# 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 2017*, is the thirty-sixth in the series. It provides projections of enrollment, graduates, teachers, and expenditures.

The general methodological procedure for *Projections of Education Statistics to 2017* 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 2006. This enrollment rate was then projected through the year 2017 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.

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

**where:**

$P$ = projected value

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

$X_t$ = observation for time t

This equation illustrates that the projection is a weighted average based on exponentially decreasing weights. For a relatively high smoothing constant (0.7 or higher), weights for earlier observations decrease rapidly. For a relatively low smoothing constant (0.3 or lower), decreases are more moderate. Projections of enrollments and public high school graduates are based on a smoothing constant of $\alpha = 0.4$.

The farther apart the observations are spaced in time, the more likely it is that there are changes in the underlying social, political, and economic structure. Since the observations 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. Therefore, large shifts tend to indicate actual changes in the process rather than noise in the data.

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 ($R^2$s), the t-statistics of the coefficients, the Durbin-Watson 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 *Forecasting: Methods and Applications* by Spiro Makridakis, Steven C. Wheelwright, and Rob J. Hyndman (John Wiley and Sons, 1998, p. 607).

## Assumptions

All projections are based on underlying assumptions, and these assumptions determine projection results to a large extent. It is important that users of projections understand the assumptions to determine the acceptability of projected time series for their purposes. Descriptions of the primary assumptions upon which the projections of time series are based are presented in table A-1.

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

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 are high school graduates. Projections of associate's, bachelor's, master's, doctor's, and first-professional degrees are based on projections of college-age populations and college enrollment, by sex, attendance status, level enrolled by student, and type of institution.

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: February 2007: Long-Term-Projections" of the economic consulting firm Global Insight, Inc. (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, but instead represent judgments made by the authors as to reasonable upper and lower bounds. The mean absolute percentage error is one way to express the forecast accuracy of past projections. This measure expresses the average value of the absolute value of errors over past projections in percentage terms. For example, the mean absolute percentage errors of public school enrollment in grades K–12 for lead times of 1, 2, 5, and 10 years were 0.3, 0.6, 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 2017**

| 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 -0.07% | Same as middle alternative | Same as middle alternative |
| 25- to 29-year-old population | Census Bureau middle series projection: average annual growth rate of 0.9% | 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 decline of -0.3% | Same as middle alternative | Same as middle alternative |
| **Economic assumptions** | | | |
| Disposable income per capita in constant dollars | Annual percent changes range between 0.4% and 2.7% with an annual growth rate of 2.1% | Annual percent changes range between 0.4% and 2.3% with an annual growth rate of 1.4% | Annual percent changes range between 0.4% and 3.6% with an annual growth rate of 2.6% |
| Education revenue receipts from state sources per capita in constant dollars | Annual percent changes range between -1.2% and 3.6% with an annual growth rate of 2.5% | Annual percent changes range between -1.2% and 3.5% with an annual growth rate of 1.7% | Annual percent changes range between -1.2% and 3.7% with an annual growth rate of 3.1% |
| Inflation rate | Inflation rate ranges between 1.8% and 3.8% | Inflation rate ranges between 2.2% and 3.8% | Inflation rate ranges between 1.1% and 3.8% |
| **Unemployment rate (men)** | | | |
| Ages 18 and 19 | Remains between 15.4% and 17.0% | Remains between 16.8% and 18.5% | Remains between 15.2% and 16.7% |
| Ages 20 to 24 | Remains between 8.3% and 9.2% | Remains between 9.1% and 10.1% | Remains between 8.2% and 9.1% |
| Age 25 and over | Remains between 3.3% and 3.7% | Remains between 3.7% and 4.1% | Remains between 3.3% and 3.7% |
| **Unemployment rate (women)** | | | |
| Ages 18 and 19 | Remains between 12.0% and 13.0% | Remains between 12.9% and 14.0% | Remains between 11.8% and 12.9% |
| Ages 20 to 24 | Remains between 6.9% and 7.6% | Remains between 7.5% and 8.2% | Remains between 6.9% and 7.5% |
| Age 25 and over | Remains between 3.4% and 3.7% | Remains between 3.7% and 4.1% | Remains between 3.4% and 3.7% |

[1]As the Census Bureau projections were not updated to reflect the 2007 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 2007 to the total Census Bureau projection for 2007.

SOURCE: U.S. Department of Commerce, Census Bureau, Population Estimates, retrieved September 7, 2007, from http://www.census.gov/popest/national/asrh/2006_nat_af.html; and Population Projections, retrieved September 7, 2007, from http://www.census.gov/ipc/www/usinterimproj/; and Global Insight, Inc., "U.S. Quarterly Model." (This table was prepared December 2007.)

**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: 2007**

| Statistic | Lead time (years) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 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 | 1.4 | 1.6 | 1.7 | 2.0 | 2.3 |
| Prekindergarten–8 enrollment | 0.4 | 0.6 | 0.9 | 1.1 | 1.3 | 1.6 | 1.9 | 2.2 | 2.7 | 3.2 |
| 9–12 enrollment | 0.4 | 0.7 | 1.0 | 1.2 | 1.4 | 1.6 | 1.9 | 2.1 | 2.2 | 2.3 |
| High school graduates | 0.8 | 0.8 | 1.6 | 1.9 | 1.8 | 2.1 | 2.7 | 3.5 | 3.9 | 3.9 |
| Elementary and secondary teachers[1] | 1.0 | 1.5 | 1.9 | 2.6 | 2.7 | 3.3 | 3.9 | 4.7 | 5.3 | 6.1 |
| Total current expenditures[2] | 1.3 | 2.2 | 2.2 | 2.4 | 2.9 | 3.7 | 4.4 | 4.7 | 4.5 | 3.8 |
| Current expenditures per pupil in fall enrollment[2] | 1.3 | 2.1 | 2.0 | 2.3 | 3.3 | 4.0 | 4.9 | 5.3 | 5.8 | 5.4 |
| **Degree-granting institutions** | | | | | | | | | | |
| Total enrollment | 1.5 | 2.1 | 2.8 | 3.2 | 4.6 | 5.6 | 7.0 | 9.4 | 9.8 | 10.9 |
| Men | 1.5 | 2.7 | 3.1 | 3.8 | 5.4 | 6.6 | 8.4 | 9.3 | 9.6 | 10.3 |
| Women | 2.5 | 3.0 | 3.3 | 4.3 | 5.6 | 6.5 | 7.9 | 9.4 | 10.0 | 11.3 |
| 4-year institutions | 1.2 | 2.1 | 2.8 | 3.8 | 5.4 | 6.8 | 8.1 | 9.9 | 11.2 | 12.5 |
| 2-year institutions | 2.2 | 3.7 | 4.2 | 4.3 | 4.9 | 5.6 | 7.6 | 8.5 | 7.5 | 8.1 |
| Associate's degrees | 2.1 | 2.9 | 3.1 | 4.8 | 5.7 | 6.9 | 8.9 | 11.0 | 12.6 | 14.3 |
| Bachelor's degrees | 1.0 | 1.9 | 2.6 | 4.0 | 5.6 | 7.3 | 8.8 | 9.7 | 11.1 | 12.1 |
| Master's degrees | 1.9 | 3.7 | 6.9 | 10.1 | 12.1 | 14.7 | 17.3 | 19.5 | 21.8 | 22.9 |
| Doctor's degrees | 3.0 | 4.4 | 3.6 | 5.1 | 5.4 | 3.9 | 5.7 | 7.3 | 7.2 | 7.6 |
| First-professional degrees | 1.4 | 1.5 | 1.6 | 3.0 | 5.1 | 6.8 | 8.3 | 9.9 | 12.4 | 13.7 |

[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 24 editions of *Projections of Education Statistics.* MAPEs for high school graduates were calculated from the past 16 editions of *Projections of Education Statistics.* MAPEs for teachers were calculated from the past 17 editions containing teachers projections and MAPEs for current expenditures were calculated using projections from the last 17 editions containing current expenditure projections. MAPEs for degree-granting institution enrollments and earned degrees were calculated using the last 10 and 11 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 2007.)

# Enrollment

## National

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

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 known more aggregate totals to ensure that the sum across these most detailed level of enrollment data equal the more aggregate NCES totals 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 earlier ages. Full-time and part-time enrollments are modeled separately, with each model run by sex. Within an enrollment category, where applicable, college enrollment rates were projected by individual ages 16 through 24 and for the age groups 25 to 29, 30 to 34, and 35 years and over. Three alternative projections were made using various economic assumptions. Table A-3 shows enrollment rates for 2006 and middle alternative projected enrollment rates for 2012 and 2017. 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.

### 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 2005 and projections for 2006 through 2017. 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 2007 through 2017 are shown in tables A-8 and A-9, along with actual values for 2006. 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 2007 through 2017 are shown in table A-10, along with actual percents for 2006. 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 2006 and projections for 2007 through 2017 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 2006 and projections for 2007 and 2017 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 Hawaiian-Pacific Islander; American Indian/Alaska Native and Non-Resident Alien. 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 2006. 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 level of enrollment data (by age, sex, enrollment status, and race/ethnicity) were iteratively changed using proportions that are based on known more aggregate totals to ensure that the sum across these most detailed level of enrollment data equal the more aggregate NCES totals 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. College enrollment is negligible for earlier ages. 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. Table A-14 shows the estimated equations used to project the enrollments for White men by attendance status. Table A-15 shows the estimated equations used to project enrollment rates for White women by attendance. Table A-16 shows the estimated equations used to project the enrollments for Black men by attendance status. Table A-17 shows the estimated equations used to project enrollment rates for Black women by attendance. Table A-18 shows the estimated equations used to project the enrollments for Hispanic men by attendance status. Table A-19 shows the estimated equations used to project enrollment rates for Hispanic women by attendance. Table A-20 shows the estimated equations used to project the enrollments for Asian or Hawaiian-Pacific Islander men by attendance status. Table A-21 shows the estimated equations used to project enrollment rates for Asian or Hawaiian-Pacific Islander women by attendance status.

### Accuracy of Projections

An analysis of projection errors from the past 24 editions of *Projections of Education Statistics* indicates that the mean absolute percentage errors (MAPEs) for lead times of 1, 2, 5, and 10 years out for projections of public school enrollment in grades K–12 were 0.3, 0.6, 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 K–8, the MAPEs for lead times of 1, 2, 5, and 10 years out were 0.4, 0.6, 1.3, and 3.2 percent, respectively, while those for projections of public school enrollment in grades 9–12 were 0.4, 0.7, 1.4, and 2.3 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 1.5, 2.1, 4.6, and 10.9 percent, respectively. For the 1-year-out prediction, this means that one would expect the projection to be within 1.5 percent of the actual value, on the average. For more information on MAPEs, see table A-2, page 86.

## Basic Methodology

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

## Public Elementary and Secondary Enrollment

**Let:**

$i$ = Subscript denoting age

$j$ = Subscript denoting grade

$t$ = Subscript denoting time

$K_t$ = Enrollment at the nursery and kindergarten level

$G_{jt}$ = Enrollment in grade j

$G_{1t}$ = Enrollment in grade 1

$E_t$ = Enrollment in elementary special and ungraded programs

$S_t$ = Enrollment in secondary special and ungraded programs

$P_{it}$ = Population age i

$RK_t$ = Enrollment rate for nursery and kindergarten

$RG_{1t}$ = Enrollment rate for grade 1

$RE_t$ = Enrollment rate for elementary special and ungraded programs

$RS_t$ = Enrollment rate for secondary special and ungraded programs

$EG_t$ = Total enrollment in elementary grades (K–8)

$SG_t$ = Total enrollment in secondary grades (9–12)

$R_{jt}$ = Progression rate for grade j: the proportion that enrollment in grade j in year t is of enrollment in grade j - 1 in year t-1.

**Then:**

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

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

**where:**

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

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

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

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

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

## Enrollment in Degree-Granting Institutions

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

**Let:**

i = Subscript denoting age except:

i = 25: ages 25–29

i = 26: ages 30–34

i = 27: ages 35 and over for enrollment (35–44 for population)

t = Subscript denoting year

j = Subscript denoting sex

k = Subscript denoting attendance status

$E_{ijkt}$ = Enrollment of students age i by sex and attendance status

$P_{ijt}$ = Population age i by sex

$R_{ijkt}$ = Enrollment rate for students age i by sex and attendance status

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

**Then:**

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

**where:**

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

## 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:**

$$E_{ijklt} = R_{ijklt}\left(P_{ijlt}\right)$$

## Methodological Tables

Table A-22 gives the basic assumptions underlying enrollment projections.

### 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 NCES Private School Universe Survey for 1989–90, 1991–92, 1993–94, 1995–96, 1997–98, 1999–2000, 2001–02, 2003–04, and 2005–06 were used to develop these projections. In addition, population estimates for 1989 to 2006 and population projections for 2007 to 2017 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 2005 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 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 2006 to the year 2017 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 2005 were used to develop these projections. This survey does not collect enrollment data for private schools.

Population estimates for 1980 to 2006 and population projections for 2007 to 2017 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 2017* are the Census Bureau's set of interim state-level population projections (April 2005), which were also used in last year's report. This set of state-level projections line up with 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 2005 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 K–12, K–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 2006, 2012, and 2017**

| Sex, attendance status, and age | Actual 2006 | Projected 2012 | Projected 2017 |
|---|---|---|---|
| **Men** | | | |
| Full-time | | | |
| 16 years old | 0.6 | 0.4 | 0.4 |
| 17 years old | 2.3 | 2.4 | 2.6 |
| 18 years old | 29.6 | 30.8 | 32.5 |
| 19 years old | 36.0 | 37.3 | 39.1 |
| 20 years old | 31.6 | 32.8 | 34.6 |
| 21 years old | 29.1 | 30.2 | 31.8 |
| 22 years old | 23.6 | 24.6 | 26.1 |
| 23 years old | 13.2 | 13.9 | 14.8 |
| 24 years old | 8.8 | 9.2 | 9.9 |
| 25 to 29 years old | 5.3 | 5.6 | 6.0 |
| 30 to 34 years old | 2.3 | 2.5 | 2.7 |
| 35 to 44 years old | 1.3 | 1.3 | 1.4 |
| Part-time | | | |
| 16 years old | 0.1 | 0.2 | 0.2 |
| 17 years old | 0.6 | 0.6 | 0.7 |
| 18 years old | 6.4 | 6.6 | 6.9 |
| 19 years old | 7.5 | 7.7 | 8.0 |
| 20 years old | 6.8 | 7.0 | 7.4 |
| 21 years old | 8.8 | 9.1 | 9.5 |
| 22 years old | 7.0 | 7.3 | 7.7 |
| 23 years old | 6.5 | 6.8 | 7.3 |
| 24 years old | 7.6 | 7.9 | 8.5 |
| 25 to 29 years old | 4.6 | 4.8 | 5.2 |
| 30 to 34 years old | 3.2 | 3.4 | 3.7 |
| 35 to 44 years old | 3.5 | 3.7 | 4.0 |
| **Women** | | | |
| Full-time | | | |
| 16 years old | 0.7 | 0.5 | 0.5 |
| 17 years old | 3.9 | 2.7 | 3.4 |
| 18 years old | 37.0 | 37.7 | 41.0 |
| 19 years old | 49.0 | 50.4 | 54.0 |
| 20 years old | 42.6 | 44.7 | 48.8 |
| 21 years old | 36.3 | 37.7 | 41.2 |
| 22 years old | 27.2 | 28.2 | 30.9 |
| 23 years old | 15.5 | 17.0 | 19.7 |
| 24 years old | 10.9 | 11.7 | 13.6 |
| 25 to 29 years old | 6.5 | 6.6 | 7.4 |
| 30 to 34 years old | 3.8 | 3.9 | 4.4 |
| 35 to 44 years old | 2.3 | 2.4 | 2.6 |
| Part-time | | | |
| 16 years old | 0.5 | 0.2 | 0.2 |
| 17 years old | 1.5 | 1.6 | 1.7 |
| 18 years old | 5.1 | 5.3 | 5.4 |
| 19 years old | 10.6 | 10.8 | 10.6 |
| 20 years old | 9.2 | 9.3 | 9.1 |
| 21 years old | 8.6 | 8.8 | 8.8 |
| 22 years old | 11.2 | 11.5 | 11.7 |
| 23 years old | 10.6 | 11.0 | 11.3 |
| 24 years old | 9.2 | 9.6 | 10.0 |
| 25 to 29 years old | 6.9 | 7.2 | 7.6 |
| 30 to 34 years old | 4.9 | 5.2 | 5.5 |
| 35 to 44 years old | 7.2 | 7.5 | 8.0 |

SOURCE: U.S. Department of Education, National Center for Education Statistics, Enrollment in Degree-Granting Institutions Model, 1980–2006. (This table was prepared November 2007.)

**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** | | | | | |
| Age 17 | -5.71 | 0.253 | -22.58 | 0.99 | 2.1* |
| Age 18 | -3.04 | 0.198 | -15.33 | | |
| Age 19 | -2.82 | 0.177 | -15.95 | | |
| Age 20 | -2.98 | 0.179 | -16.71 | | |
| Age 21 | -3.09 | 0.181 | -17.10 | | |
| Age 22 | -3.59 | 0.183 | -19.59 | | |
| Age 23 | -4.02 | 0.178 | -22.57 | | |
| Age 24 | -4.34 | 0.194 | -22.39 | | |
| Age 25 | -5.12 | 0.201 | -25.44 | | |
| Age 25–29 | -6.07 | 0.198 | -30.62 | | |
| Age 35–44 | -6.70 | 0.192 | -34.85 | | |
| LNRYPDRNMA | 0.41 | 0.033 | 12.24 | | |
| LNRUM | 0.08 | 0.038 | 2.14 | | |
| Rho17 | 0.70 | 0.093 | 7.47 | | |
| Rho18 | 0.78 | 0.074 | 10.63 | | |
| Rho19 | 0.26 | 0.140 | 1.86 | | |
| Rho20 | 0.37 | 0.122 | 3.03 | | |
| Rho21 | 0.48 | 0.134 | 3.56 | | |
| Rho22 | 0.50 | 0.139 | 3.58 | | |
| Rho23 | 0.09 | 0.134 | 0.64 | | |
| Rho24 | 0.71 | 0.099 | 7.23 | | |
| Rho25–29 | 0.77 | 0.077 | 10.00 | | |
| Rho30–34 | 0.64 | 0.104 | 6.13 | | |
| Rho35–44 | 0.42 | 0.101 | 4.17 | | |
| **Part-time** | | | | | |
| Age 17 | -8.27 | 0.880 | -9.40 | 0.38 | 1.9* |
| Age 18 | -4.79 | 0.583 | -8.22 | | |
| Age 19 | -4.44 | 0.626 | -7.10 | | |
| Age 20 | -4.41 | 0.582 | -7.58 | | |
| Age 21 | -4.49 | 0.583 | -7.69 | | |
| Age 22 | -4.39 | 0.586 | -7.50 | | |
| Age 23 | -4.65 | 0.580 | -8.02 | | |
| Age 24 | -4.85 | 0.594 | -8.17 | | |
| Age 25 | -4.97 | 0.634 | -7.85 | | |
| Age 25–29 | -5.34 | 0.619 | -8.63 | | |
| Age 35–44 | -5.37 | 0.591 | -9.08 | | |
| LNRYPDRNMA | 0.40 | 0.108 | 3.68 | | |
| LNRUM | 0.06 | 0.072 | 0.79 | | |
| Rho17 | -0.12 | 0.158 | -0.73 | | |
| Rho18 | 0.33 | 0.178 | 1.84 | | |
| Rho19 | 0.83 | 0.081 | 10.21 | | |
| Rho20 | 0.37 | 0.169 | 2.20 | | |
| Rho21 | 0.38 | 0.193 | 1.97 | | |
| Rho22 | 0.44 | 0.146 | 2.99 | | |
| Rho23 | 0.19 | 0.187 | 1.03 | | |
| Rho24 | 0.65 | 0.120 | 5.44 | | |
| Rho25–29 | 0.86 | 0.070 | 12.29 | | |
| Rho30–34 | 0.85 | 0.061 | 13.94 | | |
| Rho35–44 | 0.66 | 0.127 | 5.21 | | |

* $p<.05$.

$R^2$ = Coefficient of determination.

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

**Where:**

AGE(age) = Age-specific intercept term.

Rho(age) = Autocorrelation coefficient for each age.

LNRUM = Log unemployment rate for men.

LNRYPDRNMA = Log of three-period weighted average of per capita disposable income in 2000 dollars, using the present period and the previous two periods.

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 1975 to 2006. The number of observations is 374. For additional information, see M. D. Intriligator, *Econometric Models, Techniques, & Applications*, New Jersey: Prentice-Hall, Inc., 1978, pp. 165–173.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Enrollment in Degree-Granting Institutions Model, 1980–2006. (This table was prepared December 2007.)

**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** | | | | | |
| Age 17 | -10.39 | 2.009 | -5.17 | 0.99 | 2.39* |
| Age 18 | -6.92 | 0.377 | -18.37 | | |
| Age 19 | -6.61 | 0.215 | -30.70 | | |
| Age 20 | -6.80 | 0.210 | -32.45 | | |
| Age 21 | -7.02 | 0.209 | -33.55 | | |
| Age 22 | -7.69 | 0.240 | -32.04 | | |
| Age 23 | -8.18 | 0.221 | -37.02 | | |
| Age 24 | -8.47 | 0.211 | -40.03 | | |
| Age 25 | -9.18 | 0.215 | -42.81 | | |
| Age 25–29 | -9.89 | 0.211 | -46.87 | | |
| Age 35–44 | -10.14 | 0.208 | -48.78 | | |
| LNRYPDRNMA | 1.18 | 0.048 | 24.48 | | |
| LNRUF | 0.21 | 0.062 | 3.37 | | |
| Rho17 | 0.96 | 0.052 | 18.38 | | |
| Rho18 | 0.91 | 0.070 | 13.01 | | |
| Rho19 | 0.35 | 0.138 | 2.51 | | |
| Rho20 | 0.34 | 0.142 | 2.38 | | |
| Rho21 | 0.31 | 0.131 | 2.39 | | |
| Rho22 | 0.79 | 0.073 | 10.77 | | |
| Rho23 | 0.68 | 0.088 | 7.72 | | |
| Rho24 | 0.41 | 0.105 | 3.91 | | |
| Rho25–29 | 0.67 | 0.085 | 7.90 | | |
| Rho30–34 | 0.45 | 0.139 | 3.25 | | |
| Rho35–44 | 0.08 | 0.120 | 0.68 | | |
| **Part-time** | | | | | |
| Age 17 | -7.01 | 0.554 | -12.67 | 0.79 | 2.34* |
| Age 18 | -4.30 | 0.301 | -14.29 | | |
| Age 19 | -3.83 | 0.460 | -8.32 | | |
| Age 20 | -4.04 | 0.319 | -12.68 | | |
| Age 21 | -4.15 | 0.334 | -12.43 | | |
| Age 22 | -4.09 | 0.301 | -13.56 | | |
| Age 23 | -4.35 | 0.306 | -14.21 | | |
| Age 24 | -4.48 | 0.330 | -13.59 | | |
| Age 25 | -4.67 | 0.299 | -15.61 | | |
| Age 25–29 | -4.90 | 0.303 | -16.17 | | |
| Age 35–44 | -4.67 | 0.300 | -15.54 | | |
| LNRYPDRNMA | 0.35 | 0.053 | 6.69 | | |
| Rho17 | 0.51 | 0.121 | 4.22 | | |
| Rho18 | 0.38 | 0.162 | 2.35 | | |
| Rho19 | 0.87 | 0.075 | 11.65 | | |
| Rho20 | 0.63 | 0.116 | 5.40 | | |
| Rho21 | 0.76 | 0.075 | 10.16 | | |
| Rho22 | 0.38 | 0.137 | 2.78 | | |
| Rho23 | 0.51 | 0.121 | 4.18 | | |
| Rho24 | 0.77 | 0.091 | 8.46 | | |
| Rho25–29 | 0.54 | 0.117 | 4.60 | | |
| Rho30–34 | 0.75 | 0.073 | 10.27 | | |
| Rho35–44 | 0.60 | 0.088 | 6.82 | | |

* $p<.05$.
$R^2$ = Coefficient of determination.
D.W. statistic = Durbin-Watson statistic. For an explanation of the Durbin-Watson statistic, see J. Johnston and J. Dinardo, *Econometric Methods*, New York: McGraw-Hill, 1996.
**Where:**
AGE(age) = Age-specific intercept term.
Rho(age) = Autocorrelation coefficient for each age.
LNRUF = Log unemployment rate for women.
LNRYPDRNMA = Log of three-period weighted average of per capita disposable income in 2000 dollars, using the present period and the previous two periods.
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 1975 to 2006. The number of observations is 374. For additional information, see M. D. Intriligator, *Econometric Models, Techniques, & Applications*, New Jersey: Prentice-Hall, Inc., 1978, pp. 165–173.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Enrollment in Degree-Granting Institutions Model, 1980–2006. (This table was prepared December 2007.)

**Table A-6. Actual and projected numbers for national enrollment rates in public schools, by grade level: Fall 2005, and 2006 through 2017**

| Grade level | Actual 2005 | Projected 2006 through 2017 |
|---|---|---|
| Prekindergarten | 26.5 | 26.5 |
| Kindergarten | 92.5 | 92.5 |
| Grade 1 | 95.4 | 95.4 |
| Elementary ungraded | 0.6 | 0.6 |
| Secondary ungraded | 0.6 | 0.6 |

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-year-olds; and secondary ungraded 14- to 17-year-olds. Projected values for 2006 through 2017 were held constant at the actual values for 2005.
SOURCE: U.S. Department of Education, National Center for Education Statistics, National Elementary and Secondary Enrollment Model, 1972–2005. (This table was prepared November 2007.)

**Table A-7. Actual and projected numbers for national public school grade progression rates: Fall 2005, and 2006 through 2017**

| Grade | Actual 2005 | Projected 2006 through 2017 |
|---|---|---|
| 1 to 2 | 98.5 | 98.5 |
| 2 to 3 | 100.7 | 100.9 |
| 3 to 4 | 99.9 | 100.0 |
| 4 to 5 | 100.6 | 100.5 |
| 5 to 6 | 101.0 | 101.3 |
| 6 to 7 | 101.1 | 101.3 |
| 7 to 8 | 99.6 | 99.6 |
| 8 to 9 | 112.1 | 112.6 |
| 9 to 10 | 90.3 | 89.7 |
| 10 to 11 | 92.1 | 91.6 |
| 11 to 12 | 94.4 | 94.1 |

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Elementary and Secondary Enrollment Model, 1972–2005. (This table was prepared November 2007.)

**Table A-8. Actual and projected numbers for the percentage distribution of full-time students at degree-granting postsecondary institutions, by sex and age group: Fall 2006, and 2007 through 2017**

| Age and institution type | Men | | Women | |
|---|---|---|---|---|
| | Actual 2006 | Projected 2007 through 2017 | Actual 2006 | Projected 2007 through 2017 |
| **18 and 19 years old** | | | | |
| Undergraduate, 4-year institutions | 63.3 | 64.9 | 69.5 | 68.2 |
| Undergraduate, 2-year institutions | 36.7 | 34.8 | 30.3 | 31.5 |
| Postbaccalaureate, 4-year institutions | # | 0.2 | # | 0.3 |
| **20 and 21 years old** | | | | |
| Undergraduate, 4-year institutions | 78.2 | 76.7 | 78.1 | 78.9 |
| Undergraduate, 2-year institutions | 20.7 | 21.2 | 19.4 | 18.9 |
| Postbaccalaureate, 4-year institutions | 1.1 | 2.1 | 2.5 | 2.2 |
| **22 to 24 years old** | | | | |
| Undergraduate, 4-year institutions | 70.4 | 67.3 | 58.8 | 60.4 |
| Undergraduate, 2-year institutions | 12.9 | 15.6 | 16.2 | 17.1 |
| Postbaccalaureate, 4-year institutions | 16.8 | 17.1 | 25.0 | 22.5 |
| **25 to 29 years old** | | | | |
| Undergraduate, 4-year institutions | 42.3 | 41.0 | 41.9 | 40.6 |
| Undergraduate, 2-year institutions | 16.1 | 18.1 | 23.2 | 24.4 |
| Postbaccalaureate, 4-year institutions | 41.6 | 40.9 | 35.0 | 35.0 |
| **30 to 34 years old** | | | | |
| Undergraduate, 4-year institutions | 32.7 | 34.8 | 46.0 | 38.2 |
| Undergraduate, 2-year institutions | 19.3 | 19.3 | 28.2 | 33.7 |
| Postbaccalaureate, 4-year institutions | 48.0 | 45.9 | 25.8 | 28.2 |
| **35 years and over** | | | | |
| Undergraduate, 4-year institutions | 43.2 | 40.9 | 43.1 | 40.4 |
| Undergraduate, 2-year institutions | 26.1 | 27.8 | 32.5 | 32.8 |
| Postbaccalaureate, 4-year institutions | 30.7 | 31.4 | 24.4 | 26.8 |

# Rounds to zero.
NOTE: Detail may not sum to totals because of rounding.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Enrollment in Degree-Granting Institutions Model, 1980–2006. (This table was prepared November 2007.)

**Table A-9. Actual and projected numbers for the percentage distribution of part-time students at degree-granting postsecondary institutions, by sex and age group: Fall 2006, and 2007 through 2017**

| | Men | | Women | |
|---|---|---|---|---|
| Institution type and age | Actual 2006 | Projected 2007 through 2017 | Actual 2006 | Projected 2007 through 2017 |
| **18 and 19 years old** | | | | |
| Undergraduate, 4-year institutions | 22.8 | 20.7 | 19.7 | 19.8 |
| Undergraduate, 2-year institutions | 77.2 | 79.2 | 80.3 | 79.9 |
| Postbaccalaureate, 4-year institutions | # | 0.1 | # | 0.3 |
| **20 and 21 years old** | | | | |
| Undergraduate, 4-year institutions | 26.0 | 26.8 | 40.3 | 33.9 |
| Undergraduate, 2-year institutions | 73.3 | 72.7 | 57.6 | 65.1 |
| Postbaccalaureate, 4-year institutions | 0.8 | 0.5 | 2.0 | 1.0 |
| **22 to 24 years old** | | | | |
| Undergraduate, 4-year institutions | 34.5 | 34.2 | 27.5 | 28.6 |
| Undergraduate, 2-year institutions | 54.4 | 56.1 | 60.0 | 59.6 |
| Postbaccalaureate, 4-year institutions | 11.1 | 9.7 | 12.6 | 11.8 |
| **25 to 29 years old** | | | | |
| Undergraduate, 4-year institutions | 28.5 | 28.2 | 21.1 | 22.8 |
| Undergraduate, 2-year institutions | 52.3 | 52.5 | 56.2 | 53.9 |
| Postbaccalaureate, 4-year institutions | 19.2 | 19.4 | 22.8 | 23.3 |
| **30 to 34 years old** | | | | |
| Undergraduate, 4-year institutions | 21.2 | 23.6 | 22.2 | 23.3 |
| Undergraduate, 2-year institutions | 52.2 | 47.1 | 50.1 | 52.4 |
| Postbaccalaureate, 4-year institutions | 26.6 | 29.3 | 27.8 | 24.3 |
| **35 years and over** | | | | |
| Undergraduate, 4-year institutions | 23.6 | 21.6 | 24.8 | 23.2 |
| Undergraduate, 2-year institutions | 48.9 | 51.7 | 52.0 | 52.3 |
| Postbaccalaureate, 4-year institutions | 27.6 | 26.7 | 23.2 | 24.6 |

# Rounds to zero.
NOTE: Detail may not sum to totals because of rounding.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Enrollment in Degree-Granting Institutions Model, 1980–2005. (This table was prepared November 2007.)

**Table A-10. Actual and projected numbers for enrollment in public degree-granting postsecondary institutions as a percent of total enrollment, by sex, attendance status, level enrolled, and type of institution: Fall 2006, and 2007 through 2017**

| | Men | | Women | |
|---|---|---|---|---|
| Enrollment category | Actual 2006 | Projected 2007 through 2017 | Actual 2006 | Projected 2007 through 2017 |
| Full-time, undergraduate, 4-year institutions | 65.6 | 65.9 | 62.7 | 63.6 |
| Part-time, undergraduate, 4-year institutions | 70.6 | 70.5 | 67.0 | 67.6 |
| Full-time, undergraduate, 2-year institutions | 92.0 | 91.5 | 89.3 | 89.7 |
| Part-time, undergraduate, 2-year institutions | 99.3 | 99.2 | 98.7 | 98.7 |
| Full-time, postbaccalaureate, 4-year institutions | 49.3 | 49.3 | 47.8 | 47.8 |
| Part-time, postbaccalaureate, 4-year institutions | 54.3 | 54.3 | 56.4 | 56.4 |

SOURCE: U.S. Department of Education, National Center for Education Statistics, Enrollment in Degree-Granting Institutions Model, 1980–2006. (This table was prepared November 2007.)

**Table A-11. Actual and projected numbers for graduate enrollment in degree-granting postsecondary institutions as a percent of total postbaccalaureate enrollment, by sex, attendance status, and control of institution: Fall 2006, and 2007 through 2017**

| | Men | | Women | |
|---|---|---|---|---|
| Enrollment category | Actual 2006 | Projected 2007 through 2017 | Actual 2006 | Projected 2007 through 2017 |
| Full-time, 4-year, public | 79.1 | 79.1 | 81.1 | 81.1 |
| Part-time, 4-year, public | 98.6 | 98.6 | 99.2 | 99.2 |
| Full-time, 4-year, private | 70.5 | 70.5 | 79.1 | 79.1 |
| Part-time, 4-year, private | 92.5 | 92.5 | 96.2 | 96.2 |

NOTE: Projected values for 2007 through 2017 were held constant at the actual values for 2006.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Enrollment in Degree-Granting Institutions Model, 1980–2006. (This table was prepared November 2007.)

**Table A-12. Actual and projected numbers for full-time-equivalent enrollment of part-time students in degree-granting postsecondary institutions as a percent of part-time enrollment, by type and control of institution, and level enrolled: Fall 2006, and 2007 through 2017**

| Enrollment category | Actual 2006 | Projected 2007 through 2017 |
|---|---|---|
| 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 | 60.0 |
| Private, 4-year, first-professional | 54.6 | 54.6 |

NOTE: Projected values for 2007 through 2017 were held constant at the actual values for 2006.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Enrollment in Degree-Granting Institutions Model, 1980–2006. (This table was prepared November 2007.)

**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 (1972–2005) | Projection method | Smoothing constant | Basis for smoothing constant |
|---|---|---|---|---|
| Grade progression rates | 33 | Single exponential smoothing | 0.4 | Empirical research |
| Graduates divided by grade 12 enrollment | 33 | 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, 1980–2005; and State Public High School Graduates Model, 1980–81 through 2004–05. (This table was prepared November 2007.)

**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** | | | | | |
| Age 17 | -7.85 | 0.148 | -52.98 | 0.99 | 1.67* |
| Age 18 | -4.89 | 0.114 | -42.99 | | |
| Age 19 | -4.67 | 0.110 | -42.62 | | |
| Age 20 | -4.89 | 0.110 | -44.32 | | |
| Age 21 | -5.02 | 0.111 | -45.37 | | |
| Age 22 | -5.52 | 0.113 | -48.76 | | |
| Age 23 | -6.04 | 0.111 | -54.46 | | |
| Age 24 | -6.41 | 0.113 | -56.86 | | |
| Age 25–29 | -7.32 | 0.111 | -66.09 | | |
| Age 30–34 | -8.37 | 0.114 | -73.12 | | |
| Age 35 and up | -9.00 | 0.118 | -76.15 | | |
| LNYPDNWNH | 0.22 | 0.006 | 39.12 | | |
| **Part-time** | | | | | |
| Age 17 | -6.21 | 0.900 | -6.89 | 0.99 | 1.71* |
| Age 18 | -1.76 | 0.125 | -14.14 | | |
| Age 19 | -1.46 | 0.136 | -10.76 | | |
| Age 20 | -1.41 | 0.121 | -11.68 | | |
| Age 21 | -1.52 | 0.125 | -12.17 | | |
| Age 22 | -1.45 | 0.125 | -11.63 | | |
| Age 23 | -1.72 | 0.119 | -14.41 | | |
| Age 24 | -1.92 | 0.122 | -15.74 | | |
| Age 25–29 | -2.00 | 0.117 | -17.20 | | |
| Age 30–34 | -2.45 | 0.120 | -20.47 | | |
| Age 35 and up | -2.51 | 0.114 | -21.89 | | |
| LNRJECIWSSPCPI | 1.03 | 0.148 | 6.99 | | |

* $p<.05$.
$R^2$ = Coefficient of determination.
D.W. statistic = Durbin-Watson statistic. For an explanation of the Durbin-Watson statistic, see J. Johnston and J. Dinardo, *Econometric Methods*, New York: McGraw-Hill, 1996.
**Where:**
AGE(age) = Age-specific intercept term.
LNYPDNWNH = Log of White per capita disposable income in current dollars.
LNRJECIWSSPCPI = Log of real total private compensation employment cost index.
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 2006. The number of observations is 297. For additional information, see M. D. Intriligator, *Econometric Models, Techniques, & Applications,* New Jersey: Prentice-Hall, Inc., 1978, pp. 165–173.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Enrollment in Degree-Granting Institutions by Race/Ethnicity Model, 1980–2006. (This table was prepared December 2007.)

**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** | | | | | |
| Age 17 | -12.49 | 0.264 | -47.24 | 0.99 | 1.82* |
| Age 18 | -9.59 | 0.244 | -39.25 | | |
| Age 19 | -9.48 | 0.243 | -39.01 | | |
| Age 20 | -9.75 | 0.243 | -40.13 | | |
| Age 21 | -10.00 | 0.243 | -41.14 | | |
| Age 22 | -10.79 | 0.246 | -43.89 | | |
| Age 23 | -11.28 | 0.244 | -46.16 | | |
| Age 24 | -11.58 | 0.244 | -47.55 | | |
| Age 25–29 | -12.49 | 0.243 | -51.29 | | |
| Age 30–34 | -13.19 | 0.243 | -54.18 | | |
| Age 35 and up | -13.38 | 0.243 | -54.98 | | |
| LNYPDNWNH | 0.48 | 0.013 | 38.56 | | |
| **Part-time** | | | | | |
| Age 17 | -8.92 | 0.418 | -21.32 | 0.99 | 1.80* |
| Age 18 | -5.08 | 0.266 | -19.10 | | |
| Age 19 | -4.79 | 0.270 | -17.72 | | |
| Age 20 | -4.76 | 0.266 | -17.88 | | |
| Age 21 | -4.95 | 0.268 | -18.50 | | |
| Age 22 | -4.88 | 0.265 | -18.44 | | |
| Age 23 | -5.17 | 0.265 | -19.51 | | |
| Age 24 | -5.33 | 0.266 | -20.04 | | |
| Age 25–29 | -5.46 | 0.262 | -20.80 | | |
| Age 30–34 | -5.77 | 0.264 | -21.82 | | |
| Age 35 and up | -5.46 | 0.262 | -20.82 | | |
| LNYPDNWNH | 0.15 | 0.014 | 10.96 | | |

* $p<.05$.

$R^2$ = Coefficient of determination.

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

**Where:**

AGE(age) = Age-specific intercept term.

LNYPDNWNH = Log of White per capita disposable income in current dollars.

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 2006. The number of observations is 297. For additional information, see M. D. Intriligator, *Econometric Models, Techniques, & Applications,* New Jersey: Prentice-Hall, Inc., 1978, pp. 165–173.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Enrollment in Degree-Granting Institutions by Race/Ethnicity Model, 1980–2006. (This table was prepared December 2007.)

**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** | | | | | |
| Age 17 | -9.23 | 0.438 | -21.10 | 0.97 | 1.96* |
| Age 18 | -7.04 | 0.430 | -16.36 | | |
| Age 19 | -6.79 | 0.430 | -15.78 | | |
| Age 20 | -6.90 | 0.431 | -16.01 | | |
| Age 21 | -7.15 | 0.431 | -16.60 | | |
| Age 22 | -7.35 | 0.432 | -17.00 | | |
| Age 23 | -7.81 | 0.437 | -17.87 | | |
| Age 24 | -8.05 | 0.432 | -18.67 | | |
| Age 25–29 | -8.86 | 0.433 | -20.46 | | |
| Age 30–34 | -9.68 | 0.439 | -22.05 | | |
| Age 35 and up | -10.05 | 0.435 | -23.08 | | |
| LNYPDNBNH | 0.29 | 0.023 | 12.59 | | |
| **Part-time** | | | | | |
| Age 17 | -10.84 | 0.960 | -11.30 | 0.99 | 1.97* |
| Age 18 | -8.58 | 0.465 | -18.44 | | |
| Age 19 | -7.82 | 0.450 | -17.37 | | |
| Age 20 | -7.74 | 0.444 | -17.44 | | |
| Age 21 | -7.69 | 0.436 | -17.65 | | |
| Age 22 | -7.59 | 0.451 | -16.81 | | |
| Age 23 | -8.04 | 0.454 | -17.72 | | |
| Age 24 | -8.07 | 0.447 | -18.08 | | |
| Age 25–29 | -8.06 | 0.435 | -18.52 | | |
| Age 30–34 | -8.29 | 0.433 | -19.15 | | |
| Age 35 and up | -8.35 | 0.431 | -19.38 | | |
| LNYPDNBNH | 0.26 | 0.023 | 11.04 | | |

* $p<.05$.
$R^2$ = Coefficient of determination.
D.W. statistic = Durbin-Watson statistic. For an explanation of the Durbin-Watson statistic, see J. Johnston and J. Dinardo, *Econometric Methods*, New York: McGraw-Hill, 1996.
**Where:**
AGE(age) = Age-specific intercept term.
LNYPDNBNH = Log of Black per capita disposable income in current dollars.
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 2006. The number of observations is 297. For additional information, see M. D. Intriligator, *Econometric Models, Techniques, & Applications,* New Jersey: Prentice-Hall, Inc., 1978, pp. 165–173.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Enrollment in Degree-Granting Institutions by Race/Ethnicity Model, 1980–2006. (This table was prepared December 2007.)

**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** | | | | | |
| Age 17 | -13.62 | 0.604 | -22.57 | 0.93 | 1.81* |
| Age 18 | -11.57 | 0.597 | -19.38 | | |
| Age 19 | -11.34 | 0.597 | -19.00 | | |
| Age 20 | -11.62 | 0.597 | -19.48 | | |
| Age 21 | -11.74 | 0.596 | -19.69 | | |
| Age 22 | -12.27 | 0.597 | -20.55 | | |
| Age 23 | -12.49 | 0.598 | -20.90 | | |
| Age 24 | -12.74 | 0.597 | -21.32 | | |
| Age 25–29 | -13.67 | 0.598 | -22.84 | | |
| Age 30–34 | -14.12 | 0.597 | -23.67 | | |
| Age 35 and up | -14.50 | 0.597 | -24.30 | | |
| LNYPDNBNH | 0.57 | 0.032 | 17.65 | | |
| **Part-time** | | | | | |
| Age 17 | -13.52 | 0.659 | -20.51 | 0.98 | 1.83* |
| Age 18 | -11.35 | 0.555 | -20.46 | | |
| Age 19 | -11.09 | 0.554 | -20.01 | | |
| Age 20 | -11.00 | 0.553 | -19.89 | | |
| Age 21 | -11.05 | 0.554 | -19.96 | | |
| Age 22 | -10.78 | 0.555 | -19.42 | | |
| Age 23 | -10.99 | 0.554 | -19.85 | | |
| Age 24 | -11.32 | 0.556 | -20.35 | | |
| Age 25–29 | -11.31 | 0.546 | -20.72 | | |
| Age 30–34 | -11.42 | 0.547 | -20.87 | | |
| Age 35 and up | -11.29 | 0.546 | -20.70 | | |
| LNYPDNBNH | 0.46 | 0.030 | 15.52 | | |

* $p<.05$.

$R^2$ = Coefficient of determination.

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

**Where:**

AGE(age) = Age-specific intercept term.

LNYPDNBNH = Log of Black per capita disposable income in current dollars.

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 2006. The number of observations is 297. For additional information, see M. D. Intriligator, *Econometric Models, Techniques, & Applications,* New Jersey: Prentice-Hall, Inc., 1978, pp. 165–173.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Enrollment in Degree-Granting Institutions by Race/Ethnicity Model, 1980–2006. (This table was prepared December 2007.)

**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** | | | | | |
| Age 17 | -9.68 | 0.552 | -17.53 | 0.97 | 1.97* |
| Age 18 | -7.72 | 0.544 | -14.20 | | |
| Age 19 | -7.51 | 0.543 | -13.83 | | |
| Age 20 | -7.72 | 0.543 | -14.21 | | |
| Age 21 | -7.91 | 0.547 | -14.46 | | |
| Age 22 | -8.42 | 0.546 | -15.42 | | |
| Age 23 | -8.66 | 0.546 | -15.85 | | |
| Age 24 | -8.75 | 0.545 | -16.05 | | |
| Age 25–29 | -9.64 | 0.547 | -17.64 | | |
| Age 30–34 | -10.40 | 0.547 | -19.02 | | |
| Age 35 and up | -10.97 | 0.553 | -19.84 | | |
| LNYPDNH | 0.31 | 0.030 | 10.53 | | |
| **Part-time** | | | | | |
| Age 17 | -10.30 | 0.979 | -10.52 | 0.99 | 1.90* |
| Age 18 | -7.39 | 0.472 | -15.66 | | |
| Age 19 | -7.29 | 0.479 | -15.22 | | |
| Age 20 | -7.05 | 0.471 | -14.96 | | |
| Age 21 | -7.12 | 0.473 | -15.07 | | |
| Age 22 | -7.23 | 0.471 | -15.34 | | |
| Age 23 | -7.49 | 0.484 | -15.49 | | |
| Age 24 | -7.67 | 0.476 | -16.10 | | |
| Age 25–29 | -7.81 | 0.462 | -16.91 | | |
| Age 30–34 | -8.24 | 0.464 | -17.73 | | |
| Age 35 and up | -8.27 | 0.462 | -17.91 | | |
| LNYPDNH | 0.24 | 0.025 | 9.50 | | |

* $p<.05$.
$R^2$ = Coefficient of determination.
D.W. statistic = Durbin-Watson statistic. For an explanation of the Durbin-Watson statistic, see J. Johnston and J. Dinardo, *Econometric Methods*, New York: McGraw-Hill, 1996.
**Where:**
AGE(age) = Age-specific intercept term.
LNYPDNH = Log of Hispanic per capita disposable income in current dollars.
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 2006. The number of observations is 297. For additional information, see M. D. Intriligator, *Econometric Models, Techniques, & Applications,* New Jersey: Prentice-Hall, Inc., 1978, pp. 165–173.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Enrollment in Degree-Granting Institutions by Race/Ethnicity Model, 1980–2006. (This table was prepared December 2007.)

**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** | | | | | |
| Age 17 | -16.44 | 0.504 | -32.65 | 0.97 | 1.94* |
| Age 18 | -13.98 | 0.480 | -29.11 | | |
| Age 19 | -13.88 | 0.477 | -29.07 | | |
| Age 20 | -14.22 | 0.479 | -29.69 | | |
| Age 21 | -14.35 | 0.479 | -29.97 | | |
| Age 22 | -15.00 | 0.483 | -31.06 | | |
| Age 23 | -15.20 | 0.480 | -31.64 | | |
| Age 24 | -15.60 | 0.487 | -32.06 | | |
| Age 25–29 | -16.32 | 0.478 | -34.15 | | |
| Age 30–34 | -16.97 | 0.482 | -35.19 | | |
| Age 35 and up | -17.30 | 0.486 | -35.59 | | |
| LNYPDNH | 0.69 | 0.026 | 26.43 | | |
| **Part-time** | | | | | |
| Age 17 | -14.64 | 0.522 | -28.03 | 0.99 | 1.98* |
| Age 18 | -12.46 | 0.400 | -31.18 | | |
| Age 19 | -12.27 | 0.392 | -31.26 | | |
| Age 20 | -12.45 | 0.401 | -31.03 | | |
| Age 21 | -12.35 | 0.400 | -30.87 | | |
| Age 22 | -12.51 | 0.400 | -31.29 | | |
| Age 23 | -12.51 | 0.396 | -31.61 | | |
| Age 24 | -12.96 | 0.403 | -32.15 | | |
| Age 25–29 | -13.01 | 0.386 | -33.73 | | |
| Age 30–34 | -13.37 | 0.387 | -34.59 | | |
| Age 35 and up | -13.24 | 0.385 | -34.42 | | |
| LNYPDNH | 0.55 | 0.021 | 25.95 | | |

* $p<.05$.

$R^2$ = Coefficient of determination.

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

**Where:**

AGE(age) = Age-specific intercept term.

LNYPDNH = Log of Hispanic per capita disposable income in current dollars.

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 2006. The number of observations is 297. For additional information, see M. D. Intriligator, *Econometric Models, Techniques, & Applications,* New Jersey: Prentice-Hall, Inc., 1978, pp. 165–173.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Enrollment in Degree-Granting Institutions by Race/Ethnicity Model, 1980–2006. (This table was prepared December 2007.)

**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** | | | | | |
| Age 17 | -8.00 | 0.497 | -14.87 | 0.98 | 2.00* |
| Age 18 | -5.16 | 0.479 | -10.11 | | |
| Age 19 | -4.98 | 0.480 | -9.69 | | |
| Age 20 | -5.10 | 0.478 | -9.94 | | |
| Age 21 | -5.07 | 0.481 | -9.87 | | |
| Age 22 | -5.40 | 0.479 | -10.48 | | |
| Age 23 | -5.64 | 0.481 | -10.88 | | |
| Age 24 | -5.99 | 0.485 | -11.46 | | |
| Age 25–29 | -6.85 | 0.479 | -13.19 | | |
| Age 30–34 | -7.84 | 0.481 | -14.98 | | |
| Age 35 and up | -8.61 | 0.480 | -16.47 | | |
| LNYPDNAHNH | 0.25 | 0.025 | 10.03 | | |
| **Part-time** | | | | | |
| Age 17 | -7.21 | 1.476 | -4.88 | 0.99 | 1.98* |
| Age 18 | -4.55 | 0.750 | -6.06 | | |
| Age 19 | -3.79 | 0.745 | -5.08 | | |
| Age 20 | -3.75 | 0.749 | -5.01 | | |
| Age 21 | -3.99 | 0.756 | -5.28 | | |
| Age 22 | -3.83 | 0.776 | -4.94 | | |
| Age 23 | -3.94 | 0.748 | -5.26 | | |
| Age 24 | -4.42 | 0.746 | -5.92 | | |
| Age 25–29 | -4.62 | 0.733 | -6.31 | | |
| Age 30–34 | -5.16 | 0.732 | -7.06 | | |
| Age 35 and up | -5.48 | 0.731 | -7.51 | | |
| LNYPDNAHNH | 0.12 | 0.038 | 3.10 | | |

* $p<.05$.
$R^2$ = Coefficient of determination.
D.W. statistic = Durbin-Watson statistic. For an explanation of the Durbin-Watson statistic, see J. Johnston and J. Dinardo, *Econometric Methods*, New York: McGraw-Hill, 1996.
**Where:**
AGE(age) = Age-specific intercept term.
LNYPDNAHNH = Log of Asian/Pacific Islander per capita disposable income in current dollars.
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 2006. The number of observations is 297. For additional information, see M. D. Intriligator, *Econometric Models, Techniques, & Applications,* New Jersey: Prentice-Hall, Inc., 1978, pp. 165–173.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Enrollment in Degree-Granting Institutions by Race/Ethnicity Model, 1980–2006. (This table was prepared December 2007.)

**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** | | | | | |
| Age 17 | -12.39 | 0.496 | -24.98 | 0.99 | 1.93* |
| Age 18 | -10.11 | 0.482 | -20.95 | | |
| Age 19 | -9.47 | 0.492 | -19.26 | | |
| Age 20 | -9.91 | 0.485 | -20.43 | | |
| Age 21 | -9.90 | 0.484 | -20.47 | | |
| Age 22 | -10.47 | 0.489 | -21.40 | | |
| Age 23 | -10.84 | 0.484 | -22.39 | | |
| Age 24 | -11.33 | 0.503 | -22.53 | | |
| Age 25–29 | -12.23 | 0.480 | -25.47 | | |
| Age 30–34 | -13.55 | 0.487 | -27.84 | | |
| Age 35 and up | -13.94 | 0.486 | -28.68 | | |
| LNYPDNAHNH | 0.52 | 0.025 | 20.77 | | |
| **Part-time** | | | | | |
| Age 17 | -16.63 | 0.827 | -20.12 | 0.99 | 2.05* |
| Age 18 | -14.67 | 0.683 | -21.48 | | |
| Age 19 | -14.01 | 0.707 | -19.83 | | |
| Age 20 | -14.46 | 0.686 | -21.09 | | |
| Age 21 | -13.95 | 0.689 | -20.26 | | |
| Age 22 | -13.98 | 0.680 | -20.57 | | |
| Age 23 | -14.53 | 0.678 | -21.44 | | |
| Age 24 | -14.84 | 0.695 | -21.36 | | |
| Age 25–29 | -15.21 | 0.672 | -22.64 | | |
| Age 30–34 | -15.92 | 0.674 | -23.62 | | |
| Age 35 and up | -15.70 | 0.668 | -23.49 | | |
| LNYPDNAHNH | 0.67 | 0.035 | 19.31 | | |

* $p<.05$.
$R^2$ = Coefficient of determination.
D.W. statistic = Durbin-Watson statistic. For an explanation of the Durbin-Watson statistic, see J. Johnston and J. Dinardo, *Econometric Methods*, New York: McGraw-Hill, 1996.
**Where:**
AGE(age) = Age-specific intercept term.
LNYPDNAHNH = Log of Asian/Pacific Islander per capita disposable income in current dollars..
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 2005. The number of observations is 286. For additional information, see M. D. Intriligator, *Econometric Models, Techniques, & Applications,* New Jersey: Prentice-Hall, Inc., 1978, pp. 165–173.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Enrollment in Degree-Granting Institutions by Race/Ethnicity Model, 1980–2006. (This table was prepared December 2007.)

**Table A-22. Enrollment (assumptions)**

| Variable | Assumptions | Alternatives | Tables |
|---|---|---|---|
| Elementary and secondary enrollment | Age-specific enrollment rates will remain constant at levels consistent with the most recent rates. | Middle (no alternatives) | 1–9 |
| | Public enrollment rates and public grade retention rates will remain constant at levels consistent with the most recent rates. | Middle (no alternatives) | 1–9 |
| | The percentage of 7th- and 8th-grade public students enrolled in schools organized as secondary schools will remain constant at levels consistent with the most recent rates. | Middle (no alternatives) | 1–9 |
| College enrollment, by age, sex, and attendance status | Age-specific enrollment rates are a function of dummy variables by age, the log of three-period weighted average of real disposable income per capita from the Global Insight's February 2007 trend scenario and the log unemployment rate by age group from the Global Insight's February 2007 trend scenario. | Middle | 10–19 |
| | Age-specific enrollment rates are a function of dummy variables by age, the log of three-period weighted average of real disposable income per capita from the Global Insight's February 2007 pessimistic scenario and the log unemployment rate by age group from the Global Insight's February 2007 pessimistic scenario. | Low | 10–19 |
| | Age-specific enrollment rates are a function of dummy variables by age, the log of three-period weighted average of real disposable income per capita from the Global Insight's February 2007 optimistic scenario and the log unemployment rate by age group from the Global Insight's February 2007 optimistic scenario. | High | 10–19 |
| College enrollment, by sex, attendance status, level enrolled, and type of institution | For each group and for each attendance status separately, percent of total enrollment by sex, level enrolled, and type of institution will follow past trends through 2017. For each age group and attendance status category, the sum of the percentages must equal 100 percent. | High, middle, and low | 10–19 |
| College enrollment, by control of institution | For each enrollment category, by sex, attendance status, and level enrolled, and by type of institution, public enrollment as a percent of total enrollment will remain constant at levels consistent with the most recent rates. | High, middle, and low | 10–19 |
| Graduate enrollment | For each enrollment category, by sex and attendance status of student, and by type and control of institution, graduate enrollment as a percent of postbaccalaureate enrollment will remain constant at levels consistent with the most recent rates. | High, middle, and low | 20 |
| College enrollment, by age, sex, attendance status, and race/ethnicity | | | |
| Full-time: White men; White women; Black men; Black women; Hispanic men; Hispanic women; Asian/Pacific Islander men; Asian/Pacific Islander women. Part-time: White women; Black men; Black women; Hispanic men; Hispanic women; Asian/Pacific Islander men; Asian/Pacific Islander women | Age-specific enrollment rates by race/ethnicity are a function of dummy variables by age and the log of the corresponding race/ethnicity group's disposable income per capita in current dollars. | Middle (no alternatives) | 22 |
| Part-time White men | Age-specific enrollment rates by race/ethnicity are a function of dummy variables by age and the log of real total compensation. | Middle (no alternatives) | 22 |
| Full-time-equivalent of part-time enrollment | For each enrollment category, by type and control of institution and level enrolled, the percent that full-time-equivalent of part-time enrollment is of part-time enrollment will remain constant at levels consistent with the most recent rates. | High, middle, and low | 23 |

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Elementary and Secondary Enrollment Model, 1972–2005; State Public Elementary and Secondary Enrollment Model, 1980–2005; Enrollment in Degree-Granting Institutions Model, 1980–2006; and Enrollment in Degree-Granting Institutions by Race/Ethnicity Model, 1980–2006. (This table was prepared December 2007.)

# 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 2004–05. 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 1988–89 to 2004–05.

### Projection Accuracy

An analysis of projections from models used in the past 17 editions of *Projections of Education Statistics* indicates that the mean absolute percentage errors (MAPEs) for projections of public high school graduates were 0.8 percent for 1 year ahead, 0.8 percent for 2 years ahead, 1.8 percent for 5 years ahead, and 3.9 percent for 10 years ahead. For the 1-year-ahead prediction, this means that one would expect the projection to be within 0.8 percent of the actual value, on the average. For more information on the mean absolute percentage errors, see table A-2, page 86.

## State Level

This edition contains projections of high school graduates from public schools by state from 2005–06 to 2017–18. Public school graduate data from the Common Core of Data survey for 1980–81 to 2004–05 were used to develop these projections. This survey does not collect graduate data for private schools.

Projections of public high school graduates by state were developed in the following manner. For each state, the number of public high school graduates was expressed as a percent of grade 12 enrollment in public schools for 1980–81 to 2004–05. 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, doctor's, and first-professional degrees for men and women were based on demographic models that relate degree awards to college-age populations and college enrollment by level enrolled and attendance status. Table A-23 describes the estimated equations used to calculate projections, and table A-24 contains the basic assumptions underlying projections.

### Associate's Degrees

Associate's degree projections for men and women were based on a weighted average over the last 2 years of total undergraduate enrollment by attendance status in 2-year institutions and sex relative to the 18- to 24-year-old population by sex. The previous year is weighted two-thirds, and 2 years back is weighted one-third. Results of the regression analysis used to project associate's degrees are shown in table A-23.

### Bachelor's Degrees

Bachelor's degree projections for men and women were based on a weighted average over the last 4 years of full-time undergraduate enrollment by attendance status in 4-year institutions and sex relative to the 18- to 24-year-old population by sex. The weights for the previous 4 years—0.4, 0.3, 0.2, and 0.1—give more weight to the most recent years. Results of the regression analysis used to project bachelor's degrees are shown in table A-23.

### Master's Degrees

Master's degree projections for men were based on a weighted average over the last 2 years of full-time graduate enrollment by attendance status and sex relative to the 25- to 34-year-old population by sex. Master's degree projections for women were based on a weighted average over the last 2 years of total graduate enrollment by attendance status and sex relative to the 25- to 34-year-old population by sex. In each case, the previous year is weighted two-thirds, and 2 years back is weighted one-third. Results of the regression analysis used to project master's degrees are shown in table A-23.

### Doctor's Degrees

Doctor's degree projections for men were based on a weighted average over the last 4 years of total graduate enrollment by attendance status and sex relative to the 35- to 44-year-old population by sex. Doctor's degree projections for women were based on a weighted average over the last 4 years of full-time enrollment by attendance status and sex relative to the 35- to 44-year-old population by sex. In each case, the weights for the previous 4 years—0.4, 0.3, 0.2, and 0.1—give more weight to the most recent years. Results of the regression analysis used to project doctor's degrees are shown in table A-23.

### First-Professional Degrees

First-professional degree projections for men were based on a weighted average over the last 3 years of total first-professional enrollment by attendance status in 4-year institutions and sex relative to the 25- to 34-year-old population by sex. First-professional degree projections for women were based on a weighted average over the last 3 years of first-professional enrollment by attendance status in 4-year institutions and sex relative to the 25- to 34-year old population by sex. In each case, the weights for the previous 3 years—0.5, 0.33, and 0.17—give more weight to the most recent years. Results of the regression analysis used to project first-professional degree are shown in table A-23.

### Projection Accuracy

An analysis of projection errors from similar models used in the past nine 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, 2.9 percent for 2 years out, 5.7 percent for 5 years out, and 14.3 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 1.0 percent for 1 year out, 1.9 percent for 2 years out, 5.6 percent for 5 years out, and 12.1 percent for 10 years out. MAPEs for master's degrees were 1.9, 3.7, 12.1, and 22.9 percent, respectively. For doctor's degrees, the MAPEs were 3.0, 4.4, 5.4, and 7.6 percent, respectively. For first-professional degrees, the MAPEs were 1.4, 1.5, 5.1, and 13.7 percent, respectively. For more information on the MAPEs, see table A-2.

## Table A-23. Estimated equations and model statistics for degrees conferred, by degree type and sex

| Dependent variable | | | | | Equation | $R^2$ | Durbin-Watson statistic | Error distribution pattern[1] | Rho | Time period |
|---|---|---|---|---|---|---|---|---|---|---|
| Associate's degrees, men | LNASSOCM | = | 5.0 | + | 0.4LNUG2ML2 | 0.95 | 1.9* | AR(1) | 0.58 | 1975–76 to |
| | | | | | (10.4) | | | | (5.1) | 2005–06 |
| Associate's degrees, women | LNASSOCW | = | 5.7 | + | 0.6LNUG2WL2 | 0.99 | 1.4^ | AR(1) | 0.67 | 1975–76 to |
| | | | | | (15.6) | | | | (8.8) | 2005–06 |
| Bachelor's degrees, men | LNBACHM | = | 5.7 | + | 1.2LNUG4FTML4 | 0.98 | 1.4^ | AR(1) | 0.89 | 1977–78 to |
| | | | | | (5.4) | | | | (8.2) | 2005–06 |
| Bachelor's degrees, women | LNBACHW | = | 5.6 | + | 1.1LNUG4FTWL4 | 0.99 | 1.5* | AR(1) | 0.92 | 1977–78 to |
| | | | | | (3.9) | | | | (7.4) | 2005–06 |
| Master's degrees, men | LNMASTM | = | 6.8 | + | 1.1LNGFTML2 | 0.98 | 1.4^ | AR(1) | 0.75 | 1975–76 to |
| | | | | | (10.0) | | | | (5.0) | 2005–06 |
| Master's degrees, women | LNMASTW | = | 7.5 | + | 0.7LNGWL2 | 0.99 | 1.4^ | AR(1) | 0.80 | 1975–76 to |
| | | | | | (23.6) | | | | (17.7) | 2005–06 |
| Doctor's degrees, men | LNDOCM | = | 3.4 | + | 0.4LNGML4 | 0.98 | 1.4^ | AR(1) | 0.65 | 1977–78 to |
| | | | | | (8.2) | | | | (6.7) | 2005–06 |
| Doctor's degrees, women | LNDOCW | = | 3.7 | + | 0.9LNGFTWL4 | 0.97 | 1.8* | AR(1) | 0.71 | 1977–78 to |
| | | | | | (12.3) | | | | (5.1) | 2005–06 |
| First-professional degrees, | LNFPROM | = | 3.7 | + | 0.2LNFPML3 | 0.99 | 1.7* | AR(1) | 0.86 | 1976–77 to |
| men | | | | | (3.2) | | | | (20.1) | 2005–06 |
| First-professional degrees, | LNFPROW | = | 5.7 | + | 1.0LNFPFTWL3 | 0.99 | 1.6* | AR(1) | 0.55 | 1976–77 to |
| women | | | | | (27.9) | | | | (3.12) | 2005–06 |

* $p<.05$.

^ The Durbin-Watson statistic is inconclusive as to whether to either accept or reject the hypothesis of no autocorrelation at the .05 significance level. For an explanation of the Durbin-Watson statistic, see J. Johnston and J. Dinardo, *Econometric Methods*, New York: McGraw-Hill, 1996.

[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 G. Judge, W. Hill, R. Griffiths, H. Lutkepohl, and T. Lee, *The Theory and Practice of Econometrics*, New York: John Wiley and Sons, 1985, pp. 315–318.

**Where:**

LNASSOCM = Log of the ratio of associate's degrees awarded to men relative to the population of 18- to 24-year-old men.
LNASSOCW = Log of the ratio of associate's degrees awarded to women relative to the population of 18- to 24-year-old women.
LNBACHM = Log of the ratio of bachelor's degrees awarded to men relative to the population of 18- to 24-year-old men.
LNBACHW = Log of the ratio of bachelor's degrees awarded to women relative to the population of 18- to 24-year-old women.
LNMASTM = Log of the ratio of master's degrees awarded to men relative to the population of 25- to 34-year-old men.
LNMASTW = Log of the ratio of master's degrees awarded to women relative to the population of 25- to 34-year-old women.
LNDOCM = Log of the ratio of doctor's degrees awarded to men relative to the population of 35- to 44-year-old men.
LNDOCW = Log of the ratio of doctor's degrees awarded to women relative to the population of 35- to 44-year-old women.
LNFPROM = Log of the ratio of first-professional degrees awarded to men relative to the population of 25- to 34-year-old men.
LNFPROW = Log of the ratio of first-professional degrees awarded to women relative to the population of 25- to 34-year-old women.
LNUG2ML2 = Log of the ratio of full-time male undergraduate enrollment in 2-year institutions to the male population of 18- to 24-year-olds, weighted over the last 2 years (where weights are .67 and .33 for descending lagged years), plus the similar log ratio for part-time male undergraduate enrollment in 2-year institutions.
LNUG2WL2 = Log of the ratio of full-time female undergraduate enrollment in 2-year institutions to the female population of 18- to 24-year-olds, weighted over the last 2 years (where weights are .67 and .33 for descending lagged years), plus the similar log ratio for part-time female undergraduate enrollment in 2-year institutions.
LNUG4FTML4 = Log of the ratio of full-time male undergraduate enrollment in 4-year institutions to the male population of 18- to 24-year-olds, weighted over the last 4 years (where weights are .4, .3, .2, and .1 for descending lagged years).
LNUG4FTWL4 = Log of the ratio of full-time female undergraduate enrollment in 4-year institutions to the female population of 18- to 24-year-olds, weighted over the last 4 years (where weights are .4, .3, .2, and .1 for descending lagged years).
LNGFTML2 = Log of the ratio of full-time male graduate enrollment to the male population of 25- to 34-year-olds, weighted over the last 2 years (where weights are .67 and .33 for descending lagged years).
LNGWL2 = Log of the ratio of full-time female graduate enrollment to the female population of 25- to 34-year-olds, weighted over the last 2 years (where weights are .67 and .33 for descending lagged years), plus the similar log ratio for part-time female graduate enrollment.
LNGML4 = Log of the ratio of full-time male graduate enrollment to the male population of 35- to 44-year-olds, weighted over the last 4 years (where weights are .4, .3., .2, and .1 for descending lagged years), plus the similar log ratio for part-time male graduate enrollment.
LNGFTWL4 = Log of the ratio of full-time female graduate enrollment to the female population of 35- to 44-year-olds, weighted over the last 4 years (where weights are .4, .3, .2, and .1 for descending lagged years).
LNFPML3 = Log of the ratio of full-time male first-professional enrollment to the male population of 25- to 34-year-olds, weighted over the last 3 years (where weights are .5, .33, and .17 for descending lagged years), plus the similar log ratio for part-time male first-professional enrollment.
LNFPFTWL3 = Log of the ratio of full-time female first-professional enrollment to the female population of 25- to 34-year-olds, weighted over the last 3 years (where weights are .5, .33, and .17 for descending lagged years).

NOTE: $R^2$ indicates the coefficient of determination. Rho measures the correlation between errors in time period t and time period t minus 1. Numbers in parentheses are t-statistics.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Degrees Conferred Model, 1975–76 through 2005–06. (This table was prepared December 2007.)

**Table A-24. Degrees conferred (assumptions)**

| Variable | Assumptions | Alternative | Table |
|---|---|---|---|
| Associate's degrees | | | |
| Men | The number of associate's degrees awarded to men is a linear function of the log of the ratio of full-time male undergraduate enrollment in 2-year institutions to the male population of 18- to 24-year-olds, weighted over the last 2 years (where weights are .67 and .33 for descending lagged years), plus the similar log ratio for part-time male undergraduate enrollment in 2-year institutions. This relationship will continue through 2017–18. | Middle | 27 |
| Women | The number of associate's degrees awarded to women is a linear function of the log of the ratio of full-time female undergraduate enrollment in 2-year institutions to the female population of 18- to 24-year-olds, weighted over the last 2 years (where weights are .67 and .33 for descending lagged years), plus the similar log ratio for part-time female undergraduate enrollment in 2-year institutions. This relationship will continue through 2017–18. | Middle | 27 |
| Bachelor's degrees | | | |
| Men | The number of bachelor's degrees awarded to men is a linear function of the log of the ratio of full-time male undergraduate enrollment in 4-year institutions to the male population of 18- to 24-year-olds, weighted over the last 4 years (where weights are .4, .3, .2, and .1 for descending lagged years), plus the similar log ratio for part-time male undergraduate enrollment in 4-year institutions. This relationship will continue through 2017–18. | Middle | 28 |
| Women | The number of bachelor's degrees awarded to women is a linear function of the log of the ratio of full-time female undergraduate enrollment in 4-year institutions to the female population of 18- to 24-year-olds, weighted over the last 4 years (where weights are .4, .3, .2, and .1 for descending lagged years), plus the similar log ratio for part-time female undergraduate enrollment in 4-year institutions. This relationship will continue through 2017–18. | Middle | 28 |
| Master's degrees | | | |
| Men | The number of master's degrees awarded to men is a linear function of the log of the ratio of full-time male graduate school enrollment to the male population of 25- to 34-year-olds, weighted over the last 2 years (where weights are .67 and .33 for descending lagged years), plus the similar log ratio for part-time male graduate school enrollment. This relationship will continue through 2017–18. | Middle | 29 |
| Women | The number of master's degrees awarded to women is a linear function of the log of the ratio of full-time female graduate school enrollment to the female population of 25- to 34-year-olds, weighted over the the last 2 years (where weights are .67 and .33 for descending lagged years), plus the similar log ratio for part-time female graduate school enrollment. This relationship will continue through 2017–18. | Middle | 29 |
| Doctor's degrees | | | |
| Men | The number of doctor's degrees awarded to men is a linear function of the log of the ratio of full-time male graduate school enrollment to the male population of 35- to 44-year-olds, weighted over the last 4 years (where weights are .4, .3, .2, and .1 for descending lagged years), plus the similar log ratio for part-time male graduate school enrollment. This relationship will continue through 2017–18. | Middle | 30 |
| Women | The number of doctor's degrees awarded to women is a linear function of the log of the ratio of full-time female graduate school enrollment to the female population of 35- to 44-year-olds, weighted over the last 4 years (where weights are .4, .3, .2, and .1 for descending lagged years), plus the similar log ratio for part-time female graduate school enrollment. This relationship will continue through 2017–18. | Middle | 30 |
| First-professional degrees | | | |
| Men | The number of first-professional degrees awarded to men is a linear function of the log of the ratio of full-time male first-professional school enrollment to the male population of 25- to 34-year-olds, weighted over the last 3 years (where weights are .5, .33, and .17 for descending lagged years), plus the similar log ratio for part-time male first-professional school enrollment. This relationship will continue through 2017–18. | Middle | 31 |
| Women | The number of first-professional degrees awarded to women is a linear function of the log of the ratio of full-time female first-professional school enrollment to the female population of 25- to 34-year-olds, weighted over the last 3 years (where weights are .5, .33, and .17 for descending lagged years), plus the similar log ratio for part-time female first-professional school enrollment. This relationship will continue through 2017–18. | Middle | 31 |

SOURCE: U.S. Department of Education, National Center for Education Statistics, Degrees Conferred Model, 1975–76 through 2005–06. (This table was prepared December 2007.)

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

The 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:**

$RELENRTCH_t$ 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:**

$RSCENRTCH_t$ 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-25 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 were derived in the following manner. From 1960 to 2005, the ratio of private school teachers to public school teachers was calculated by organizational level. 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 public school teachers by organizational level to yield projections of private school teachers. This method assumes that the future pattern in the trend of private school teachers will be the same as that for public school teachers. The reader is cautioned that a number of factors could alter the assumption of constant ratios over the projection period.

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

## 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 the NCES report *Predicting the Need for Newly Hired Teachers in the United States to 2008-09*, which is available on-line (http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=1999026). 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 2017, 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 (2006 through 2017). 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 2017 are similar to either the projections produced using exponential smoothing or the values from the 2004–05 TFS depending (Step 2); (3) the age distribution for newly hired FTE teachers from 2004 through 2017 is similar to that of newly hired full-time and part-time teachers in the 2003–04 SASS (Step 3); and (4) the actual numbers of FTE teachers for each year from 2004 through 2017 are similar to projections of FTE teachers on table 32; (5) and no economic or political changes further affect the size of the teaching force.

Table A-26 shows the age distributions for full-time and part-time teachers; table A-27 shows age distributions of new teacher hires; and table A-28 shows actual and projected continuation rates of teachers.

## Projection Accuracy

An analysis of projection errors from the past 17 editions of *Projections of Education Statistics* indicated that the mean absolute percentage errors (MAPEs) for projections of classroom teachers in public elementary and secondary schools were 1.0 percent for 1 year out, 1.5 percent for 2 years out, 2.7 percent for 5 years out, and 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-25. Estimated equations and model statistics for public elementary and secondary teachers**

| Dependent variable | | | | | | | Equation | $R^2$ | Durbin-Watson statistic[1] | Error distribution pattern[2] | Rho | Time period |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Elementary | ln(RELENRTCH) | = | 3.8 | + | .1 ln(RSALARY) | - | .2 ln(RSGRNTELENR) | 0.99 | 2.0* | AR(1) | 0.34 | 1973 to |
| | | | | | (4.9) | | (-10.5) | | | | (1.99) | 2004 |
| Secondary | ln(RSCENRTCH) | = | 4.1 | - | .2 ln(RSGRNTSCENR) | + | .6 ln(RSCENRPU) | 0.99 | 1.9* | AR(1) | 0.62 | 1973 to |
| | | | | | (-14.6) | | (4.8) | | | | (4.1) | 2004 |

* $p<.05$.
[1]For an explanation of the Durbin-Watson statistic, see J. Johnston and J. Dinardo, *Econometric Methods*, New York: McGraw-Hill, 1996.
[2]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 G. Judge, W. Hill, R. Griffiths, H. Lutkepohl, and T. Lee, *The Theory and Practice of Econometrics*, New York: John Wiley and Sons, 1985, pp. 315–318.
**Where:**
RELENRTCH = Log of the ratio of public elementary school enrollment to classroom teachers (i.e., student/teacher ratio).
RSCENRTCH = Log of the ratio of public secondary school enrollment to classroom teachers (i.e., student/teacher ratio).
RSALARY = Log of the average annual teacher salary relative to the overall economy wage in 2000 dollars.
RSGRNTELENR = Log of the ratio of education revenue receipts from state sources per capita to public elementary school enrollment in 2000 dollars.
RSGRNTSCENR = Log of the ratio of education revenue receipts from state sources per capita to public secondary school enrollment in 2000 dollars.
RSCENRPU = Log of the ratio of enrollment in public secondary schools to the 11- to 18-year-old population.
NOTE: $R^2$ indicates the coefficient of determination. Rho measures the correlation between errors in time period t and time period t minus 1. Numbers in parentheses are t-statistics.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Elementary and Secondary Teacher Model, 1968–2004. (This table was prepared December 2007.)

**Table A-26. 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 December 2007.)

**Table A-27. 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 December 2007.)

**Table A-28. Actual and projected number for continuation rates of full-time and part-time school teachers, by age and control of school: Various years, 1987–88 to 1988–89 through 2016–17 to 2017–18**

| 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 |
| **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 |

NOTE: The continuation rate for teachers for each sector 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 table was prepared December 2007.)

# Expenditures of Public Elementary and Secondary Schools

### Elementary and Secondary School Current Expenditure Model

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

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

In a median voter model, the demand for education expenditures is typically linked to four different types of variables: (1) measures of the income of the median voter; (2) measures of intergovernmental aid for education going indirectly to the median voter; (3) measures of the price to the median voter of providing one more dollar of education expenditures per pupil; and (4) any other variables that may affect one's tastes for education.

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

The elementary and secondary school 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 year 1982–84 dollars in year t. The model used to project this variable is discussed below.

The model was estimated using least squares with the AR(1) process for correcting for autocorrelation. The model was estimated using data from 1969–70 to 2004–05.

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

Beginning in 1988–89, there was a major change in the survey form used to collect data on current expenditures (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-29. Each variable affects current expenditures in the direction that would be expected. With high levels of income (PCI) or revenue from state sources (SGRNT), the level of spending increases.

From the cross-sectional studies of the demand for education expenditures, we have an estimate of how sensitive current expenditures are to changes in PCI. We can compare the results from this model with those from the cross-sectional studies. For this model, an increase in PCI of 1 percent, with SGRNT held constant, would result in an increase of current expenditures per pupil in fall enrollment of approximately .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,*[2] average daily attendance rather than fall enrollment, was used as the measure of enrollment. This change was made because the definitions of fall enrollment are more consistent from state to state than those of average daily attendance.

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

Projections for total current expenditures were made by multiplying the projections for current expenditures per pupil in fall enrollment by projections for fall enrollment. The projections for total current expenditures were also divided by projections for average daily attendance to produce projections of current expenditures per pupil in average daily attendance to provide projections that are consistent with those from earlier years. Projections were developed in 1982–84 dollars and then placed in 2005–06 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: February 2007: Long-Term-Projections" of the economic consulting firm Global Insight, Inc. (supplemental table B-6).

Global Insight's February 2007 trend scenario was used as a base for the middle alternative projections of the economic variables. Global Insight's trend scenario depicts a mean of possible paths that the economy could take over the forecast period, barring major shocks. The economy, in this scenario, evolves smoothly, without major fluctuations.

Global Insight's February 2007 pessimistic scenario was used for the low alternative projections, and Global Insight's February 2007 optimistic scenario was used for the high alternative projections.

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

In the middle alternative projections, disposable income per capita rises each year from 2006–07 to 2017–18 at rates between 0.4 percent and 2.7 percent. In the low alternative projections, disposable income per capita ranges between 0.4 percent and 2.3 percent, and in the high alternative projections, disposable income per capita rises at rates between 0.4 percent and 3.6 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;

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

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

The model was estimated using least squares with the AR(1) process for correcting for autocorrelation. The model was estimated using the period from 1971–72 to 2004–05. These models are shown in table A-29.

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 three year's editions. The model used in the prior two editions, *Projections of Education Statistics 2012* and *Projections of Education Statistics 2013,* was different. It 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 1971-72). 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 models in the five most recent editions of the *Projections of Education Statistics* each used the same variable to represent enrollment (ENRPOP). In the earlier editions, models used average daily attendance rather than fall enrollment as the measure of enrollment, and the sample period used to produce the forecast began in 1959–60. As with the current expenditures model, the change to fall enrollment was done because the definition of fall enrollment is more consistent across states, and the change in sample period was done because of superior model diagnostics. Other models in the past have contained a second measure of state and local government revenue. Also in earlier editions, similar models were used except the variables were not in log form. Both of these changes were made because of superior model diagnostics.

Three alternative sets of projections for SGRNT were produced using this model. Each is based on a different set of projections for 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 2006–07 to 2017–18 at rates between -1.2 percent and 3.6 percent. In the low alternative projections, revenue from state sources per capita ranges between -1.2 percent and 3.5 percent, and in the high alternative projections, revenue from state sources per capita changes at rates between -1.2 percent and 3.7 percent.

## Projection Accuracy

Seventeen of the last 18 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.

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

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

Similar sets of independent variables have been used in the production of the current expenditure projections presented in the last 15 editions of *Projections of Education Statistics*, including this one. The one major change is that in all the earlier editions except the two 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, current expenditures per pupil in fall enrollment, current expenditures per pupil in average daily attendance, and teacher salaries.

An analysis of projection errors from similar models used in the past seventeen editions of *Projections of Education Statistics* that contained expenditure projections indicates that mean absolute percentage errors (MAPEs) for total current expenditures in constant dollars were 1.3 percent for 1 year out, 2.2 percent for 2 years out, 2.9 percent for 5 years out, and 3.8 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 current dollars were 1.3 percent for 1 year out, 2.1 percent for 2 years out, 3.3 percent for 5 years out, and 5.4 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 2003–04, 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 2005–06 to 2017–18 were made by multiplying the projections for enrollment by the average value of the ratios of average daily attendance to the enrollment from 1991–92 to 2004–05; this average value was approximately .93.

The values for fall enrollment from 1979–80 to 2005–06 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 2004–05, 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 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 Global Insight were placed in school-year terms. The school-year numbers were calculated by taking the average of the last two quarters of one year and the first two quarters of the next year.

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

**Table A-29. Estimated equations and model statistics for current expenditures per pupil in fall enrollment, and education revenue from state sources per capita**

| Dependent variable | | | | | | | Equation | $R^2$ | Durbin-Watson statistic | Error distribution pattern[1] | Rho | Time period |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Current expenditures per pupil | ln(CUREXP) | = | 1.0 | + | 0.6ln(PCI) (3.4) | + | 0.2ln(SGRANT) (2.3) | 0.99 | 1.56^ | AR(1) | 0.94 (20.6) | 1973–74 to 2004–05 |
| Education revenue from state sources per capita | ln(SGRNT) | = | 1.0 | + | 1.2ln(PCI) (20.3) | + | 0.9ln(ENRPOP) (5.7) | 0.99 | 1.73* | AR(1) | 0.47 (3.1) | 1973–74 to 2004–05 |

* $p<.05$.
^ The Durbin-Watson statistic is inconclusive as to whether to either accept or reject the hypothesis of no autocorrelation at the .05 significance level. For an explanation of the Durbin-Watson statistic, see J. Johnston and J. Dinardo, *Econometric Methods,* New York: McGraw-Hill, 1996.
[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 G. Judge, W. Hill, R. Griffiths, H. Lutkepohl, and T. Lee, *The Theory and Practice of Econometrics,* New York: John Wiley and Sons, 1985, pp. 315–318.
**Where:**
CUREXP = Current expenditures of public elementary and secondary schools per pupil in fall enrollment in constant 1982–84 dollars.
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. Rho measures the correlation between errors in time period t and time period t minus 1. Numbers in parentheses are t-statistics.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Elementary and Secondary School Current Expenditures Model, 1969–70 through 2004–05; and Revenue Receipts from State Sources Model, 1971–72 through 2004–05. (This table was prepared December 2007.)

# Appendix B
# Supplementary Tables

**Table B-1. Annual number of births: 1946 through 2006**

| 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 | | |

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 December 2007.)

**Table B-2. Actual and projected numbers for preprimary school-age populations: 1992 through 2017**

[In thousands]

| Year (July 1) | 3- to 5-year-olds | 3-year-olds | 4-year-olds | 5-year-olds |
|---|---|---|---|---|
| **Actual** | | | | |
| 1992 | 11,346 | 3,824 | 3,790 | 3,732 |
| 1993 | 11,692 | 3,989 | 3,898 | 3,805 |
| 1994 | 12,001 | 4,023 | 4,066 | 3,912 |
| 1995 | 12,188 | 4,004 | 4,103 | 4,081 |
| 1996 | 12,141 | 3,936 | 4,086 | 4,119 |
| 1997 | 12,019 | 3,894 | 4,021 | 4,104 |
| 1998 | 11,880 | 3,862 | 3,979 | 4,040 |
| 1999 | 11,768 | 3,827 | 3,946 | 3,996 |
| 2000 | 11,701 | 3,824 | 3,905 | 3,971 |
| 2001 | 11,580 | 3,816 | 3,840 | 3,924 |
| 2002 | 11,514 | 3,824 | 3,832 | 3,859 |
| 2003 | 11,569 | 3,883 | 3,837 | 3,848 |
| 2004 | 11,798 | 4,051 | 3,895 | 3,852 |
| 2005 | 11,984 | 4,008 | 4,064 | 3,911 |
| 2006 | 12,155 | 4,054 | 4,022 | 4,080 |
| **Projected** | | | | |
| 2007 | 12,219 | 4,114 | 4,067 | 4,037 |
| 2008 | 12,314 | 4,151 | 4,099 | 4,064 |
| 2009 | 12,420 | 4,190 | 4,135 | 4,095 |
| 2010 | 12,535 | 4,230 | 4,173 | 4,131 |
| 2011 | 12,657 | 4,274 | 4,213 | 4,169 |
| 2012 | 12,784 | 4,318 | 4,257 | 4,209 |
| 2013 | 12,915 | 4,361 | 4,301 | 4,252 |
| 2014 | 13,041 | 4,401 | 4,344 | 4,297 |
| 2015 | 13,157 | 4,435 | 4,383 | 4,340 |
| 2016 | 13,260 | 4,465 | 4,417 | 4,378 |
| 2017 | 13,350 | 4,491 | 4,447 | 4,413 |

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 September 7, 2007, from http://www.census.gov/popest/national/asrh/2006_nat_af.html; and Population Projections, retrieved September 7, 2007, from http://www.census.gov/ipc/www/usinterimproj/. (This table was prepared November 2007.)

**Table B-3. Actual and projected numbers for school-age populations, ages 5, 6, 5 to 13, and 14 to 17: 1992 through 2017**

[In thousands]

| Year (July 1) | 5-year-olds | 6-year-olds | 5- to 13-year-olds | 14- to 17-year-olds |
|---|---|---|---|---|
| **Actual** | | | | |
| 1992 | 3,732 | 3,715 | 33,199 | 13,775 |
| 1993 | 3,805 | 3,743 | 33,761 | 14,096 |
| 1994 | 3,912 | 3,814 | 34,217 | 14,637 |
| 1995 | 4,081 | 3,919 | 34,825 | 15,013 |
| 1996 | 4,119 | 4,088 | 35,375 | 15,443 |
| 1997 | 4,104 | 4,127 | 35,915 | 15,769 |
| 1998 | 4,040 | 4,112 | 36,454 | 15,829 |
| 1999 | 3,996 | 4,045 | 36,804 | 16,007 |
| 2000 | 3,971 | 4,008 | 37,054 | 16,123 |
| 2001 | 3,924 | 3,991 | 37,091 | 16,190 |
| 2002 | 3,859 | 3,944 | 36,996 | 16,366 |
| 2003 | 3,848 | 3,876 | 36,788 | 16,514 |
| 2004 | 3,852 | 3,864 | 36,390 | 16,834 |
| 2005 | 3,911 | 3,869 | 36,123 | 17,096 |
| 2006 | 4,080 | 3,928 | 36,078 | 17,240 |
| **Projected** | | | | |
| 2007 | 4,037 | 4,096 | 36,047 | 17,245 |
| 2008 | 4,064 | 4,101 | 36,150 | 17,017 |
| 2009 | 4,095 | 4,128 | 36,324 | 16,759 |
| 2010 | 4,131 | 4,159 | 36,579 | 16,524 |
| 2011 | 4,169 | 4,195 | 36,946 | 16,277 |
| 2012 | 4,209 | 4,234 | 37,372 | 16,094 |
| 2013 | 4,252 | 4,275 | 37,816 | 15,983 |
| 2014 | 4,297 | 4,319 | 38,253 | 15,971 |
| 2015 | 4,340 | 4,364 | 38,566 | 16,202 |
| 2016 | 4,378 | 4,407 | 38,914 | 16,454 |
| 2017 | 4,413 | 4,447 | 39,271 | 16,706 |

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 September 7, 2007, from http://www.census.gov/popest/national/asrh/2006_nat_af.html; and Population Projections, retrieved September 7, 2007, from http://www.census.gov/ipc/www/usinterimproj/. (This table was prepared November 2007.)

**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: 1992 through 2017**

[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** | | | | | |
| 1992 | 3,354 | 26,282 | 20,591 | 22,564 | 40,046 |
| 1993 | 3,455 | 26,102 | 20,146 | 22,646 | 40,975 |
| 1994 | 3,428 | 25,821 | 19,809 | 22,648 | 41,877 |
| 1995 | 3,601 | 25,585 | 19,742 | 22,425 | 42,765 |
| 1996 | 3,650 | 25,376 | 19,927 | 21,996 | 43,605 |
| 1997 | 3,780 | 25,574 | 19,960 | 21,494 | 44,282 |
| 1998 | 3,984 | 26,155 | 19,863 | 20,999 | 44,802 |
| 1999 | 3,993 | 26,780 | 19,632 | 20,647 | 45,130 |
| 2000 | 4,076 | 27,393 | 19,357 | 20,579 | 45,235 |
| 2001 | 4,074 | 28,087 | 19,004 | 20,781 | 45,188 |
| 2002 | 4,033 | 28,601 | 18,997 | 20,878 | 44,869 |
| 2003 | 4,131 | 29,094 | 19,213 | 20,789 | 44,484 |
| 2004 | 4,128 | 29,408 | 19,625 | 20,528 | 44,178 |
| 2005 | 4,127 | 29,500 | 20,148 | 20,153 | 43,954 |
| 2006 | 4,190 | 29,610 | 20,800 | 19,764 | 43,748 |
| **Projected** | | | | | |
| 2007 | 4,272 | 29,809 | 21,313 | 19,713 | 43,379 |
| 2008 | 4,401 | 30,173 | 21,672 | 19,865 | 42,782 |
| 2009 | 4,384 | 30,536 | 21,878 | 20,213 | 42,109 |
| 2010 | 4,312 | 30,762 | 21,944 | 20,657 | 41,600 |
| 2011 | 4,250 | 30,894 | 21,981 | 21,205 | 41,318 |
| 2012 | 4,170 | 30,947 | 22,057 | 21,652 | 41,217 |
| 2013 | 4,126 | 30,884 | 22,205 | 22,000 | 41,222 |
| 2014 | 4,080 | 30,693 | 22,459 | 22,202 | 41,258 |
| 2015 | 4,007 | 30,297 | 22,783 | 22,271 | 41,270 |
| 2016 | 3,990 | 29,901 | 23,059 | 22,313 | 41,421 |
| 2017 | 4,018 | 29,607 | 23,260 | 22,394 | 41,754 |

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 September 7, 2007, from http://www.census.gov/popest/national/asrh/2006_nat_af.html; and Population Projections, retrieved September 7, 2007, from http://www.census.gov/ipc/www/usinterimproj/. (This table was prepared November 2007.)

**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: 1992–93 through 2017–18**

| 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** | | | | |
| 1992–93 | 42,823 | 776 | 256.9 | 0.167 |
| 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 | 285.5 | 0.167 |
| 2002–03 | 48,183 | 511 | 288.4 | 0.167 |
| 2003–04 | 48,540 | 357 | 291.3 | 0.167 |
| 2004–05 | 48,795 | 255 | 294.1 | 0.166 |
| 2005–06 | 49,113 | 319 | 296.9 | 0.165 |
| **Projected** | | | | |
| 2006–07 | 49,464 | 350 | 299.8 | 0.165 |
| 2007–08 | 49,644 | 180 | 302.6 | 0.164 |
| 2008–09 | 49,825 | 181 | 305.3 | 0.163 |
| 2009–10 | 50,067 | 242 | 308.0 | 0.163 |
| 2010–11 | 50,353 | 286 | 310.7 | 0.162 |
| 2011–12 | 50,722 | 369 | 313.4 | 0.162 |
| 2012–13 | 51,194 | 472 | 316.1 | 0.162 |
| 2013–14 | 51,701 | 508 | 318.8 | 0.162 |
| 2014–15 | 52,284 | 583 | 321.5 | 0.163 |
| 2015–16 | 52,910 | 625 | 324.2 | 0.163 |
| 2016–17 | 53,503 | 593 | 326.9 | 0.164 |
| 2017–18 | 54,087 | 585 | 329.6 | 0.164 |

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 September 7, 2007, from http://www.census.gov/popest/national/asrh/2006_nat_af.html; and Population Projections, retrieved September 7, 2007, 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," 1992–93 through 2005–06; and Elementary and Secondary Enrollment Model, 1972–2005. (This table was prepared December 2007.)

**Table B-6. Actual and alternative projected numbers for macroeconomic measures of the economy: School years 1992–93 through 2017–18**

| School year | Disposable income per capita in constant 2004–05 dollars[1] | Education revenue receipts from state sources per capita in constant 2004–05 dollars[2] | Consumer Price Index |
|---|---|---|---|
| **Actual** | | | |
| 1992–93 | $24,529 | $616 | 0.716 |
| 1993–94 | 24,624 | 614 | 0.735 |
| 1994–95 | 25,136 | 642 | 0.756 |
| 1995–96 | 25,410 | 660 | 0.776 |
| 1996–97 | 25,937 | 680 | 0.798 |
| 1997–98 | 26,879 | 711 | 0.813 |
| 1998–99 | 27,794 | 742 | 0.827 |
| 1999–2000 | 28,461 | 777 | 0.851 |
| 2000–01 | 29,113 | 803 | 0.880 |
| 2001–02 | 29,686 | 808 | 0.895 |
| 2002–03 | 29,831 | 812 | 0.915 |
| 2003–04 | 30,627 | 798 | 0.935 |
| 2004–05 | 31,130 | 807 | 0.963 |
| 2005–06 | 31,251 | 798 | 1.000 |
| **Middle alternative projections** | | | |
| 2006–07 | 32,005 | 826 | 1.020 |
| 2007–08 | 32,881 | 853 | 1.040 |
| 2008–09 | 33,764 | 879 | 1.063 |
| 2009–10 | 34,686 | 906 | 1.084 |
| 2010–11 | 35,554 | 932 | 1.105 |
| 2011–12 | 36,310 | 955 | 1.126 |
| 2012–13 | 36,935 | 976 | 1.147 |
| 2013–14 | 37,570 | 997 | 1.169 |
| 2014–15 | 38,306 | 1,024 | 1.190 |
| 2015–16 | 39,089 | 1,052 | 1.214 |
| 2016–17 | 39,877 | 1,081 | 1.237 |
| 2017–18 | 40,703 | 1,110 | 1.261 |
| **Low alternative projections** | | | |
| 2006–07 | 31,979 | 826 | 1.022 |
| 2007–08 | 32,586 | 844 | 1.051 |
| 2008–09 | 33,011 | 855 | 1.083 |
| 2009–10 | 33,496 | 868 | 1.116 |
| 2010–11 | 33,934 | 880 | 1.148 |
| 2011–12 | 34,309 | 891 | 1.184 |
| 2012–13 | 34,659 | 903 | 1.222 |
| 2013–14 | 35,055 | 917 | 1.262 |
| 2014–15 | 35,588 | 936 | 1.306 |
| 2015–16 | 36,159 | 957 | 1.354 |
| 2016–17 | 36,750 | 978 | 1.404 |
| 2017–18 | 37,370 | 1,001 | 1.457 |
| **High alternative projections** | | | |
| 2006–07 | 32,031 | 827 | 1.018 |
| 2007–08 | 33,196 | 863 | 1.029 |
| 2008–09 | 34,281 | 895 | 1.046 |
| 2009–10 | 35,326 | 926 | 1.060 |
| 2010–11 | 36,397 | 959 | 1.076 |
| 2011–12 | 37,407 | 990 | 1.093 |
| 2012–13 | 38,308 | 1,020 | 1.106 |
| 2013–14 | 39,226 | 1,051 | 1.119 |
| 2014–15 | 40,164 | 1,084 | 1.132 |
| 2015–16 | 41,149 | 1,120 | 1.147 |
| 2016–17 | 42,187 | 1,157 | 1.164 |
| 2017–18 | 43,291 | 1,197 | 1.182 |

[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.

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," 1989–90 through 2004–05; Revenue Receipts From State Sources Model, 1971–72 through 2004–05; and Global Insight, Inc., "U.S. Quarterly Model: February 2007 Long-Term-Projections." (This table was prepared December 2007.)

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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

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

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 or school district (LEA), and state levels. Information about revenues and expenditures is also collected at the state and LEA levels.

Data are collected for a particular school year 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

Quansheng Shen
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
quansheng.shen@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
Elementary/Secondary Cooperative System and
Institutional Studies Program
National Center for Education Statistics
1990 K Street NW
Washington, DC 20006
frank.johnson@ed.gov
http://nces.ed.gov/ccd/

### Private School Universe Survey

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

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

The target population for 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
1990 K Street NW
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 6,500 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 nine integrated components that obtain information on who provides postsecondary education (institutions), who participates in it and completes it (students), what programs are offered and what programs are completed, and both the human and financial resources involved in the provision of institutionally-based postsecondary education. Until 2000 these components included: institutional characteristics, fall enrollment, completions, salaries, finance, and fall staff. Since 2000, data are 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.

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 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 in recent years. The old standard for higher education institutions included those institutions that had courses leading to an associate degree or higher, or that had courses accepted for credit toward those degrees. The 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 impact of this change has generally not been large. For example, tables on degrees awarded at the bachelor's level or higher were not heavily affected. Most of the data on public 4-year colleges have been affected only to a minimal extent. The impact on enrollment in public 2-year colleges was noticeable in certain states, but relatively small at the national level. The largest impact has been on private 2-year college enrollment. Overall, 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.

Elise Miller
Postsecondary Studies Division
Postsecondary Institutional Studies Program
National Center for Education Statistics
1990 K Street NW
Washington, DC 20006
elise.miller@ed.gov
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 2006 data.

Further information may be obtained from

Janice Plotczyk
Postsecondary Studies Division
Postsecondary Institutional Studies Program
National Center for Education Statistics
1990 K Street NW
Washington, DC 20006
janice.plotczyk@ed.gov
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 2006–07, the overall response rate was 99.8 percent for degree-granting 4-year public institutions and 100.0 percent for private not-for-profit 4-year and all 2-year institutions. Imputation methods and the response bias analysis for the 2006–07 survey are discussed in *Enrollment in Postsecondary Institutions, Fall 2006; Graduation Rates, 2000 and 2003 Cohorts; and Financial Statistics, Fiscal Year 2006* (NCES 2008-173).

*The Integrated Postsecondary Education Data System Data Quality Study* (NCES 2005-175) showed that public institutions made the majority of changes to enrollment data during the 2004 revision period. 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

Tara Coffey
Postsecondary Studies Division
Postsecondary Institutional Studies Program
National Center for Education Statistics
1990 K Street NW
Washington, DC 20006
tara.coffey@ed.gov
http://nces.ed.gov/ipeds/

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

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 2006 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 2006 survey are discussed in *Postsecondary Institutions in the United States: Fall 2006 and Degrees and Other Awards Conferred: 2005–06* (NCES 2007-166).

*The Integrated Postsecondary Education Data System Data Quality Study, Methodology Report* (NCES 2005-175) indicated that most Title IV institutions supplying revised data on completions were able to supply missing data for the prior year. The small 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

Andrew Mary
Postsecondary Studies Division
Postsecondary Institutional Studies Program
National Center for Education Statistics
1990 K Street NW
Washington, DC 20006
andrew.mary@ed.gov
http://nces.ed.gov/ipeds/

## 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, if the adjustment is substantial, 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 large 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 2004 basic CPS response rate was 92.3 percent and the school enrollment supplement response rate was 96.0 percent, for a total supplement response rate of 88.6 percent.

The October 2005 basic CPS response rate was 92.6 percent and the school enrollment supplement response rate was 96.6 percent, for a total supplement response rate of 89.5 percent.

The October 2006 basic CPS household-level response rate was 91.9 percent and the school enrollment supplement person-level response rate was 88.0 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 is available in the Census Bureau Population Paper Listing 47 (PPL-47) and Current Population Report P25-1131. These reports may be obtained from

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

## Other Sources

### Global Insight, Inc.

Global Insight, Inc. provides an information system that includes: databases of economic and financial information; simulation and planning models; regular publications and special studies; data retrieval and management systems; and access to experts on economic, financial, industrial, and market activities. One service is the Global Insight Model of the U.S. Economy, which contains annual projections of U.S. economic and financial conditions, including forecasts for the federal government, incomes, population, prices and wages, and state and local governments, over a long-term (10- to 25-year) forecast period.

Additional information is available from

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

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# Appendix D
# List of Abbreviations

| | |
|---|---|
| ADA | average daily attendance |
| BLS | Bureau of Labor Statistics |
| CCD | Common Core of Data |
| CPI | Consumer Price Index |
| EDMOD | Education Forecasting Model |
| FTE | full-time-equivalent |
| IPEDS | Integrated Postsecondary Education Data System |
| MAPE | mean absolute percentage error |
| NCES | National Center for Education Statistics |

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# Appendix E
# Glossary

## Data Terms

**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.

**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).

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

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

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

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

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

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

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

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

**Current Population Survey:** See appendix C, Data Sources.

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

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

**Doctor's degree:** 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.

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

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

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

**Expenditures:** Charges incurred, whether paid or unpaid, that are presumed to benefit the current fiscal year. For elementary and secondary schools, these include all charges for current outlays plus capital outlays and interest on school debt. For 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.

**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.).

**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.

**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.

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

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

**Higher education institutions (traditional classifications):**

> **4-year institution:** An institution legally authorized to offer and offering at least a 4-year program of college-level studies wholly or principally creditable toward a bachelor's degree. A university is a postsecondary institution that typically includes one or more graduate professional schools.
>
> **2-year institution:** An institution legally authorized to offer and offering at least a 2-year program of college-level studies that terminates in an associate's degree or is principally creditable toward a baccalaureate.

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

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

**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.

**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.

**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:** 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.

**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.

**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.

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

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

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

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

**Secondary instructional level:** The general level of instruction provided for pupils in secondary schools (generally covering grades 7 through 12 or 9 through 12), and any instruction of a comparable nature and difficulty provided for adults and youth beyond the age of compulsory school attendance.

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

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

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

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

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

**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.

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

**Unclassified student (postsecondary):** A student taking courses creditable toward a degree or other formal award who cannot be classified by academic level. For example, this could include a transfer student whose earned credits have not been determined at the time of the fall report.

**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.

**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.

## Statistical Terms

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

**Interpolation:** See *Linear interpolation.*

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

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

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

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

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

**Parameter:** A quantity that describes a statistical population.

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

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

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

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

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

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

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

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

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

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

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