.32		
Intercept term for 19-year-olds	-7.07	0.423	-16.74		
Intercept term for 20-year-olds	-7.18	0.423	-16.97		
Intercept term for 21-year-olds	-7.44	0.423	-17.56		
Intercept term for 22-year-olds	-7.64	0.425	-17.98		
Intercept term for 23-year-olds	-8.09	0.429	-18.85		
Intercept term for 24-year-olds	-8.31	0.425	-19.56		
Intercept term for 25- to 29-year-olds	-9.13	0.426	-21.46		
Intercept term for 30- to 34-year-olds	-9.95	0.432	-23.05		
Intercept term for 35- to 44-year-olds	-10.32	0.428	-24.12		
Log of Black per capita disposable income in current dollars	0.31	0.023	13.51		
Part-time					
Intercept term for 17-year-olds	-11.37	0.918	-12.39	0.55	1.97*
Intercept term for 18-year-olds	-9.12	0.431	-21.18		
Intercept term for 19-year-olds	-8.40	0.414	-20.31		
Intercept term for 20-year-olds	-8.28	0.409	-20.22		
Intercept term for 21-year-olds	-8.28	0.399	-20.72		
Intercept term for 22-year-olds	-8.15	0.415	-19.61		
Intercept term for 23-year-olds	-8.59	0.418	-20.57		
Intercept term for 24-year-olds	-8.63	0.410	-21.03		
Intercept term for 25- to 29-year-olds	-8.65	0.399	-21.66		
Intercept term for 30- to 34-year-olds	-8.84	0.397	-22.26		
Intercept term for 35- to 44-year-olds	-8.92	0.394	-22.62		
Log of Black per capita disposable income in current dollars	0.29	0.021	13.54		

* $p<.05$.

R^2 = Coefficient of determination.

D.W. statistic = Durbin-Watson statistic, a test for autocorrelation among regression residuals. For more details see Johnson, J., and Dinardo, J. (1996). *Econometric Methods*. New York: McGraw-Hill.

NOTE: The regression method used to estimate the full-time and part-time equations was the pooled seemingly unrelated regression method. The time period used to estimate the equations is from 1980 to 2007. The number of observations is 308. For additional information, see Intriligator, M.D. (1978). *Econometric Models, Techniques, & Applications*. New Jersey: Prentice-Hall, Inc., pp. 165-173. Race categories exclude persons of Hispanic ethnicity.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Enrollment in Degree-Granting Institutions by Race/Ethnicity Model, 1980–2007. (This table was prepared February 2009.)

Table A-17. Estimated equations and model statistics for full-time and part-time college enrollment rates of Black women

Independent variable	Coefficient	Standard error	T-statistic	R^2	D.W. statistic
Full-time					
Intercept term for 17-year-olds	-14.12	0.623	-22.67	0.97	1.86*
Intercept term for 18-year-olds	-12.03	0.616	-19.52		
Intercept term for 19-year-olds	-11.81	0.616	-19.18		
Intercept term for 20-year-olds	-12.10	0.616	-19.63		
Intercept term for 21-year-olds	-12.21	0.616	-19.84		
Intercept term for 22-year-olds	-12.75	0.616	-20.69		
Intercept term for 23-year-olds	-12.95	0.617	-20.99		
Intercept term for 24-year-olds	-13.21	0.617	-21.41		
Intercept term for 25- to 29-year-olds	-14.12	0.618	-22.85		
Intercept term for 30- to 34-year-olds	-14.59	0.616	-23.69		
Intercept term for 35- to 44-year-olds	-14.97	0.616	-24.28		
Log of Black per capita disposable income in current dollars	0.60	0.033	17.89		
Part-time					
Intercept term for 17-year-olds	-13.76	0.705	-19.53	0.50	1.80*
Intercept term for 18-year-olds	-11.50	0.615	-18.70		
Intercept term for 19-year-olds	-11.26	0.613	-18.37		
Intercept term for 20-year-olds	-11.18	0.613	-18.25		
Intercept term for 21-year-olds	-11.22	0.613	-18.29		
Intercept term for 22-year-olds	-10.97	0.614	-17.87		
Intercept term for 23-year-olds	-11.15	0.614	-18.18		
Intercept term for 24-year-olds	-11.49	0.615	-18.68		
Intercept term for 25- to 29-year-olds	-11.49	0.607	-18.94		
Intercept term for 30- to 34-year-olds	-11.61	0.607	-19.11		
Intercept term for 35- to 44-year-olds	-11.48	0.606	-18.93		
Log of Black per capita disposable income in current dollars	0.47	0.033	14.29		

* p<.05.

R^2 = Coefficient of determination.

D.W. statistic = Durbin-Watson statistic, a test for autocorrelation among regression residuals. For more details see Johnson, J., and Dinardo, J. (1996). *Econometric Methods*. New York: McGraw-Hill.

NOTE: The regression method used to estimate the full-time and part-time equations was the pooled seemingly unrelated regression method. The time period used to estimate the equations is from 1980 to 2007. The number of observations is 308. For additional information, see Intriligator, M.D. (1978). *Econometric Models, Techniques, & Applications*. New Jersey: Prentice-Hall, Inc., pp. 165-173. Race categories exclude persons of Hispanic ethnicity.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Enrollment in Degree-Granting Institutions by Race/Ethnicity Model, 1980–2007. (This table was prepared February 2009.)

Table A-18. Estimated equations and model statistics for full-time and part-time college enrollment rates of Hispanic men

Independent variable	Coefficient	Standard error	T-statistic	R^2	D.W. statistic
Full-time					
Intercept term for 17-year-olds	-10.14	0.539	-18.83	0.94	1.95*
Intercept term for 18-year-olds	-8.18	0.530	-15.43		
Intercept term for 19-year-olds	-7.96	0.530	-15.02		
Intercept term for 20-year-olds	-8.19	0.530	-15.46		
Intercept term for 21-year-olds	-8.38	0.533	-15.71		
Intercept term for 22-year-olds	-8.88	0.533	-16.67		
Intercept term for 23-year-olds	-9.12	0.533	-17.12		
Intercept term for 24-year-olds	-9.22	0.532	-17.34		
Intercept term for 25- to 29-year-olds	-10.11	0.533	-18.95		
Intercept term for 30- to 34-year-olds	-10.88	0.533	-20.40		
Intercept term for 35- to 44-year-olds	-11.43	0.539	-21.22		
Log of Hispanic per capita disposable income in current dollars	0.34	0.029	11.71		
Part-time					
Intercept term for 17-year-olds	-10.86	0.949	-11.45	0.62	1.89*
Intercept term for 18-year-olds	-7.97	0.463	-17.21		
Intercept term for 19-year-olds	-7.85	0.470	-16.71		
Intercept term for 20-year-olds	-7.66	0.461	-16.60		
Intercept term for 21-year-olds	-7.73	0.463	-16.70		
Intercept term for 22-year-olds	-7.84	0.462	-16.97		
Intercept term for 23-year-olds	-8.07	0.474	-17.05		
Intercept term for 24-year-olds	-8.26	0.466	-17.73		
Intercept term for 25- to 29-year-olds	-8.42	0.453	-18.59		
Intercept term for 30- to 34-year-olds	-8.85	0.455	-19.43		
Intercept term for 35- to 44-year-olds	-8.88	0.453	-19.61		
Log of Hispanic per capita disposable income in current dollars	0.27	0.025	11.05		

* p<.05.

R^2 = Coefficient of determination.

D.W. statistic = Durbin-Watson statistic, a test for autocorrelation among regression residuals. For more details see Johnson, J., and Dinardo, J. (1996). *Econometric Methods*. New York: McGraw-Hill.

NOTE: The regression method used to estimate the full-time and part-time equations was the pooled seemingly unrelated regression method. The time period used to estimate the equations is from 1980 to 2007. The number of observations is 308. For additional information, see Intriligator, M.D. (1978). *Econometric Models, Techniques, & Applications*. New Jersey: Prentice-Hall, Inc., pp. 165-173.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Enrollment in Degree-Granting Institutions by Race/Ethnicity Model, 1980–2007. (This table was prepared February 2009.)

Table A-19. Estimated equations and model statistics for full-time and part-time college enrollment rates of Hispanic women

Independent variable	Coefficient	Standard error	T-statistic	R^2	D.W. statistic
Full-time					
Intercept term for 17-year-olds	-16.64	0.469	-35.49	0.95	1.94*
Intercept term for 18-year-olds	-14.18	0.445	-31.85		
Intercept term for 19-year-olds	-14.08	0.442	-31.83		
Intercept term for 20-year-olds	-14.42	0.444	-32.48		
Intercept term for 21-year-olds	-14.54	0.444	-32.77		
Intercept term for 22-year-olds	-15.20	0.448	-33.94		
Intercept term for 23-year-olds	-15.40	0.445	-34.58		
Intercept term for 24-year-olds	-15.78	0.452	-34.94		
Intercept term for 25- to 29-year-olds	-16.51	0.443	-37.29		
Intercept term for 30- to 34-year-olds	-17.17	0.447	-38.40		
Intercept term for 35- to 44-year-olds	-17.50	0.451	-38.80		
Log of Hispanic per capita disposable income in current dollars	0.70	0.024	29.04		
Part-time					
Intercept term for 17-year-olds	-14.86	0.513	-28.98	0.75	1.97*
Intercept term for 18-year-olds	-12.66	0.397	-31.91		
Intercept term for 19-year-olds	-12.43	0.390	-31.89		
Intercept term for 20-year-olds	-12.60	0.398	-31.64		
Intercept term for 21-year-olds	-12.50	0.397	-31.49		
Intercept term for 22-year-olds	-12.67	0.397	-31.94		
Intercept term for 23-year-olds	-12.69	0.393	-32.31		
Intercept term for 24-year-olds	-13.10	0.401	-32.65		
Intercept term for 25- to 29-year-olds	-13.20	0.384	-34.42		
Intercept term for 30- to 34-year-olds	-13.56	0.384	-35.29		
Intercept term for 35- to 44-year-olds	-13.43	0.382	-35.12		
Log of Hispanic per capita disposable income in current dollars	0.55	0.021	26.62		

* $p<.05$.

R^2 = Coefficient of determination.

D.W. statistic = Durbin-Watson statistic, a test for autocorrelation among regression residuals. For more details see Johnson, J., and Dinardo, J. (1996). *Econometric Methods*. New York: McGraw-Hill.

NOTE: The regression method used to estimate the full-time and part-time equations was the pooled seemingly unrelated regression method. The time period used to estimate the equations is from 1980 to 2007. The number of observations is 308. For additional information, see Intriligator, M.D. (1978). *Econometric Models, Techniques, & Applications*. New Jersey: Prentice-Hall, Inc., pp. 165-173.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Enrollment in Degree-Granting Institutions by Race/Ethnicity Model, 1980–2007. (This table was prepared February 2009.)

Table A-20. Estimated equations and model statistics for full-time and part-time college enrollment rates of Asian/Pacific Islander men

Independent variable	Coefficient	Standard error	T-statistic	R^2	D.W. statistic
Full-time					
Intercept term for 17-year-olds	-8.55	0.445	-14.87	0.90	1.93*
Intercept term for 18-year-olds	-5.65	0.424	-10.11		
Intercept term for 19-year-olds	-5.42	0.428	-9.69		
Intercept term for 20-year-olds	-5.58	0.424	-9.94		
Intercept term for 21-year-olds	-5.57	0.426	-9.87		
Intercept term for 22-year-olds	-5.80	0.434	-10.48		
Intercept term for 23-year-olds	-6.16	0.427	-10.88		
Intercept term for 24-year-olds	-6.47	0.430	-11.46		
Intercept term for 25- to 29-year-olds	-7.35	0.425	-13.19		
Intercept term for 30- to 34-year-olds	-8.34	0.427	-14.98		
Intercept term for 35- to 44-year-olds	-9.17	0.430	-16.47		
Log of Asian/Pacific Islander per capita disposable income in current dollars	0.27	0.022	12.57		
Part-time					
Intercept term for 17-year-olds	-6.81	1.520	-4.48	0.66	2.07*
Intercept term for 18-year-olds	-4.19	0.926	-4.53		
Intercept term for 19-year-olds	-3.42	0.922	-3.71		
Intercept term for 20-year-olds	-3.55	0.928	-3.83		
Intercept term for 21-year-olds	-3.69	0.929	-3.97		
Intercept term for 22-year-olds	-3.37	0.954	-3.53		
Intercept term for 23-year-olds	-3.67	0.924	-3.97		
Intercept term for 24-year-olds	-4.09	0.922	-4.44		
Intercept term for 25- to 29-year-olds	-4.34	0.912	-4.75		
Intercept term for 30- to 34-year-olds	-4.82	0.911	-5.29		
Intercept term for 35- to 44-year-olds	-5.23	0.912	-5.74		
Log of Asian/Pacific Islander per capita disposable income in current dollars	0.10	0.047	2.15		

* p<.05.

R^2 = Coefficient of determination.

D.W. statistic = Durbin-Watson statistic, a test for autocorrelation among regression residuals. For more details see Johnson, J., and Dinardo, J. (1996). *Econometric Methods*. New York: McGraw-Hill.

NOTE: The regression method used to estimate the full-time and part-time equations was the pooled seemingly unrelated regression method. The time period used to estimate the equations is from 1989 to 2007. The number of observations is 209. For additional information, see Intriligator, M.D. (1978). *Econometric Models, Techniques, & Applications*. New Jersey: Prentice-Hall, Inc., pp. 165-173. Race categories exclude persons of Hispanic ethnicity.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Enrollment in Degree-Granting Institutions by Race/Ethnicity Model, 1980–2007. (This table was prepared February 2009.)

Table A-21. Estimated equations and model statistics for full-time and part-time college enrollment rates of Asian/Pacific Islander women

Independent variable	Coefficient	Standard error	T-statistic	R^2	D.W. statistic
Full-time					
Intercept term for 17-year-olds	-13.39	0.542	-24.69	0.97	1.95*
Intercept term for 18-year-olds	-11.10	0.531	-20.89		
Intercept term for 19-year-olds	-10.42	0.541	-19.27		
Intercept term for 20-year-olds	-10.82	0.538	-20.12		
Intercept term for 21-year-olds	-10.92	0.533	-20.48		
Intercept term for 22-year-olds	-11.47	0.537	-21.37		
Intercept term for 23-year-olds	-11.82	0.533	-22.16		
Intercept term for 24-year-olds	-12.31	0.548	-22.45		
Intercept term for 25- to 29-year-olds	-13.23	0.529	-24.99		
Intercept term for 30- to 34-year-olds	-14.55	0.535	-27.19		
Intercept term for 35- to 44-year-olds	-15.04	0.542	-27.76		
Log of Asian/Pacific Islander per capita disposable income in current dollars	0.57	0.027	20.78		
Part-time					
Intercept term for 17-year-olds	-16.95	0.754	-22.50	0.86	1.97*
Intercept term for 18-year-olds	-15.03	0.608	-24.71		
Intercept term for 19-year-olds	-14.24	0.636	-22.40		
Intercept term for 20-year-olds	-14.69	0.615	-23.87		
Intercept term for 21-year-olds	-14.31	0.615	-23.27		
Intercept term for 22-year-olds	-14.29	0.603	-23.69		
Intercept term for 23-year-olds	-14.81	0.603	-24.58		
Intercept term for 24-year-olds	-15.20	0.620	-24.51		
Intercept term for 25- to 29-year-olds	-15.53	0.595	-26.07		
Intercept term for 30- to 34-year-olds	-16.23	0.598	-27.14		
Intercept term for 35- to 44-year-olds	-16.10	0.597	-26.95		
Log of Asian/Pacific Islander per capita disposable income in current dollars	0.68	0.031	22.43		

* p<.05.

R^2 = Coefficient of determination.

D.W. statistic = Durbin-Watson statistic, a test for autocorrelation among regression residuals. For more details see Johnson, J., and Dinardo, J. (1996). *Econometric Methods*. New York: McGraw-Hill.

NOTE: The regression method used to estimate the full-time and part-time equations was the pooled seemingly unrelated regression method. The time period used to estimate the equations is from 1989 to 2007. The number of observations is 209. For additional information, see Intriligator, M.D. (1978). *Econometric Models, Techniques, & Applications*. New Jersey: Prentice-Hall, Inc., pp. 165-173. Race categories exclude persons of Hispanic ethnicity.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Enrollment in Degree-Granting Institutions by Race/Ethnicity Model, 1980–2007. (This table was prepared February 2009.)

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 2005–06. 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 affected by changes in graduation requirements, but this is not considered in the projections in this report.

Projections of private high school graduates were calculated using the same methodology as public high school graduates, using data from biennial NCES Private School Universe Survey (PSS) from 1988–89 to 2005–06. Since the PSS is collected in the fall of odd numbered years, data for even numbered years without a PSS collection were estimated using data from the PSS.

Accuracy of Projections

An analysis of projections from models used in the past 18 editions of *Projections of Education Statistics* indicates that the mean absolute percentage errors (MAPEs) for projections of public high school graduates were 1.0 percent for 1 year ahead, 0.9 percent for 2 years ahead, 1.8 percent for 5 years ahead, and 3.8 percent for 10 years ahead. For the 1-year-ahead prediction, this means that one would expect the projection to be within 1.0 percent of the actual value, on the average. For more information on the mean absolute percentage errors, see table A-2, page 88.

State Level

This edition contains projections of high school graduates from public schools by state from 2006–07 to 2018–19. Public school graduate data from the Common Core of Data survey for 1980–81 to 2005–06 were used to develop these projections. This survey does not collect graduate data for private schools at the state level.

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 2005–06. 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 jurisdictions were projected using the same single exponential smoothing parameter of 0.4. Projections of grade 12 enrollment were developed based on the grade progression rates discussed in appendix A, Enrollment. The projected rates were 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.

Adjustment to National Projections

The projections of state high school graduates were adjusted to sum to the national projections of public high school projections shown in table 24. This was done through the use of ratio adjustments in which all the states' high school graduate projections were multiplied by the ratio of the national high school graduate projection to the sum of the state high school projections.

Regional Projections

For each region, the projections of high school graduates equaled the sum of the high school projections of the states within the region.

Degrees Conferred

Projections of associate's, bachelor's, master's, and first-professional degrees for men and women were based on demographic models that relate degree awards to college enrollment by level enrolled and attendance status. Table A-22 describes the estimated equations used to calculate projections. The equations shown were selected on the basis of their statistical properties, such as coefficients of determination (R^2s), the t-statistics of the coefficients, the Durbin-Watson statistic, the Breusch-Godfrey Serial Correlation LM test statistic, and residual plots.

The equations used to produce the degrees conferred projections for the previous edition of this report (*Projections of Education Statistics to 2017*) all used a similar form in which the log of the ratio of the number of degrees to the population of the relevant age group was regressed on the log of the ratio of enrollment in the relevant level to the population of the relevant age group. In the equations for associate's, bachelor's, master's, and first-professional degrees, the number of degrees is expressed as either a first-difference or a percentage change. This value is regressed on the enrollment in the relevant level, again expressed as either a first-difference or a percentage change. The projections of the of doctor's degrees for men and women were produced using double exponential smoothing.

Associate's Degrees

Associate's degree projections for men and women were based on 2 years full-time undergraduate enrollment in 2-year institutions by sex. Men's projections were based on current and lagged 2 years full-time enrollment, and women's projections were based on the current full-time enrollment and enrollment lagged 1 and 2 years. Results of the regression analysis used to project associate's degrees are shown in table A-22.

Bachelor's Degrees

Bachelor's degree projections for men and women were based on current and lagged 2 years full-time undergraduate enrollment in 4-year institutions by sex. Results of the regression analysis used to project bachelor's degrees are shown in table A-22.

Master's Degrees

Master's degree projections for men and women were based on full-time graduate enrollment by sex. Men's projections were based on current and previous year enrollment, and women's projections were based on current enrollment. Results of the regression analysis used to project master's degrees are shown in table A-22.

Doctor's Degrees

Doctor's degree projections for men and women were obtained by double exponential smoothing of the historical data with a smoothing parameter of 0.4.

First-Professional Degrees

First-professional degree projections were based on total full-time first-professional enrollment lagged 1 and 2 years by sex. Results of the regression analysis used to project first-professional degree are shown in table A-22.

Accuracy of Projections

An analysis of projection errors from similar models used in the past twelve editions of *Projections of Education Statistics* indicates that mean absolute percentage errors (MAPEs) for associate's degrees were 2.1 percent for 1 year out, 3.3 percent for 2 years out, 6.0 percent for 5 years out, and 15.6 percent for 10 years out. For the 1-year-out prediction, this means that one would expect the projection to be within 2.1 percent of the actual value, on average. MAPEs for bachelor's degree projections were 0.9 percent for 1 year out, 1.9 percent for 2 years out, 6.0 percent for 5 years out, and 13.5 percent for 10 years out. MAPEs for master's degrees were 1.5, 3.5, 12.4, and 25.0 percent, respectively. For doctor's degrees, the MAPEs were 3.4, 5.5, 6.1, and 11.9 percent, respectively. For first-professional degrees, the MAPEs were 1.3, 1.7, 5.1, and 13.8 percent, respectively. For more information on the MAPEs, see table A-2.

Table A-22. Estimated equations and model statistics for degrees conferred, by degree type and sex

Dependent variable	Equation[1]	R^2	Breusch-Godfrey Serial Correlation LM test statistic[2]	Time period
Associate's degrees, men	DASSOCM = 1,839 + 94DUGFT2M + 68DUGFT2ML2 (17.3) (16.6)	0.60	0.56*	1975–76 to 2006–07
Associate's degrees, women	DLOGASSOCW = # + 0.9DLOGUGFT2WS3 + .6MA(1) (15.6) (8.8)	0.83	2.66*	1970–71 to 2006–07
Bachelor's degrees, men	DBACHM = 73.0 + 70DUGFT4M + 149DUGFT4ML2 (24.0) (22.2)	0.68	0.46*	1970–71 to 2006–07
Bachelor's degrees, women	DBACHW = 1940 + 80DUGFT4W + 134DUGFT4WL2 (30.4) (31.0)	0.59	2.01*	1970–71 to 2006–07
Master's degrees, men	PCHMASTM = # + 0.5PCHGFTM + 0.6PCHGFTML1 (3.4) (4.1)	0.66	1.77*	1970–71 to 2006–07
Master's degrees, women	PCHMASTW = # + 0.4PCHGFTW + 0.6AR(1) (22.2) (3.8)	0.60	1.01*	1970–71 to 2006–07
First-professional degrees, men	DFPROM = 89 + 161DFPFTML1 + 89DFPFTML2 (5.0) (2.9)	0.61	3.18*	1971–72 to 2006–07
First-professional degrees, women	DFPROW = 120 + 123DFPFTWL1 + 155DFPFTWL2 (2.6) (3.6)	0.51	3.17*	1971–72 to 2006–07

Rounds to zero.
* p<.05.
[1]AR(1) indicates that the model was estimated to account for first-order autocorrelation and MA(1) indicates that the model was estimated to incorporate moving average of the residual into model fit. For a general discussion of the problem of autocorrelation, and the method used to forecast in the presence of autocorrelation, see Judge, G., Hill, W., Griffiths, R., Lutkepohl, H., and Lee, T. (1985). *The Theory and Practice of Econometrics*. New York: John Wiley and Sons, pp. 315-318.
[2]For an explanation of the Breusch-Godfrey Serial Correlation LM test statistic, see Greene, W. (2000). *Econometric Analysis*. New Jersey: Prentice-Hall.
Where:
DASSOCM = First difference of associate's degrees awarded to men.
DLOGASSOCW = First difference of the log of associate's degrees awarded to women.
DBACHM = First difference of bachelor's degrees awarded to men.
DBACHW = First difference of bachelor's degrees awarded to women.
PCHMASTM = Percentage change in master's degrees awarded to men.
PCHMASTW = Percentage change in master's degrees awarded to women.
DFPROM = First difference of first-professional degrees awarded to men.
DFPROW = First difference of first-professional degrees awarded to women.
DUGFT2M = First difference of full-time male undergraduate enrollment in 2-year institutions.
DUGFT2ML2 = First difference of full-time male undergraduate enrollment in 2-year institutions, lagged two periods.
DLOGUGFT2WS3= First difference of the sum of the full-time female undergraduate enrollment in 2-year institutions over the present year and the previous 2 years.
DUGFT4M = First difference of full-time male undergraduate enrollment in 4-year institutions.
DUGFT4ML2 = First difference of full-time male undergraduate enrollment in 4-year institutions, lagged two periods.
DUGFT4W = First difference of full-time female undergraduate enrollment in 4-year institutions.
DUGFT4WL2 = First difference of full-time female undergraduate enrollment in 4-year institutions, lagged two periods.
PCHGFTM = Percentage change in full-time male graduate enrollment.
PCHGFTML1 = Percentage change in full-time male graduate enrollment lagged one year.
PCHGFTW = Percentage change in full-time female graduate enrollment.
DFPFTML1 = First difference of full-time male first professional enrollment lagged one year.
DFPFTML2 = First difference of full-time male first professional enrollment lagged two years.
DFPFTWL1 = First difference of full-time female first professional enrollment lagged one year.
DFPFTWL2 = First difference of full-time female first professional enrollment lagged two years.
NOTE: R^2 is the coefficient of determination. Numbers in parentheses are t-statistics. There are no equations for doctor's degrees for men and women as projections of those items were obtained using double exponential smoothing.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Degrees Conferred Model, 1970–71 through 2006–07. (This table was prepared December 2008.)

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 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 the 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 the previously projected enrollment in public secondary schools.

The models were estimated using the AR(1) model for correcting for autocorrelation, and all variables are in log form. Local education revenue from state sources were in constant 2000 dollars.

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:

$$\ln(RELENRTCH_t) = b_0 + b_1 \ln(RSALARY_t) + b_2 \ln(RSGRNTELENR_t)$$

where:

ln indicates the natural log;

$RELENRTCH_t$ 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:

$$\ln(RSCENRTCH_t) = b_0 + b_1 \ln(RSGRNTSCENR_t) + b_2 \ln(RSCENRPU_t)$$

where:

ln indicates the natural log;

$RSCENRTCH_t$ 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 by increases in the number of teachers.

Table A-23 summarizes the results for the elementary and secondary public teacher models. Enrollment for this equation is by organizational level, not by grade level. Thus, secondary enrollment is not the same as grade 9–12 enrollment because some jurisdictions count some grade 7 and 8 enrollment as secondary.

Private Elementary and Secondary Teachers

Projections of private elementary and secondary teachers for this edition were derived using a different method than that used for the *Projections of Education Statistics to 2017*. In this edition, the projection of the private school pupil/teacher ratio for 2008 was calculated by multiplying the ratio for 2007 by the percentage change from 2007 to 2008 in the public school pupil/teacher ratio. The same method was then used to calculate the projections of the private school pupil/teacher ratio for 2009 through 2018. The projected pupil/teacher ratios were applied to the projected private school enrollments to produce projections of private school teachers from 2008 through 2018. This method assumes that the future pattern in the trend of private school pupil/teacher ratio will be the same as that for public school pupil/teacher ratio. 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.

Data for private school teachers are from the biennial NCES Private School Universe Survey (PSS). Since the PSS is collected in the fall of odd numbered years, data for years without a PSS collection were estimated using data from the PSS.

New Teacher Hires

Projections of new teacher hires were produced using the Teacher Hires Model. The model was estimated separately for public and private school teachers. The model produces projections of the number of teachers who were not teaching in the previous year, but who will be hired in a given year. Teachers who move from teaching in one sector to the other sector are considered new teacher hires. If a teacher moves from teaching in one public school to a different public school, that teacher would not be counted as a teacher hire for the purposes of this model. On the other hand, if a teacher moves from a public school to a private school, that teacher would be counted as a private school teacher hire since the teacher is moving between sectors.

In order to produce the projections of the number of new teacher hires, data were drawn from a number of sources: the 2003–04 Schools and Staffing Survey (SASS); 2004–05 Teacher Follow-Up Survey (TFS); the Common Core of Data (CCD); the Private School Universe Survey (PSS); and the projections of the numbers of public and private elementary and secondary school teachers. The teacher numbers coming from SASS and the TFS are for full-time and part-time teachers, while those for the other surveys are for full-time-equivalent (FTE) teachers.

The following is a general summary of the Teacher Hires Model used to produce the projections for new teacher hires in public schools. A similar process was used for the projections of new teacher hires in private schools. A more thorough presentation can be found in section II of Hussar (1999). As already noted, this model measures the demand for teacher hires. Due to difficulties in defining and measuring the pool of potential teachers, there were no attempts to measure the supply of new teacher candidates.

In step 1 of the Teacher Hires Model, the age distributions of the headcounts of public school teachers from the 2003–04 SASS are applied to the national number of FTE teachers in 2003 from the CCD.

In step 2, the age-specific continuation rates from the 2004–05 TFS are applied to the 2003 FTE count of teachers by age, the results being an estimate of the number of FTE teachers who remained teaching in 2004 by individual age. Summing these remaining teachers over all ages produces the estimate of those who remained teaching in 2004. Subtracting the remaining teachers from the total FTE teacher count for 2003 produces an estimate of the number of new FTE teacher hires needed to replace those leaving teaching.

In step 3, the total number of FTE teachers in 2003 is subtracted from the number of FTE teachers for 2004 from the CCD to produce an estimate of the number of new FTE teacher hires that are needed due to the overall increase in the teaching workforce.

In step 4, the number of new FTE teachers needed to replace those leaving teaching from step 2 are added to the estimated net change in the number of FTE teachers from step 3, to get an estimate of the total number of new FTE teacher hires needed in 2004.

In step 5, the age distribution for newly hired full-time and part-time teachers from the 2003–04 SASS is applied to the estimate of total number of new FTE teacher hires needed in 2004 to produce an estimate of the number of new FTE teacher hires by age.

In step 6, for each individual age, the estimate of the number of remaining FTE teachers from step 2 is added to the estimate of the number of newly hired FTE teachers from step 5 to produce estimates of the total number of FTE teachers by age in 2004.

Steps 2 through 6 are then repeated for each year from 2005 through 2018, so that the Teacher Hires Model can produce projections for the number of new teacher hires. Projections of the age-specific continuation rates for public school teachers ages 28 through 66 and private school teacher ages 23 through 65 were used in step 2. These projections were produced using exponential smoothing with a smoothing constant of 0.4. For all other ages, the continuation rates from the 2004–05 TFS were used in step 2. Projections of the numbers of FTE teachers were used in step 3 for those years in which there were no CCD teacher numbers (2007 through 2018). Three alternative sets of projections of new teacher hires were produced, one set for each of the alternative sets of FTE teacher projections.

A number of assumptions are made in order to make these projections. They include that: (1) the age distribution of FTE teachers in 2003 is similar to that of full-time and part-time teachers in that year (Step 1); (2) the age-specific continuation rates for FTE teachers for each year from 2004 through 2018 are similar to either the projections produced using exponential smoothing or the values from the 2004–05 TFS depending on the age of the teachers (Step 2); (3) the age distribution for newly hired FTE teachers from 2004 through 2018 is similar to that of newly hired full-time and part-time teachers in the 2003–04 SASS (Step 3); (4) the actual numbers of FTE teachers for each year from 2006 through 2018 are similar to projections of FTE teachers on table 32; and (5) no economic or political changes further affect the size of the teaching force.

Table A-24 shows the age distributions for full-time and part-time teachers; table A-25 shows age distributions of new teacher hires; and table A-26 shows actual and projected continuation rates of teachers.

Accuracy of Projections

An analysis of projection errors from the past 18 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, 3.2 percent for 5 years out, and 6.1 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 A-2.

Table A-23. Estimated equations and model statistics for public elementary and secondary teachers

Dependent variable	Equation[1]	R^2	Breusch-Godfrey Serial Correlation LM test statistic[2]	Time period
Elementary	ln(RELENRTCH) = 3.8 + .1 ln(RSALARY) - .2 ln(RSGRNTELENR) + .4AR(1) (4.8) (-10.5) (2.10)	0.99	.03*	1973 to 2005
Secondary	ln(RSCENRTCH) = 4.1 - .2 ln(RSGRNTSCENR) + .5 ln(RSCENRPU) + .7AR(1) (-14.9) (4.5) (4.14)	0.99	.06*	1973 to 2005

* p<.05.

[1]AR(1) indicates that the model 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 Judge, G., Hill, W., Griffiths, R., Lutkepohl, H., and Lee, T. (1985). *The Theory and Practice of Econometrics*. New York: John Wiley and Sons, pp. 315-318.

[2]For an explanation of the Breusch-Godfrey Serial Correlation LM test statistic, see Greene, W. (2000). *Econometric Analysis*. New Jersey: Prentice-Hall.

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: R^2 indicates the coefficient of determination. Numbers in parentheses are t-statistics.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Elementary and Secondary Teacher Model, 1973–2005. (This table was prepared February 2009.)

Table A-24. Percentage distribution of full-time and part-time school teachers, by age, control of school, and teaching status: 2003–04

Control of school and teaching status	Percent of total	Age distribution							
		Total	Less than 25 years	25–29 years	30–39 years	40–49 years	50–59 years	60–64 years	65 years or more
Public-actual									
2003–04	**100**	**100**	**4**	**13**	**25**	**26**	**29**	**3**	**1**
Full-time	91	100	4	13	25	26	29	3	1
Part-time	9	100	5	11	24	28	27	4	2
Private-actual									
2003–04	**100**	**100**	**6**	**13**	**22**	**25**	**26**	**5**	**3**
Full-time	78	100	6	14	22	24	26	5	2
Part-time	22	100	6	8	22	30	24	5	5

NOTE: Detail may not sum to totals because of rounding.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey (SASS), "Public School Teacher Questionnaire," 2003–04 and "Private School Teacher Questionnaire," 2003–04; and unpublished tabulations. (This table was prepared February 2009.)

Table A-25. Percentage distribution of full-time and part-time newly hired teachers, by age and control of school: Selected years, 1987–88 through 2003–04

Control of school and school year	Age distribution							
	Total	Less than 25 years	25–29 years	30–39 years	40–49 years	50–59 years	60–64 years	65 years or more
Public								
1987–88	100	18	24	33	21	4	#	#
1990–91	100	17	24	31	21	6	1	#
1993–94	100	16	29	25	25	5	1	#
1999–2000	100	24	23	22	19	11	1	1
2003–04	100	24	19	25	16	13	1	1
Private								
1987–88	100	17	23	32	18	5	3	2
1990–91	100	16	26	29	21	6	1	1
1993–94	100	19	24	25	23	7	1	1
1999–2000	100	19	17	24	22	14	3	1
2003–04	100	17	16	23	23	15	4	2

Rounds to zero.
NOTE: Detail may not sum to totals because of rounding.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey (SASS), "Public School Teacher Questionnaire," 1987–88 through 2003–04 and "Private School Teacher Questionnaire," 1987–88 through 2003–04; and unpublished tabulations. (This table was prepared February 2009.)

Table A-26. Actual and projected continuation rates of full-time and part-time school teachers, by age and control of school: Various years, 1987–88 to 1988–89 through 2017–18 to 2018–19

Control of school and school year	Total	Continuation rates, by age						
		Less than 25 years	25–29 years	30–39 years	40–49 years	50–59 years	60–64 years	65 years or more
Public actual								
1987–88 to 1988–89	94.4	95.9	91.0	94.2	97.4	94.3	76.6	83.3
1990–91 to 1991–92	94.9	90.9	91.0	95.8	98.0	93.3	73.2	59.1
1993–94 to 1994–95	93.4	96.2	90.0	93.3	96.1	93.7	69.5	65.9
1999–2000 to 2000–01	92.4	95.8	89.3	93.2	94.5	92.9	76.8	77.6
2003–04 to 2004–05	91.4	94.9	90.1	92.6	94.5	90.8	77.2	70.3
Public projected								
2004–05 to 2005–06	92.3	95.8	91.0	93.2	95.1	92.0	74.6	67.4
2005–06 to 2006–07	92.2	95.8	91.0	93.3	95.1	91.8	74.3	70.2
2006–07 to 2007–08	92.0	95.8	91.0	93.3	95.0	91.7	74.3	69.0
2007–08 to 2008–09	91.9	95.8	91.0	93.3	95.0	91.7	75.0	66.3
2008–09 to 2009–10	91.7	95.8	91.0	93.3	95.0	91.6	74.6	65.2
2009–10 to 2010–11	91.6	95.8	91.0	93.3	95.0	91.6	74.0	65.2
2010–11 to 2011–12	91.6	95.8	91.0	93.3	95.0	91.5	73.8	65.9
2011–12 to 2012–13	91.5	95.8	91.0	93.3	95.0	91.5	73.8	64.0
2012–13 to 2013–14	91.6	95.8	91.0	93.2	95.0	91.6	74.0	63.5
2013–14 to 2014–15	91.6	95.8	91.0	93.2	95.0	91.6	73.6	64.3
2014–15 to 2015–16	91.7	95.8	91.0	93.2	95.0	91.6	73.6	65.5
2015–16 to 2016–17	91.7	95.8	91.0	93.2	95.0	91.6	73.5	66.4
2016–17 to 2017–18	91.8	95.8	91.0	93.2	95.0	91.7	73.8	66.0
2017–18 to 2018–19	91.8	95.8	91.0	93.2	95.0	91.7	73.8	66.1
Private actual								
1987–88 to 1988–89	87.3	81.2	82.7	87.6	89.4	88.6	84.1	92.1
1990–91 to 1991–92	87.7	76.2	82.2	86.3	92.3	90.4	82.2	79.3
1993–94 to 1994–95	88.1	80.0	86.9	85.1	91.3	91.8	86.9	58.1
1999–2000 to 2000–01	83.0	61.7	72.2	80.2	86.1	92.3	78.8	75.2
2003–04 to 2004–05	83.3	75.4	71.7	82.2	86.8	89.2	80.1	79.5
Private projected								
2004–05 to 2005–06	83.2	72.7	73.6	81.3	86.9	89.6	79.6	75.7
2005–06 to 2006–07	83.1	72.5	73.5	81.1	86.8	89.5	79.1	75.1
2006–07 to 2007–08	83.3	72.5	73.5	81.3	87.0	89.5	79.7	76.0
2007–08 to 2008–09	83.3	72.4	73.5	81.4	86.8	89.4	79.7	75.3
2008–09 to 2009–10	83.2	72.4	73.5	81.4	86.9	89.5	79.6	75.7
2009–10 to 2010–11	83.1	72.4	73.5	81.4	86.8	89.4	79.3	72.8
2010–11 to 2011–12	83.1	72.4	73.5	81.3	86.8	89.4	79.0	74.8
2011–12 to 2012–13	83.0	72.4	73.5	81.4	86.9	89.4	79.2	73.0
2012–13 to 2013–14	83.1	72.4	73.5	81.3	86.9	89.4	79.3	74.1
2013–14 to 2014–15	83.0	72.4	73.5	81.3	86.9	89.4	79.1	72.9
2014–15 to 2015–16	83.0	72.4	73.5	81.3	86.8	89.4	79.2	72.4
2015–16 to 2016–17	83.0	72.4	73.5	81.3	86.9	89.4	79.2	73.2
2016–17 to 2017–18	83.0	72.4	73.5	81.3	86.9	89.4	79.2	73.7
2017–18 to 2018–19	83.0	72.4	73.5	81.3	86.9	89.4	79.3	73.3

NOTE: The continuation rate for teachers for each of the two sectors (public schools and private schools) is the percentage of teachers in that sector who continued teaching in the same sector from the first year to the next.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Teacher Follow up Survey (TFS), "Public School Teacher Questionnaire," 1988–89 through 2004–05 and "Private School Teacher Questionnaire," 1988–89 through 2004–05; and unpublished tabulations. (This tables was prepared February 2009.)

Expenditures for Public Elementary and Secondary Education

Elementary and Secondary Education Current Expenditure Model

The elementary and secondary education current expenditure model is based on the theoretical and empirical literature on the demand for local public services such as education.[2]

The model that is the basis for the elementary and secondary education 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 education current expenditure model contains variables reflecting the first two types of variables. The model is:

$$\ln(CUREXP_t) = b_0 + b_1\ln(PCI_t) + b_2\ln(SGRNT_t)$$

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 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. The model was estimated using data from 1973–74 to 2005–06.

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 by state. Second, the formulas used to apportion state monies 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 (the National Public Education Financial Survey). 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 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 A-27. 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

[2]For a discussion of the theory together with a review of some of the older literature, see Inman (1979). More recent empirical work includes: Gamkhar and Oates (1996), and Mitias and Turnbull (2001).

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 .6 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 .2 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 in editions prior to the *Projections of Education Statistics to 2014*. 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. This change was made due to superior model diagnostics. Second, in some earlier editions the model contained an additional variable, as a proxy for the price facing the median voter, the ratio of enrollment to the population. This price variable has been excluded due to its lack of statistical significance as measured by its t-statistic. Third, in editions prior to *Projections of Education Statistics to 2011* and *Projections of Education Statistics to 2013,*[3] 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.

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.

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

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 2006–07 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 from the "U.S. Quarterly Model: November 2008: Long-Term-Projections" of the economic consulting firm IHS Global Insight (supplemental table B-6).

IHS Global Insight's November 2008 trend scenario was used as a base for the middle alternative projections of the economic variables. IHS 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.

IHS Global Insight's November 2008 pessimistic scenario was used for the low alternative projections, and IHS Global Insight's November 2008 optimistic scenario was used for the high alternative projections.

In the middle alternative projections, disposable income per capita rises each year from 2007–08 to 2018–19 at rates between 0.1 percent and 2.9 percent. In the low alternative projections, disposable income per capita ranges between -1.3 percent and 2.8 percent, and in the high alternative projections, disposable income per capita rises at rates between 1.2 percent and 3.1 percent.

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

$$\ln(SGRNT_t) = b_0 + b_1\ln(PCI_t) + b_2\ln(ENRPOP_t)$$

where:

ln indicates the natural log;

$SGRNT_t$ equals local governments' education revenue from state sources, per capita, in constant 1982–84 dollars in year t;

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

$ENRPOP_t$ equals the ratio of fall enrollment to the population 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 1973–74 to 2005–06. These models are shown in table A-27.

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.

This year's edition of the *Projections of Education Statistics* uses the same revenue from state sources model as the last four year's editions. The model used in *Projections of Education Statistics 2012* and *Projections of Education Statistics 2013* included a term for personal taxes and non-tax receipts (PERTAX1) and an inflation rate term (RCPIANN) and was estimated over a different time period (the sample period began in 1967–68 rather than 1973–74). The current model specification yielded superior model diagnostics than the model used in the *Projections of Education Statistics 2012* and *Projections of Education Statistics 2013*. The forecasts in the six most recent editions of the *Projections of Education Statistics* were based on fall enrollment. In the earlier editions, the models used average daily attendance. Also, 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.

Three alternative sets of projections for SGRNT were produced using this model. Each is based on a different set of projections for revenue from state sources 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, revenue from state sources per capita changes each year from 2007–08 to 2018–19 at rates between 0.05 percent and 3.6 percent. In the low alternative projections, revenue from state sources per capita ranges between -1.7 percent and 3.6 percent, and in the high alternative projections, revenue from state sources per capita changes at rates between -1.1 percent and 3.9 percent.

Accuracy of Projections

Eighteen of the last 19 editions of *Projections of Education Statistics* contained projections of current expenditures. The actual values of current expenditures can be compared with the projected values in the previous editions to examine the accuracy of the model.

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 16 editions of *Projections of Education Statistics*, including this one. The one major change is that in all the earlier editions except the three previous editions of the *Projections of Education Statistics*, the set of variables included the ratio of the number of students to the population.

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 A-2. MAPEs of expenditure projections are presented for total current expenditures and current expenditures per pupil in fall enrollment.

An analysis of projection errors from similar models used in the past eighteen editions of *Projections of Education Statistics* that contained expenditure projections indicates that MAPEs for total current expenditures in constant dollars were 1.3 percent for 1 year out, 2.1 percent for 2 years out, 2.8 percent for 5 years out, and 4.5 percent for 10 years out. For the 1-year-out prediction, this means that one would expect the projection to be within 1.3 percent of the actual value, on average. MAPEs for current expenditure per pupil in fall enrollment in constant dollars were 1.3 percent for 1 year out, 2.0 percent for 2 years out, 3.1 percent for 5 years out, and 5.8 percent for 10 years out. For more information on the MAPEs, see table A-2.

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 2005–06, the data were 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 geographic 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 2006–07 to 2018–19 were made by multiplying the projections for enrollment by the average value of the ratios of average daily attendance to the enrollment from 1992–93 to 2005–06; this average value was approximately .93.

The values for fall enrollment from 1979–80 to 2006–07 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 2005–06, 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 projected values for disposable income, personal taxes and non-tax receipts to state and local governments, and indirect business taxes and tax accruals to state and local governments were developed using projections developed by IHS 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, 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 IHS 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.

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 A-27. Estimated equations and model statistics for current expenditures per pupil in fall enrollment, and education revenue from state sources per capita

Dependent variable										Equation[1]	R^2	Breusch-Godfrey Serial Correlation LM test statistic[2]	Time period
Current expenditures per pupil	ln(CUREXP)	=	1.0	+	0.6ln(PCI) (3.5)	+	0.2ln(SGRANT) (2.3)	+		0.9AR(1)	0.99	1.04*	1973–74 to 2005–06
Education revenue from state sources per capita	ln(SGRNT)	=	1.0	+	1.2ln(PCI) (19.7)	+	0.8ln(ENRPOP) (5.3)	+		0.4AR(1)	0.99	1.71*	1973–74 to 2005–06

* p<.05.

[1]AR(1) indicates that the models were 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 Judge, G., Hill, W., Griffiths, R., Lutkepohl, H., and Lee, T. (1985). *The Theory and Practice of Econometrics*. New York: John Wiley and Sons, pp. 315-318.

[2]For an explanation of the Breusch-Godfrey Serial Correlation LM test statistic, see Greene, W. (2000). *Econometric Analysis*. New Jersey: Prentice-Hall.

Where:

CUREXP = Current expenditures of public elementary and secondary schools per pupil in fall enrollment 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.

NOTE: R^2 indicates the coefficient of determination. Numbers in parentheses are t-statistics.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Elementary and Secondary Education Current Expenditures Model, 1973–74 through 2005–06; and Revenue Receipts from State Sources Model, 1973–74 through 2005–06. (This table was prepared February 2009.)

Appendix B
Supplementary Tables

Table B-1. Annual number of births: 1946 through 2007

Calendar year	Number of births, in thousands	Calendar year	Number of births, in thousands
1946	3,426	1977	3,327
1947	3,834	1978	3,333
1948	3,655	1979	3,494
1949	3,667	1980	3,612
1950	3,645	1981	3,629
1951	3,845	1982	3,681
1952	3,933	1983	3,639
1953	3,989	1984	3,669
1954	4,102	1985	3,761
1955	4,128	1986	3,757
1956	4,244	1987	3,809
1957	4,332	1988	3,910
1958	4,279	1989	4,041
1959	4,313	1990	4,158
1960	4,307	1991	4,111
1961	4,317	1992	4,065
1962	4,213	1993	4,000
1963	4,142	1994	3,953
1964	4,070	1995	3,900
1965	3,801	1996	3,891
1966	3,642	1997	3,881
1967	3,555	1998	3,942
1968	3,535	1999	3,959
1969	3,626	2000	4,059
1970	3,739	2001	4,026
1971	3,556	2002	4,022
1972	3,258	2003	4,090
1973	3,137	2004	4,112
1974	3,160	2005	4,138
1975	3,144	2006	4,266
1976	3,168	2007	4,317

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 June 2009.)

Table B-2. Actual and projected numbers for preprimary school-age populations: 1993 through 2018

[In thousands]

Year (July 1)	3- to 5-year-olds	3-year-olds	4-year-olds	5-year-olds
Actual				
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	11,700	3,824	3,905	3,971
2001	11,577	3,815	3,839	3,923
2002	11,507	3,822	3,830	3,856
2003	11,560	3,881	3,834	3,845
2004	11,788	4,048	3,892	3,848
2005	11,971	4,005	4,060	3,906
2006	12,142	4,051	4,017	4,074
2007	12,206	4,111	4,063	4,032
Projected				
2008	12,321	4,120	4,123	4,077
2009	12,427	4,159	4,160	4,109
2010	12,542	4,199	4,199	4,145
2011	12,664	4,242	4,239	4,183
2012	12,791	4,286	4,282	4,223
2013	12,922	4,329	4,327	4,266
2014	13,048	4,368	4,370	4,311
2015	13,165	4,402	4,409	4,354
2016	13,268	4,431	4,444	4,393
2017	13,358	4,457	4,474	4,427
2018	13,436	4,480	4,500	4,457

NOTE: Some data have been revised from previously published figures. Detail may not sum to totals because of rounding. Projections are from the U.S. Census Bureau's middle series.
SOURCE: U.S. Department of Commerce, Census Bureau, Population Estimates, retrieved October 27, 2008, from http://www.census.gov/popest/national/asrh/2006_nat_af.html; and Population Projections, retrieved October 29, 2008, from http://www.census.gov/ipc/www/usinterimproj/. (This table was prepared November 2008.)

Table B-3. Actual and projected numbers for school-age populations, ages 5, 6, 5 to 13, and 14 to 17: 1993 through 2018

[In thousands]

Year (July 1)	5-year-olds	6-year-olds	5- to 13-year-olds	14- to 17-year-olds
Actual				
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	3,971	4,008	37,052	16,122
2001	3,923	3,990	37,080	16,184
2002	3,856	3,941	36,972	16,353
2003	3,845	3,872	36,752	16,497
2004	3,848	3,859	36,345	16,813
2005	3,906	3,863	36,064	17,068
2006	4,074	3,921	36,009	17,207
2007	4,032	4,089	35,971	17,207
Projected				
2008	4,077	4,047	36,050	16,959
2009	4,109	4,073	36,223	16,702
2010	4,145	4,104	36,476	16,468
2011	4,183	4,140	36,842	16,222
2012	4,223	4,178	37,267	16,039
2013	4,266	4,218	37,710	15,929
2014	4,311	4,261	38,146	15,918
2015	4,354	4,306	38,457	16,149
2016	4,393	4,349	38,805	16,401
2017	4,427	4,388	39,161	16,652
2018	4,457	4,422	39,516	16,883

NOTE: Some data have been revised from previously published figures. Projections are from the U.S. Census Bureau's middle series.
SOURCE: U.S. Department of Commerce, Census Bureau, Population Estimates, retrieved October 27, 2008, from http://www.census.gov/popest/national/asrh/2006_nat_af.html; and Population Projections, retrieved October 29, 2008, from http://www.census.gov/ipc/www/usinterimproj/. (This table was prepared November 2008.)

Table B-4. Actual and projected numbers for college-age populations, ages 18, 18 to 24, 25 to 29, 30 to 34, and 35 to 44: 1993 through 2018

[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					
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	4,075	27,387	19,353	20,577	45,232
2001	4,071	28,054	18,985	20,768	45,173
2002	4,027	28,537	18,956	20,849	44,835
2003	4,124	29,006	19,151	20,745	44,433
2004	4,120	29,303	19,544	20,468	44,111
2005	4,117	29,373	20,039	20,074	43,864
2006	4,179	29,468	20,665	19,665	43,636
2007	4,260	29,657	21,155	19,593	43,244
Projected					
2008	4,436	30,026	21,561	19,772	42,697
2009	4,420	30,387	21,765	20,118	42,026
2010	4,347	30,610	21,832	20,560	41,518
2011	4,284	30,740	21,868	21,106	41,236
2012	4,203	30,791	21,944	21,550	41,135
2013	4,159	30,728	22,091	21,897	41,141
2014	4,113	30,537	22,344	22,098	41,176
2015	4,039	30,142	22,666	22,167	41,188
2016	4,022	29,749	22,940	22,209	41,339
2017	4,050	29,457	23,140	22,289	41,671
2018	4,103	29,280	23,205	22,442	42,168

NOTE: Some data have been revised from previously published figures. Projections are from the U.S. Census Bureau's middle series.
SOURCE: U.S. Department of Commerce, Census Bureau, Population Estimates, retrieved October 27, 2008, from http://www.census.gov/popest/national/asrh/2006_nat_af.html; and Population Projections, retrieved October 29, 2008, from http://www.census.gov/ipc/www/usinterimproj/. (This table was prepared November 2008.)

Table B-5. Actual and projected numbers for fall enrollment in public elementary and secondary schools, change in fall enrollment from previous year, population, and fall enrollment as a ratio of the population: School years 1993–94 through 2018–19

School year	Fall enrollment (in thousands)	Change in fall enrollment from previous year (in thousands)	Population (in millions)	Fall enrollment as a ratio of the population
Actual				
1993–94	43,465	642	260.3	0.167
1994–95	44,111	647	263.4	0.167
1995–96	44,840	729	266.6	0.168
1996–97	45,611	771	269.7	0.169
1997–98	46,127	516	272.9	0.169
1998–99	46,539	412	276.1	0.169
1999–2000	46,857	319	279.3	0.168
2000–01	47,204	346	282.4	0.167
2001–02	47,672	468	285.3	0.167
2002–03	48,183	511	288.2	0.167
2003–04	48,540	357	290.9	0.167
2004–05	48,795	255	293.6	0.166
2005–06	49,113	318	296.3	0.166
2006–07	49,299	186	299.2	0.165
Projected				
2007–08	49,470	171	302.0	0.164
2008–09	49,623	153	304.9	0.163
2009–10	49,788	165	307.6	0.162
2010–11	50,034	246	310.3	0.161
2011–12	50,349	315	312.9	0.161
2012–13	50,767	418	315.6	0.161
2013–14	51,239	472	318.3	0.161
2014–15	51,769	530	321.0	0.161
2015–16	52,346	577	323.7	0.162
2016–17	52,892	546	326.4	0.162
2017–18	53,426	534	329.1	0.162
2018–19	53,933	507	331.8	0.163

NOTE: Calculations were made using unrounded numbers. Some data have been revised from previously published figures. Population projections are from the U.S. Census Bureau's middle series.

SOURCE: U.S. Department of Commerce, Census Bureau, Population Estimates, retrieved October 27, 2008, from http://www.census.gov/popest/national/asrh/2006_nat_af.html; and Population Projections, retrieved October 29, 2008 from http://www.census.gov/ipc/www/usinterimproj/. U.S. Department of Education, National Center for Education Statistics, Common Core of Data (CCD), "State Nonfiscal Survey of Public Elementary/Secondary Education," 1993–94 through 2006–07; and Elementary and Secondary Enrollment Model, 1972–2006. (This table was prepared December 2008.)

Table B-6. Actual and alternative projected numbers for macroeconomic measures of the economy: School years 1993–94 through 2018–19

School year	Disposable income per capita in constant 2006–07 dollars[1]	Education revenue receipts from state sources per capita in constant 2006–07 dollars[2]	Consumer Price Index
Actual			
1993–94	$25,229	$630	0.716
1994–95	25,752	658	0.737
1995–96	26,033	677	0.757
1996–97	26,574	697	0.779
1997–98	27,538	729	0.793
1998–99	28,476	761	0.806
1999–2000	29,159	797	0.829
2000–01	29,829	824	0.858
2001–02	30,427	829	0.873
2002–03	30,588	833	0.892
2003–04	31,409	819	0.912
2004–05	31,949	829	0.939
2005–06	32,310	838	0.975
Middle alternative projections			
2006–07[3]	33,115	846	1.000
2007–08[3]	33,548	861	1.037
2008–09	33,954	872	1.053
2009–10	34,074	874	1.056
2010–11	34,122	873	1.088
2011–12	34,713	890	1.117
2012–13	35,413	912	1.143
2013–14	36,202	937	1.171
2014–15	37,245	971	1.195
2015–16	38,241	1,004	1.218
2016–17	39,098	1,033	1.244
2017–18	39,965	1,062	1.269
2018–19	40,583	1,083	1.289
Low alternative projections			
2006–07[3]	33,115	846	1.000
2007–08[3]	33,548	861	1.037
2008–09	34,051	875	1.047
2009–10	33,952	870	1.039
2010–11	33,521	855	1.077
2011–12	33,776	861	1.122
2012–13	34,251	876	1.159
2013–14	34,879	896	1.196
2014–15	35,862	928	1.229
2015–16	36,848	961	1.261
2016–17	37,673	988	1.296
2017–18	38,464	1,015	1.332
2018–19	39,023	1,033	1.361
High alternative projections			
2006–07[3]	33,115	846	1.000
2007–08[3]	33,548	861	1.037
2008–09	33,966	873	1.057
2009–10	34,442	885	1.071
2010–11	34,816	895	1.104
2011–12	35,526	915	1.127
2012–13	36,302	939	1.145
2013–14	37,261	970	1.163
2014–15	38,417	1,007	1.181
2015–16	39,519	1,044	1.198
2016–17	40,492	1,077	1.219
2017–18	41,440	1,109	1.238
2018–19	42,094	1,131	1.254

[1]Based on the price deflator for personal consumption expenditures, Bureau of Labor Statistics, U.S. Department of Labor.
[2]Based on the Consumer Price Index for all urban consumers, Bureau of Labor Statistics, U.S. Department of Labor.
[3]Disposable income per capita and consumer price index numbers are actual numbers.
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," 1990–91 through 2005–06; Revenue Receipts From State Sources Model, 1971–72 through 2005–06; and IHS Global Insight, "U.S. Quarterly Model: November 2008 Long-Term-Projections." (This table was prepared December 2008.)

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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 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) to acquire and maintain statistical data from each of the 50 states, the District of Columbia, the Bureau of Indian Education, Department of Defense Dependents' Schools (overseas), and the outlying areas. Information about staff and students is collected annually at the school, local education agency (LEA) or school district, 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 via an on-line reporting system open to state education agencies during the school year. Beginning with the 2006–07 school year, nonfiscal CCD data are collected through the Department of Education's Education Data Exchange Network (EDEN). Since the CCD is a universe collection, CCD data are not subject to sampling errors. However, nonsampling errors could come from two sources: nonresponse and inaccurate reporting. Almost all of the states submit the five CCD survey instruments each year, but submissions are sometimes incomplete.

Misreporting can occur when 58 education agencies compile and submit data for approximately 97,000 public schools and over 17,000 local education agencies. Typically, this results from varying interpretations of NCES definitions and differing record-keeping 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 these 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 state education agencies to a comprehensive edit. Where data are determined to be inconsistent, missing, or out of range, NCES contacts the agencies for verification. NCES-prepared state summary forms are returned to the agencies for verification. Each year, states are also given an opportunity to revise their state-level aggregates from the previous survey cycle.

Further information on the nonfiscal CCD may be obtained from

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Elementary/Secondary and Libraries Studies Division
Elementary/Secondary Cooperative System and
Institutional Studies Program
National Center for Education Statistics
1990 K Street NW
Washington, DC 20006
john.sietsema@ed.gov
http://nces.ed.gov/ccd/

Further information on the fiscal CCD data may be obtained from

Frank H. Johnson
Elementary/Secondary and Libraries Studies Division
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National Center for Education Statistics
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http://nces.ed.gov/ccd/

Private School Universe Survey

The purposes of Private School Universe Survey (PSS) data collection activities are (1) to build an accurate and complete list of private schools to serve as a sampling frame for NCES sample surveys of private schools; and (2) to report data on the total number of private schools, teachers, and students in the survey universe. Beginning in 1989, the PSS has been conducted every 2 years, and data for the 1989–90, 1991–92, 1993–94, 1995–96, 1997–98, 1999–2000, 2001–02, 2003–04, and 2005–06 school years have been released.

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 number 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 this universe survey is all private schools in the United States that meet the NCES criteria of a school (i.e., 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 124 geographic areas, conducted by the U.S. Census Bureau.

Further information on the PSS may be obtained from

Steve Broughman
Elementary/Secondary and Libraries Studies Division
Elementary/Secondary Sample Survey Studies Program
National Center for Education Statistics
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Washington, DC 20006
stephen.broughman@ed.gov
http://nces.ed.gov/surveys/pss/

Integrated Postsecondary Education Data System

The Integrated Postsecondary Education Data System (IPEDS) surveys approximately 6,800 postsecondary institutions, including universities and colleges, as well as institutions offering technical and vocational education beyond the high school level. IPEDS, which began in 1986, replaced the Higher Education General Information Survey (HEGIS).

IPEDS consists of eight interrelated 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. Until 2000 these components included institutional characteristics, fall enrollment, completions, salaries, finance, and fall staff. Beginning in 2000, data were collected in the fall for institutional characteristics and completions; in the winter for employees by assigned position (EAP), salaries, and fall staff; and in the spring for enrollment, student financial aid, finances, and graduation rates. With the winter 2005–06 survey the employees by assigned position, fall staff, and salaries components were merged into the human resources component. In 2007–08, the enrollment component was broken into two separate components: 12-month enrollment (collected in the fall) and fall enrollment (collected in the spring).

The degree-granting institutions portion of IPEDS is a census of colleges awarding associate's or higher degrees, that are eligible to participate in Title IV financial aid programs. Prior to 1993, data from technical and vocational institutions were collected through a sample survey. Beginning in 1993, all data were gathered in a census of all postsecondary Title IV 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 changed as of 1996. The old standard for higher education institutions included those institutions that had courses leading to an associate's degree or higher, or that had courses accepted for credit toward those degrees. Higher education institutions were accredited by an agency or association that was recognized by the U.S. Department of Education, or were recognized directly by the Secretary of Education. The current category includes institutions that award associate or higher level degrees and that are eligible to participate in Title IV federal financial aid programs. The largest impact has been on private 2-year college enrollment. The impact on enrollment in public 2-year colleges was larger for some states than others. Overall, total enrollment for all institutions was about one-half of a percent higher for degree-granting institutions than 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 collected 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 HEGIS enrollment and degrees surveys can be obtained from 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/

Fall (Institutional Characteristics) This survey collects the basic information necessary to classify institutions, including control, level, and types of programs offered, as well as 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 headcounts and instructional activity are now collected in a separate component (12-month Enrollment), part of the fall collection. The overall response rate was 100 percent for Title IV degree-granting institutions in reporting fall 2007 data.

Further information may be obtained from

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

Winter/Spring (Fall Enrollment) This survey has been part of the HEGIS and IPEDS series since 1966. The enrollment survey response rate is nearly 100 percent. Beginning in 2000, the data collection method became web-based, replacing the paper survey forms that had been used in past years, resulting in higher responses rates. In 2007–08, the overall response rate for all degree-granting institutions was 100 percent, except for 99.9 percent for private not-for-profit 4-year institutions. Imputation methods and the response bias analysis for the 2007–08 survey are discussed in Knapp, Kelly-Reid, and Ginder (2009).

Public institutions made the majority of changes to enrollment data during the 2004 revision period (Jackson et al. 2005). The majority of changes were made to unduplicated headcount data, with the net differences between the original data and the revised data at about 1 percent. Part-time students in general and enrollment in private not-for-profit institutions were often underestimated. The fewest changes by institutions were to Classification of Instructional Programs (CIP) code data.

Further information about the Winter/Spring (Fall Enrollment) survey may be obtained from

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

Fall (Completions) This survey was part of the HEGIS series throughout its existence. However, the degree classification taxonomy was revised in 1970–71, 1982–83, 1991–92, and 2002–03. Collection of degree data has been maintained through IPEDS.

The nonresponse rate does not appear to be a significant source of nonsampling error for this survey. The response rate over the years has been high, with the degree-granting institutions response rate for the 2007 survey at 100 percent. Because of the high response rate for degree-granting institutions, nonsampling error caused by imputation is also minimal. Imputation methods and the response bias analysis for the fall 2007 survey are discussed in Knapp, Kelly-Reid, and Ginder (2008).

Most Title IV institutions supplying revised data on completions in 2003–04 were able to supply missing data for the prior year (Jackson et al. 2005). The size of the differences between imputed data for the prior year and the revised actual data supplied by the institution indicated that the imputed values produced by NCES were acceptable.

Further information on the IPEDS Completions surveys may be obtained from

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Census Bureau

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* or methods for deriving standard errors can be found within the CPS technical documentation at http://www.census.gov/apsd/techdoc/cps/cps-main.html. The CPS data are subject to both nonsampling and sampling errors.

Caution should also be used when comparing data between Census years. With the release of the January 2003 CPS data, population controls that reflect the results of Census 2000 were used in the monthly CPS estimation process. The new controls increased the size of the civilian noninstitutional population by about 3.5 million in May 2002. This adjustment usually occurs 3 to 4 years after the census, and, in some instances, historical data will be revised. Data from January 2000 through December 2002 were revised to reflect these new controls. Over and above these revisions, the U.S. Census Bureau introduced another upward adjustment to the controls as part of its annual update of population estimates for 2003. The prior change in population controls occurred in March 1993, where data after this date were based on the 1990 census-based population controls and data before this date were based on 1980 or earlier census-based population controls. This change in population controls between 1980-based and 1990-based 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 resulted 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 differed 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.

In addition to the changes in population controls, two other relevant changes were introduced into the CPS with the release of the January 2003 data. First, the questions on race and Hispanic origin in the CPS were modified to comply with the new standards for maintaining, collecting, and presenting federal data on race and ethnicity for federal statistical agencies. A major change under those standards is that respondents may select more than one race when answering the survey. Respondents continued to be asked a separate question to determine if they are Hispanic, which is considered an ethnicity rather than a race. The ethnicity question was reworded to ask directly whether the respondent was Hispanic. Persons who report they are Hispanic also are classified separately in the race (or races) they consider themselves to be. Second, improvements were introduced to both the second stage and composite

weighting procedures. These changes adapt the weighting procedures to the new race/ethnic classification system and enhance the stability over time of national and state/substate labor force estimates for demographic groups. These two changes, in addition to the change in population controls discussed above, benchmark the CPS data to the results of Census 2000, improve the estimation procedures, and ensure that the data series produced from the survey reflect the evolving composition of the U.S. population.

Further information on CPS may be obtained from

Education and Social Stratification Branch
Population Division
Census Bureau
U.S. Department of Commerce
Washington, DC 20233
http://www.census.gov/cps

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 non-sampling 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.

The October 2006 basic CPS household-level response rate was 91.9 percent and the school enrollment supplement person-level response rate was 96.1 percent. Since these rates are determined at different levels they cannot be combined to derive an overall response rate.

Further information on CPS methodology may be obtained from

http://www.census.gov/cps

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

Education and Social Stratification Branch
Census Bureau
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 on Census Bureau projections may be obtained from

Population Division
Census Bureau
U.S. Department of Commerce
Washington, DC 20233
http://www.census.gov

Other Sources

IHS Global Insight

IHS Global Insight 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 IHS 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

IHS Global Insight
1000 Winter Street Suite 4300N
Waltham, MA 02451-124
http://www.ihsglobalinsight.com/

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Appendix D
List of Abbreviations

ADA	average daily attendance
BLS	Bureau of Labor Statistics
CCD	Common Core of Data
CIP	Classification of Instructional Programs
CPI	Consumer Price Index
CPS	Current Population Survey
EAP	employees by assigned position
EDEN	education data exchange network
EDMOD	Education Forecasting Model
FTE	full-time-equivalent
HEGIS	Higher Education General Information Survey
IPEDS	Integrated Postsecondary Education Data System
LEA	local education agency
MAPE	mean absolute percentage error
NCES	National Center for Education Statistics

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Appendix E
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Appendix F
Glossary

American Indian or Alaska Native: A person having origins in any of the original peoples of North America and who maintains cultural identification through tribal affiliation or community recognition.

Asian/Pacific Islander: A person having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, and Pacific Islands. This includes people from China, Japan, Korea, the Philippine Islands, American Samoa, India, and Vietnam.

Associate's degree: An award that normally requires at least 2 but less than 4 years of full-time equivalent college work.

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

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: An award (baccalaureate or equivalent degree, as determined by the Secretary, U.S. Department of Education) that normally requires at least 4 but not more than 5 years of full-time equivalent college-level work. This includes all bachelor's degrees conferred in a 5-year cooperative (work-study) program. A cooperative plan provides for alternate class attendance and employment in business, industry, or government; thus, it allows students to combine actual work experience with their college studies. Also includes bachelor's degrees in which the normal 4 years of work are completed in 3 years.

Black: A person having origins in any of the black racial groups of Africa (except those of Hispanic origin).

Breusch-Godfrey serial correlation LM test: A statistic testing the independence of errors in least-squares regression against alternatives of first-order and higher degrees of serial correlation. The test belongs to a class of asymptotic tests known as the Lagrange multiplier (LM) tests.

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 and school districts, excluding capital outlay, interest on school debt, and programs outside of public elementary and secondary education. 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 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.

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,..., plus a stochastic term, then y is known as the "dependent variable."

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: The highest award a student can earn for graduate study. The doctor's degree classification includes such degrees as Doctor of Education, Doctor of Juridical Science, Doctor of Public Health, and the Doctor of Philosophy degree in any field such as agronomy, food technology, education, engineering, public administration, ophthalmology, or radiology.

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.

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, federal schools for Indians, and federal schools on military posts and other federal installations.

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.

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

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.

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 degree-granting institutions, 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.

Exponential smoothing: A method used in time series analysis 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.*

First-professional degree: An award that requires completion of a program that meets all of the following criteria: (1) completion of the academic requirements to begin practice in the profession; (2) at least 2 years of college work prior to entering the program; and (3) a total of at least 6 academic years of college work to complete the degree program, including prior required college work plus the length of the professional program itself. First-professional degrees may be awarded in the following 10 fields: Chiropractic (D.C. or D.C.M.), Dentistry (D.D.S. or D.M.D.), Law (L.L.B., J.D.), Medicine (M.D.), Optometry (O.D.), Osteopathic Medicine (D.O.), Pharmacy (Pharm.D.), Podiatry (D.P.M., D.P., or Pod.D.), Theology (M.Div., M.H.L., B.D., or Ordination), Veterinary Medicine (D.V.M.).

First-professional enrollment: The number of students enrolled in following degree programs: Chiropractic (D.C. or D.C.M.), Dentistry (D.D.S. or D.M.D.), Law (L.L.B., J.D.), Medicine (M.D.), Optometry (O.D.), Osteopathic Medicine (D.O.), Pharmacy (Pharm.D.), Podiatry (D.P.M., D.P., or Pod.D.), Theology (M.Div., M.H.L., B.D., or Ordination), Veterinary Medicine (D.V.M.).

First-time freshman: A student attending any institution for the first time at the undergraduate level. Includes students enrolled in academic or occupational programs. Also includes students enrolled in the fall term who attended college for the first time in the prior summer term, as well as students who entered with advanced standing (college credits earned before graduation from high school).

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

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.

Four-year institution: A postsecondary institution that offers programs of at least 4 years duration or one that offers programs at or above the baccalaureate level. Includes schools that offer postbaccalaureate certificates only or those that offer graduate programs only. Also includes free-standing medical, law or other first-professional schools.

Full-time-equivalent (FTE) enrollment: A measurement equal to one student enrolled full time for one academic year. Total FTE enrollment includes full time plus the calculated equivalent of the part-time enrollment. The full-time equivalent of the part-time students can be estimated using different factors depending on the type and control of institution and level of student.

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.

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.

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 towards 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.

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*.

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).

Hispanic: A person of Mexican, Puerto Rican, Cuban, Central or South American or other Spanish culture or origin, regardless of race.

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

Interpolation: See *Linear interpolation.*

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.

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.

Master's degree: An award that requires the successful completion of a program of study of at least the full-time equivalent of 1 but not more than 2 academic years of work beyond the bachelor's degree.

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.

Nonresident alien: A person who is not a citizen or national of the United States and who is in this country on a visa or temporary basis and does not have the right to remain indefinitely.

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

Parameter: A quantity that describes a statistical population.

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.

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 students with a bachelor's degree who are enrolled in graduate-level or first-professional courses.

Postsecondary education: The provision of a formal instructional program whose curriculum is designed primarily for students who are beyond the compulsory age for high school. This includes programs whose purpose is academic, vocational, and continuing professional education, and excludes avocational and adult basic education programs.

Postsecondary education institution: An institution which has as its sole purpose or one of its primary missions, the provision of postsecondary education.

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.

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

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.

R^2: The coefficient of determination; the square of the correlation coefficient between the dependent variable and its OLS estimate.

Race/ethnicity: Categories used to describe groups to which individuals belong, identify with, or belong in the eyes of the community. The categories do not denote scientific definitions of anthropological origins. A person may be counted in only one group. The groups used to categorize U.S. citizens, resident aliens, and other eligible non-citizens in this report are as follows: Black, American Indian/Alaska Native, Asian/Pacific Islander, Hispanic, White.

Region: The four geographical regions of the United States as defined by the Census Bureau of the U.S. Department of Commerce presented below:

> **Northeast:** Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont.
>
> **Midwest:** Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin.
>
> **South:** Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia.
>
> **West:** Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

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

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.

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.

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

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.

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.

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 the Internet, television, radio, telephone, or correspondence.

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

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.

Two-year institution: A postsecondary institution that offers programs of at least 2 but less than 4 years duration. Includes occupational and vocational schools with programs of at least 1800 hours and academic institutions with programs of less than 4 years. Does not include bachelor's degree-granting institutions where the baccalaureate program can be completed in 3 years.

Undergraduate enrollment: The number of students enrolled in a 4- or 5-year bachelor's degree program, an associate's degree program, or a vocational or technical program below the baccalaureate.

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.

Ungraded student (elementary/secondary): A student who has been assigned to a school or program that does not have stan dard grade designations.

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

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