ies NATIONAL CENTER FOR EDUCATION STATISTICS
Institute of Education Sciences

U.S. Department of Education
NCES 2006–605

User's Guide to Computing High School Graduation Rates

Volume 2

Technical report: Technical Evaluation of Proxy Graduation Indicators

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August 2006

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Executive Summary

The increased focus on accountability in education in recent years has resulted in a growing interest in the accurate measurement of an on-time high school graduation rate. In fact, the No Child Left Behind Act of 2001 included an on-time graduation rate as an accountability-reporting requirement. The accurate reporting of such a rate requires student record data on student progression from grade to grade, data on graduation status, and data on students who transfer in and out of a school, district, or state during the high school years, or in other words cohort data (National Institute of Statistical Sciences (NISS) 2004 Task Force, NCES 2005-1105). At the time the on-time graduation rate reporting requirement was enacted, few states had data collection systems adequate to support the calculation of an accurate on-time graduation rate.

Absent the required cohort data, existing measures of high school completion have been considered and a number of new proxy graduation indicators have been proposed. The existing high school completion measures rely on cross-sectional data, but do not focus uniquely on on-time graduation and thus are not adequate for a measure of on-time graduation. Each of the newly proposed proxy measures can be calculated using existing cross-sectional data, but each requires a set of assumptions to bridge the gap from cross-sectional data to the desired cohort rate. Recognizing the need for an interim measure to use while individual states develop student record systems, the leadership in the Department of Education asked NCES to evaluate the array of current and proposed graduation indicators. This two-volume report describes that effort.

The first volume of this report examines the existing measures of high school completion and the newly proposed proxy measures. This includes a description of the computational formulas, the data required for each indicator, the assumptions underlying each formula, the strengths and weaknesses of each indicator relative to a true cohort on-time graduation rate, and a consideration of the conditions under which each indicator does or does not work.

The second volume of this report provides documentation of the technical work that the Department leadership used to select an interim graduation rate. The analysis in volume 2 draws upon the student record data from two states to compute the true cohort on-time graduation rate for each of those states, to compute the proxy graduation measures for each of these states, and to compare the performance of each proxy indicator to that of the true cohort rate. State and school district level rates were computed for three graduating classes in State 1 and four graduating classes in State 2. A combination of descriptive univariate statistics and regression analyses were employed. Although each of the four proxy measures of on-time graduation rates— the Freshman Graduation Rate (FGR) indicator, the Averaged Freshman Graduation Rate (AFGR) indicator, the Green Graduation Indicator (GGI), and the Swanson Cumulative Promotion Indicator (SCPI), perform well relative to the true cohort rate (EACGI) in one or more of the analyses, AFGR is the only measure that is consistently among the best performing indicators in each analysis.

Building on the performance of the Averaged Freshman Graduation Rate in the student record data comparisons from States 1 and 2, this rate was taken as the standard for comparison and the performance of this rate was compared to that of the other three proxy graduation rate measures using cross-sectional data for the 50 states and the District of Columbia for rates computed at the national and state levels. First, it was shown that in States 1 and 2 each of the four proxy measures computed using cross-sectional data correlate strongly with the same proxy measures computed using student record data and that the four proxy measures computed using cross-sectional data show the same patterns of correlation with the true cohort on-time graduation rate that were observed with the proxy measures computed using the student record data. Next, the analyses that compared the performance of each proxy graduation measure to the true cohort-on-time graduation rates in States 1 and 2 were repeated at the national and state levels comparing the performance of the other three proxy graduation rate measures to that of the Averaged Freshman Graduation Rate. The relative performance of each of the proxy measures repeated the patterns observed in the two states, with the performance of the Freshman Graduation Rate most closely approximating that of the Averaged Freshman Graduation Rate, and with weaker associations with the Greene Graduation Indicator and then with the Swanson Cumulative Promotion Indicator.

Preface

The fact that graduation rates are an important indicator of students' performance in American schools was highlighted by the inclusion of an on-time high school graduation rate in the monitoring requirements included in the 2001 No Child Left Behind Act. Unlike the assessment measures called out in the law, the calculation of an on-time graduation rate requires data that do not exist in most states. An on-time high school graduation rate requires data on student progression from grade to grade, data on graduation status, and data on students who transfer in and out of a school, district, or state during the four year period—in other words a student record system.

Absent the data required to compute an accurate on-time cohort high school graduation rate, a number of researchers have proposed different formulations that rely on existing data to estimate proxy indicators of high school graduation rates. Each measure is unique with it's own positive and negative attributes. In an attempt to sort out the various measures, the National Center for Education Statistics, on behalf of the Department of Education, asked the National Institute of Statistical Sciences (NISS) to convene a 2004 Task Force of experts to examine the array of measures and provide a recommendation for the calculation of graduation rates. The NISS Task Force concluded that the only way to accurately measure high school graduation rates in a mobile society like the United States is through the development and use of student record systems. They provided detailed specifications for the true cohort rate that will yield an accurate on-time graduation rate, and recommended that NCES work with the states to move the implementation forward (NCES 2005-105).

At that time, seven states reported that they had statewide student record systems in place, and a number of other states were in the planning and early developmental stages. Recognizing that even if all 50 states were to start collecting the required data elements for the cohort on-time graduation rate in the 2005-06 school year, the country would still be 4 years away from having one consistent graduation rate measure across the states, leadership in the Department of Education asked NCES to further evaluate the array of current and proposed graduation indicators. This report describes that effort.

This report consists of two volumes, the first takes an in-depth look at the various graduation indicators, with a description of the computational formulas, the data required for each indicator, the assumptions underlying each formula, the strengths and weaknesses of each indicator, and a consideration of the conditions under which each indicator does or does not work. In addition to the discussion in the body of the text, there is a summary description of each indicator and an accompanying spreadsheet that can be used to compute each indicator in appendix A.

The second volume of this report is more technical in nature. The analysis presented in this volume of the report provided the technical basis that Department policy makers used to identify an interim graduation indicator. Thus, using the information from volume 1 as a backdrop, volume 2 uses the best available national and state data to provide estimates of the

various indicators. While this provides some basis for drawing comparisons across the indicators, the comparative analysis relies most heavily on student record data from two individual states. The state data represent the universe of students enrolled in public schools in each state over a sufficient number of years to compute the true cohort rate. The NISS panel recommended the true cohort rate as the only rate that will yield an accurate on-time graduation rate. The true cohort rate is thus used as the "gold standard" for a comparison of the performance of the various graduation indicators for the two individual states. The analysis of the state student record data then served as a basis for a related analysis of proxy graduation indicators computed for all 50 states and the District of Columbia at the national and state levels using NCES Common Core of Data.

Acknowledgments

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Technical Evaluation of Proxy Graduation Indicators

Chapter 1

The first volume described the data elements included in each proxy graduation indicator, illustrated how to calculate each indicator, and discussed potential limitations. This volume of the report provides the technical information base used by Department policy makers in identifying an interim graduation indicator to use in monitoring progress under the No Child Left Behind Act. With the information from Volume 1 as a backdrop, this volume evaluates the performance of the subset of proxy indicators that can be calculated using existing public school data.

The National Institute of Statistical Sciences (NISS) Task Force on graduation and dropout rates, convened by NCES on behalf of the Department of Education, identified the true cohort on-time graduation rate—that is, the Exclusion-Adjusted Cohort Graduation Rate (EACGI) as the most accurate graduation rate. Taking the true cohort on-time graduation rate as the gold standard, the goal of the analyses in this volume is to determine which proxy graduation indicator best approximates the true cohort on-time graduation rate. This evaluation is done first using data from the student record systems of two states to compare the performance of the proxy indicators with the true cohort on-time graduation rates computed for those states, and second, looking more broadly at the performance of the proxy graduation indicators for the nation and individual states.

The recommended true cohort on-time graduation indicator, the EACGI, uses data from an individual student record system to take all possible changes in status into account, following the movement of students from one entering class of first-time 9th-graders (i.e., a cohort), new entrants to that class, and exits from that class over time as the students progress towards graduation (table 1.1). This indicator requires counts of first-time 9th-graders; counts of students who leave the 9th grade and each successive grade during the high school years due to documented transfers, imprisonment, or death (i.e., exclusions); counts of transfers in to the 9th grade and each successive grade during the high school years; and counts of graduates for the first-time 9th-graders who started in the class and for students who transferred in to the class.

The array of proxy graduation indicators described in volume 1 uses different combinations of aggregate counts of year- and grade-specific enrollments (grades 8-12), year-specific graduates, and in the case of the Common Core of Data Graduation Leaver Indicator (CCD GLI), year- and grade-specific dropouts (grades 9-12). The formulas for the proxy graduation indicators are included in table 1.1.

The data required to compute the true cohort on-time graduation rate are not currently available at the national level. However, the best way to evaluate the performance of the proposed proxy graduation indicators is to compare the estimates computed for the proxy indicators with the values of the true cohort rate computed for the same population. In order to conduct such an analysis, NCES staff identified states that have had student

record systems in place for enough years to have the data elements needed to compute the recommended true cohort on-time graduation rate for several years—the cohort graduation indicator (EACGI).

Two states meeting these criteria agreed to provide their data. NCES then worked with staff in the state education departments for the two states to acquire the data, and used the state data to compute the true cohort rate and the proxy indicators. Since the proxy measures are each designed to estimate the true cohort on-time graduation rate, the individual proxy indicators computed for these two states can be compared to their true cohort rates to evaluate how well each of the proxy indicators performs relative to the true cohort rate. This is done by comparing the distributional characteristics of the various indicators to those of the true cohort rate, by examining the correlations between each proxy indicator and the true cohort rate, by examining the amount of variation in each proxy measure that is explained by its association with the true cohort rate, and by examining the amount of error in each indicator measured as the distance from the true cohort estimate for the same population.

The computation of the true cohort on-time graduation rate from the available data in the two states was informative. While the effort succeeded in yielding estimates of the cohort rate for these two states, the processes required to manipulate the data helped identify the level of specificity required in record keeping and data documentation to successfully use student-record system data. In particular, different approaches to student record keeping were used in each of the states. One state utilizes a centralized state-level system with unique records for individual students, whereas the other state utilizes a more decentralized system in which the records are maintained at the district level and consolidated for reporting at the state level.

Both systems presented definitional problems concerning how to define first-time freshmen and how to define regular graduates. They also raised questions about which year's cohort to assign transfers to when it is not known if transfer students had been retained since first enrolling in the 8th grade, or in what high school grades they have been retained; which year's cohort to assign students to when they switched grades within a year; and how to assign students who transfer or otherwise leave a state when their records are inconsistent. In addition, there were some difficulties with multiple identifiers for individual students in the state with the decentralized student record system. In each case, decisions were reached and the data were processed consistently in light of the decisions. (See appendix A for additional details on the specific problems and their resolutions.)

The analytic results from the state with the centralized individual student record system, State 1, are presented in chapter 2 and those for the state with the decentralized district-based individual student record system are presented in chapter 3.

Chapter 4 includes a broader look at the performance of the proxy graduation indicators for the nation and individual states. Here, currently available data from the Common Core of Data are used to compute the proxy graduation rates for the nation and states over the 7-year period from 1995-96 through 2001-02. This analysis draws upon the findings

from Chapters 2 and 3, by comparing the Averaged Freshman Graduation Rate (AFGR) indicator that was identified as the closest approximation of the true cohort rate performance to the other proxy graduation indicators—Freshman Graduation Rate (FGR) indicator, Greene Graduation Indicator (GGI), and Swanson Cumulative Promotion Indicator (SCPI). These comparisons are done at the national, state, and school district levels.

Table 1.1. Formulas and definitions for the graduation rate proxy indicators

Exclusion-Adjusted Cohort Graduation Indicator (EACGI)

Formula:

$$EACGI = \frac{S_{9,c}G_{c+3}+TI_{9,c}G_{c+3}+TI_{10,c+1}G_{c+3}+TI_{11,c+2}G_{c+3}+T_{12,c+3}G_{c+3}}{(S_{9,c} - E_{c,c+1,c+2,\,c+3}) + (TI_{9,c} - E_{c,c+1,c+2,\,c+3}) + (TI_{10,c+1} - E_{c+1,c+2,\,c+3}) + (TI_{11,c+2} - E_{c+2,c+3}) + (TI_{12,c+3} - E_{c+3})}$$

Where:

S_9	=	Number of first-time 9th-graders
C	=	Cohort school year (i.e., the school year a student entered high school)
G	=	Number of graduates receiving a regular diploma
TI	=	Number of students transferring into a grade level
E	=	Number of students excluded (documented transfers to state-designated diploma granting programs, death, or imprisonment)

Averaged Freshman Graduation Indicator (AFGR)

Formula:

$$UGI = \frac{G_y}{S_{9,y-3}}$$

Where:

G	=	Number of graduates receiving a regular diploma
Y	=	School Year
$S'_{9,y-3}$	=	$\frac{S_{8,y-4} + S_{9,y-3} + S_{10,y-2}}{3}$

Where:

$S'_{9,y-3}$	=	Smoothed estimator for first-time 9th-grade enrollment

Freshman Graduation Indicator (FGR)

Formula:

$$UGI_0 = \frac{G_y}{S^*_{9,y-3}}$$

Where:

G	=	Number of graduates receiving a regular diploma
Y	=	School year
S^*_9	=	Number of all 9th-grade students

Greene's Graduation Indicator (GGI)

Formula:

$$GGI = \frac{G_y}{S'_{12,y}}$$

Where:

$$S'_{12,y} = (1 + \Delta P_{HS}) * (S'_{9,y-3})$$

$$\Delta P_{HS} = \frac{(S_{9,y} + S_{10,y} + S_{11,y} + S_{12,y}) - (S_{9,y-3} + S_{10,y-3} + S_{11,y-3} + S_{12,y-3})}{(S_{9,y-3} + S_{10,y-3} + S_{11,y-3} + S_{12,y-3})}$$

$$S'_{9,y-3} = \frac{S_{8,y-4} + S_{9,y-3} + S_{10,y-2}}{3}$$

Where:

G	=	Number of graduates receiving a regular diploma
Y	=	School Year
S_{grade}	=	Number of students enrolled in a specific grade
ΔP_{HS}	=	High school population change over 4-year period
$S'_{9,y-3}$	=	Smoothed estimator for first-time 9th-grade enrollment

Swanson's Cumulative Promotion Indicator (SCPI)

Formula:

$$SCPI = \frac{S_{10,y+1}}{S_{9,y}} * \frac{S_{11,y+1}}{S_{10,y}} * \frac{S_{12,y+1}}{S_{11,y}} * \frac{G_y}{S_{12,y}}$$

Where:

S_{grade}	=	Number of students in a specified grade
Y	=	School year
G	=	Number of graduates receiving regular diplomas

Chapter 2

An Application of the Proxy Graduation Indicators and the True Cohort Rate Using Data From the Student Record System in State 1

Student records from State 1 were used to compute the true cohort on-time graduation rate (EACGI) and each of the other school based measures—Freshman Graduation Rate based on all freshmen (FGR), Averaged Freshman Graduation Rate based on first-time freshmen (AFGR), Greene's Graduation Indicator (GGI), Swanson's Cumulative Promotion Indicator (SCPI), and CCD Graduation Leaver Indicator (GLI).

The individual student record system data were used to compute rates for EACGI at the state and school district levels for school years 2000-01, 2001-02, and 2002-03. Then, the individual student record data were aggregated to the school district and state levels and the five school-based indicators described in volume 1 (FGR, AFGR, SCPI, GGI, and GLI) were computed.[1] It is essential that the proxy indicators were computed using the aggregated measures described in volume 1 because the goal of this analysis is to evaluate the proxy indicators computed using the aggregated cross-sectional data that are currently available for most states. For example, the estimate for first-time freshmen was computed using average of the numbers of 8th-, 9th-, and 10th-graders in consecutive school years, rather than substituting the true estimate of first-time 9th-graders, and the annual counts of graduates were used rather than substituting the true estimate of on-time graduates.

2.1. State-Level Analysis

In State 1, the available student record data were used to track individual students enrolled in regular school districts over time—first-time freshmen were identified, adjustments were made for cohort exclusions and transfers in and out of the state over the high school years, and on-time graduates from these students were counted. The resulting number of on-time graduates was divided by the number of students in the exclusion- and transfer-adjusted cohort of freshmen that started high school 4 years earlier. This yielded true cohort on-time graduation rates of 60.5 in 2000-01, 62.6 in 2001-02, and 63.0 in 2002-03—for an average rate of 62.1 percent. Thus, about 62 percent of the cohort of freshmen classes in this state graduated on time (table 2.1).

As indicated above, data from student records can be used to compute both the recommended true cohort rate and the set of proxy graduation indicators to provide a basis for evaluating the performance of each of the proxy measures relative to the true

[1] Consideration was given to extending this analysis to the school level, however there were two constraints that led to a decision to not pursue this analysis at the school level. First, approximately two-thirds of the students in grades 9-12 in State 1 attended schools that did not include the 8th grade. As a result, because the calculation of the estimated number of freshmen that is used to compute AFGR and GGI requires a count of the number of students enrolled in grade 8, it is not possible to compute these proxy indicators for two-thirds of the high school students in State 1. Second, at this lower level of disaggregation, the indicators are more sensitive to year-to-year changes in the population resulting from transfers in and out of individual schools.

cohort on-time graduation rate. Thus, estimates for the five proxy measures, FGR, AFGR, GGI, GLI, and SCPI, were computed using data aggregated from the student records with the formulas described and used in volume 1.

In State 1, the estimates for GLI are higher than any of the other graduation indicators (figure 2.1). The estimates for GGI are the second highest in each year. Conversely, the estimates of FGR are lowest in each year. Estimates of AFGR and SCPI fall between those of GLI and FGR, with similar estimates in 2000-01 and 2001-02, but with SCPI dropping in 2002-03. A comparison of these proxy indicators to the EACGI shows that the GLI and GGI are highest and the true cohort rate falls between the lower estimate for FGR and the higher estimates for AFGR and SCPI in the first 2 years and between the lower estimates for FGR and SCPI and the higher estimate for AFGR in the third year.

To further quantify the differences between each of the state-level proxy indicators and the true cohort rate, the difference between each graduation indicator and EACGI was computed for each year. Figure 2.2 shows that in State 1 AFGR, GGI, and GLI are each consistently higher than EACGI. In contrast, SCPI straddles EACGI, ranging from 5 percentage points above EACGI to 3 percentage points below; and FGR is consistently lower than EACGI. One use of the various proxy graduation measures is to track year-to-year changes in graduation rates, to do this it is important to look at differences relative to EACGI within individual years and at the average of the absolute differences over the years of available data (table 2.1). The averaged absolute difference gives an indication of the average amount of error in a specific measure relative to the true cohort rate for the same period. GLI has absolute differences of 7 to 13 percentage points from EACGI, with an average absolute difference of 9 percentage points; and the absolute differences between GGI and EACGI range from 6 to 9 percentage points, with an average absolute difference of 7 percentage points. In contrast, AFGR, SCPI, and FGR each have absolute differences relative to EACGI ranging from 2 to 5 percentage points, with averaged absolute differences of 3.0 percentage points for AFGR, 3.2 for SCPI, and 3.5 for FGR.

Table 2.1. Graduation indicators EACGI, FGR, AFGR, GGI, GLI, and SCPI for State 1, by year: 2000-01 through 2002-03

School year	Indicator[1]					
	EACGI	FGR	AFGR[2]	GGI[2]	GLI	SCPI
2000-01	60.5	58.2	65.1	69.7	73.2	65.0
2001-02	62.7	58.8	65.4	69.7	71.1	64.8
2002-03	63.0	58.5	64.6	69.0	69.9	59.9
	Absolute difference from EACGI					
2000-01	†	2.3	4.6	9.3	12.7	4.5
2001-02	†	3.8	2.7	7.0	8.4	2.2
2002-03	†	4.5	1.6	6.0	6.9	3.1
Average	†	3.5	3.0	7.4	9.3	3.2

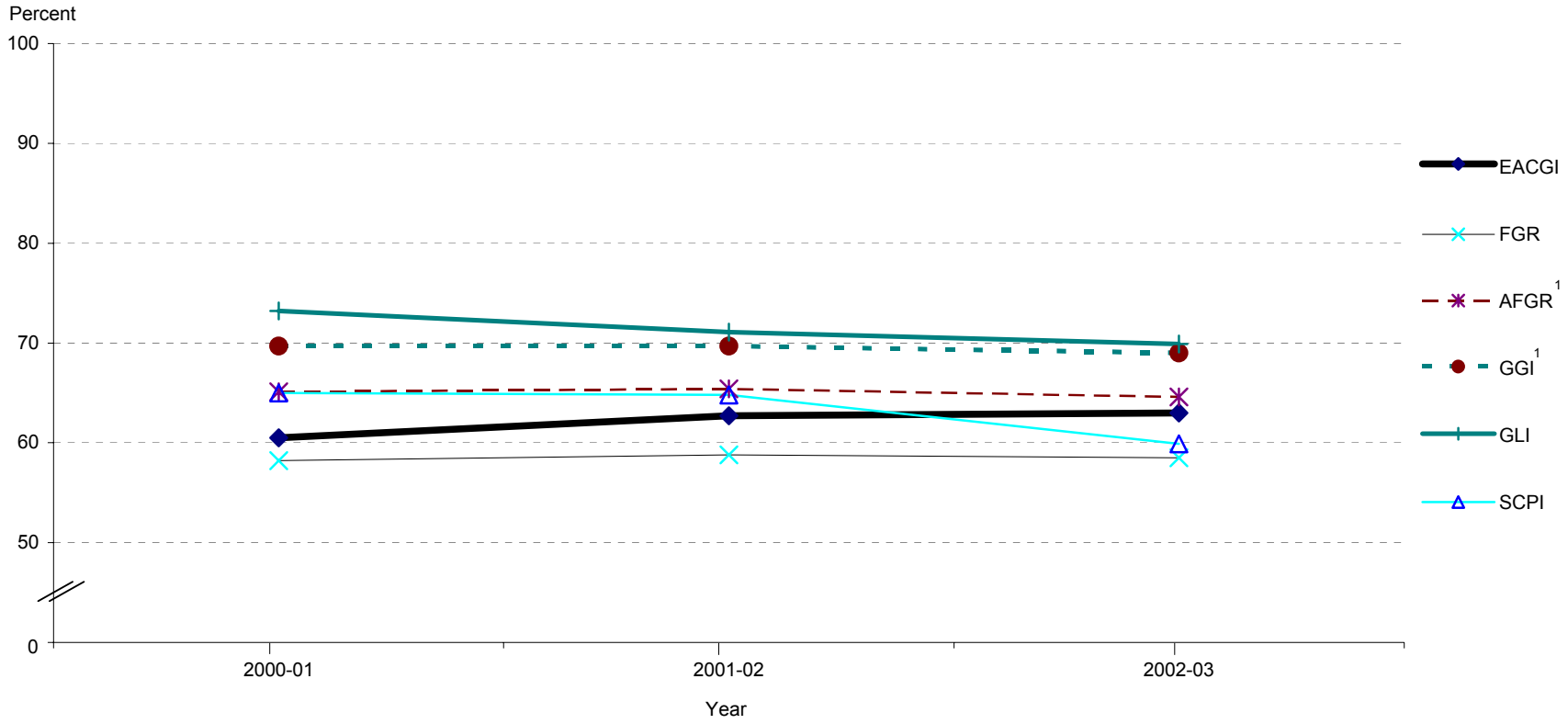
† Not applicable

[1] EACGI = Exclusion-Adjusted Cohort Graduation Indicator; FGR = Freshman Graduation Rate, all freshmen; AFGR= Averaged Freshman Graduation Rate, first-time freshmen; GGI = Greene's Graduation Indicator; GLI = CCD Graduation Leaver Indicator; SCPI = Swanson's Cumulative Promotion Indicator.

[2] First-time 9th-grade counts were estimated using Greene's smoothed 9th-grade estimate.

NOTE: Estimates are based on regular school districts
SOURCE: Data from a state 1 student record system.

Figure 2.1. Estimates of graduation indicators EACGI, FGR, AFGR, GGI, GLI, SCPI in State 1: 2000-01 through 2002-03

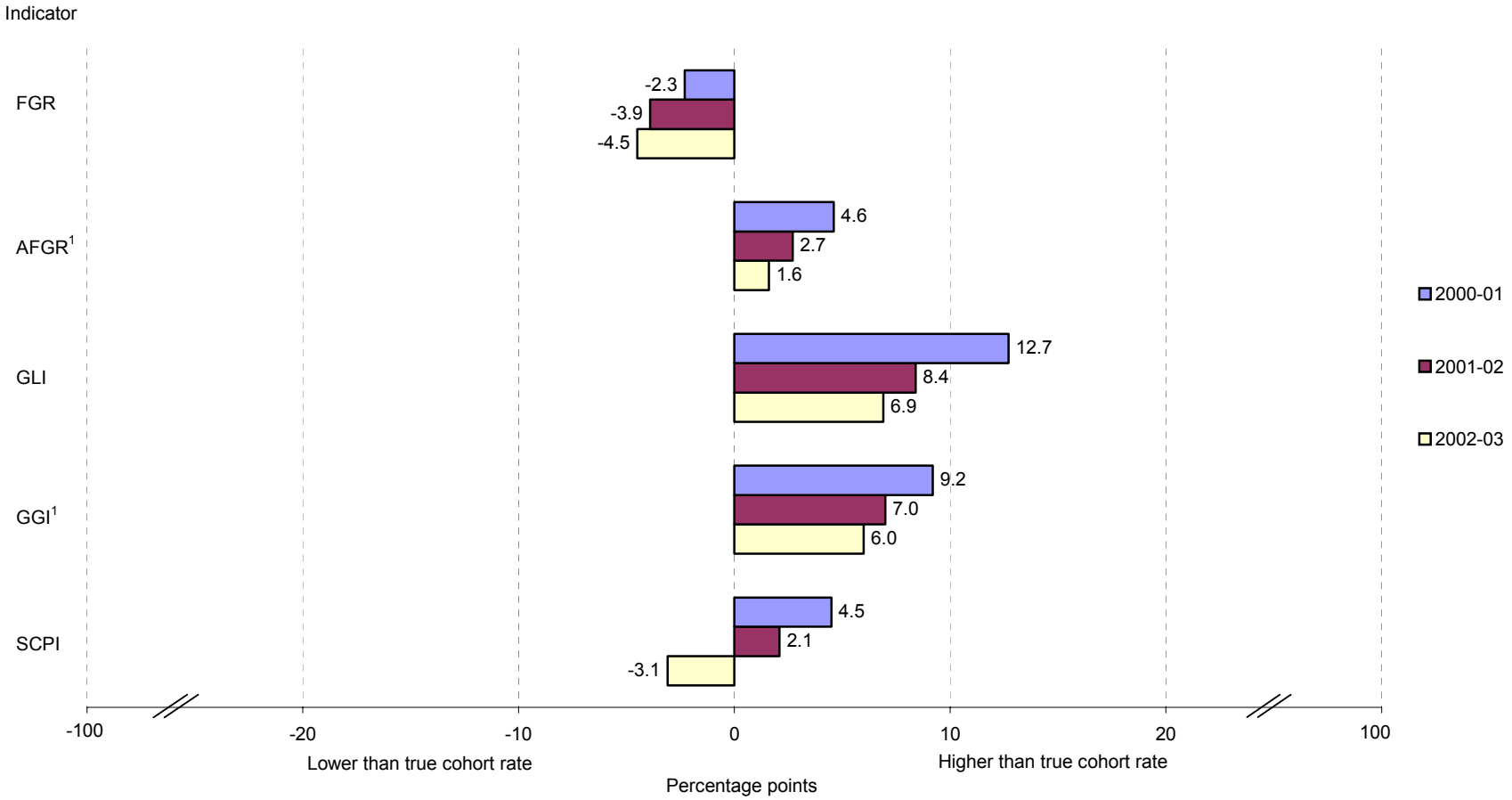


[1] First-time 9th-grade counts were estimated using Greene's smoothed 9th-grade estimate.

NOTE: FGR = Freshman Graduation Rate, all freshmen; AFGR= Averaged Freshman Graduation Rate, first-time freshmen; GGI = Greene's Graduation Indicator; GLI=Graduation Leaver Indicator; SCPI = Swanson's Cumulative Promotion indicator; EACGI = Exclusion-Adjusted Cohort Graduation Indicator.

SOURCE: Data from state 1 student record system.

Figure 2.2. Distance, in percentage points, of each graduation indicator FGR, AFGR, GLI, GGI, and SCPI from the true cohort rate EACGI in State 1: 2000-01 through 2002-03



[1] First-time 9th-grade counts were estimated using Greene's smoothed 9th-grade estimate.

NOTE: FGR = Freshman Graduation Rate, all freshmen; AFGR= Averaged Freshman Graduation Rate, first-time freshmen; GGI = Greene's Graduation Indicator; GLI=Graduation Leaver Indicator; SCPI = Swanson's Cumulative Promotion indicator; EACGI = Exclusion-Adjusted Cohort Graduation Indicator.

SOURCE: Data from state 1 student record system.

2.2. School District-Level Analysis

The graduation indicators can also be computed at the school district level using the student-record-system data. In this case, first-time freshmen were identified, adjustments were made for cohort exclusions and transfers in and out of the school district over the high school years, and counts of on-time graduates from these students were tallied. These data were used to compute the true cohort on-time graduation rate for each regular school district in State 1. As was the case in the state-level analysis, data from the student record system were aggregated to form the cross-sectional estimates needed to compute the five proxy graduation indicators. The six graduation indicators were then analyzed to further evaluate the performance of the five proxy indicators relative to the true cohort on-time graduation rate for regular school districts in State 1.

Looking first at the distributional properties of each of the school district-level indicators, table 2.2a displays the mean rate computed across school districts, along with the minimum, 25th percentile, median (50th percentile), 75th percentile, maximum values, and standard deviations across the regular school districts for each of the six graduation indicators in school years 2000-01 through 2002-03.

Over the 3-year period, the lowest district rate for the true cohort on-time graduation rate occurred in 2000-01 with one district having a rate of 28 percent. The minimum rates for the other 2 years were 45 percent in 2001-02 and 49 percent in 2002-03. Conversely, the highest maximum rate was 88 percent, and it occurred in both 2001-02 and 2002-03. The maximum in 2000-01 was 79 percent.

In 2000-01, the minimum estimates across the proxy indicators ranged from 22 for GLI to 55 percent for GGI. In 2001-02, the minimum estimates ranged from approximately 30 percent for FGR to 51 percent for GGI, and in 2002-03, they ranged from 37 percent for SCPI to 54 percent for GLI and GGI. In 2000-01, the maximum estimates ranged from about 81 percent for FGR and AFGR to about 90 percent for GGI, GLI, and SCPI. In 2001-02, the maximum rates for FGR and AFGR were approximately 80 percent, while those for GGI, GLI, and SCPI were approximately 88 percent or above. In 2002-03, the maximum for values ranged from 84 percent for SCPI to 91 percent for GLI.

Table 2.2a. Mean, standard deviation, minimum, 25th percentile, median, 75th percentile, and maximum of graduation indicators across school districts in State 1, by indicator and school year: 2000-01 through 2002-03

	Indicator[1]					
Statistic	EACGI	FGR	AFGR[2]	GGI[2]	GLI	SCPI
2000-01						
Mean rate[3]	62.5	59.5	65.9	71.3	75.7	65.5
Standard deviation	8.6	8.9	7.5	7.3	9.9	10.7
Minimum	28.3	26.8	33.6	53.8	22.2	35.7
25th percentile	56.7	53.9	62.3	65.5	70.5	62.1
Median	61.9	60.1	66.6	70.3	77.8	66.4
75th percentile	68.2	65.3	70.7	75.6	81.6	69.2
Maximum	78.9	81.1	80.9	90.5	89.1	93.2
2001-02						
Mean rate[3]	65.2	60.5	66.5	71.0	74.3	65.7
Standard deviation	8.3	9.5	7.7	7.5	9.1	9.4
Minimum	45.1	29.5	39.4	50.8	33.1	35.9
25th percentile	60.0	54.6	61.0	66.5	71.5	60.2
Median	65.8	61.3	67.6	71.1	74.7	66.9
75th percentile	69.6	65.9	71.2	75.6	79.4	71.3
Maximum	87.8	80.1	80.5	90.9	92.3	88.0
2002-03						
Mean rate[3]	65.6	60.4	66.2	70.6	73.4	62.4
Standard deviation	9.3	9.7	8.1	7.8	8.4	10.9
Minimum	48.9	40.9	42.2	54.5	54.4	37.1
25th percentile	59.0	52.2	61.1	64.1	67.5	55.9
Median	65.5	60.5	66.0	70.3	74.0	63.9
75th percentile	71.4	67.5	72.0	76.8	78.8	68.7
Maximum	87.7	88.5	85.3	88.9	90.6	84.1

[1] EACGI = Exclusion-adjusted cohort graduation indicator; FGR = Freshman graduation rate, all freshmen; AFGR = Averaged freshman graduation rate, first-time freshmen; GGI = Greene's graduation indicator; GLI = CCD graduation leaver indicator; SCPI = Swanson's cumulative promotion indicator.
[2] First-time 9th-grade counts estimated using Greene's smoothed 9th-grade estimate.
[3] The mean rate is the mean of the means across school districts.

NOTE: Estimates are based on regular school districts.
SOURCE: Data from a state 1 student record system.

To further quantify the differences between each of the school district-level proxy indicators and the true cohort rate, the difference between each graduation indicator and EACGI was computed for each year (table 2.2b), and averaged absolute differences were computed to provide an indication of the average amount of error in each specific measure relative to the true cohort rate for the same period. As was the case in the state-level analyses, the differences between the estimates for GLI and EACGI are largest with an average absolute difference of 10 percentage points. Once again, GLI is followed by

GGI, which has an averaged absolute difference relative to EACGI of 6.5 percentage points. Taken across the individual differences, the comparisons of the performance of FGR relative to EACGI do not fare as well as was observed in the aggregate state-level data, with FGR exhibiting an averaged absolute difference relative to EACGI of 4.3 percentage points. As was the case in the state-level data AFGR and SCPI have average absolute differences that show that on average they yield district-level results that are closest to the observed true cohort rates (i.e., EACGI) with averaged absolute differences of 1.8 percentage points for AFGR and 2.2 percentage points for SCPI.

A comparison of the means and medians of each indicator in each of the 3 years shows differences up to 1 percentage point for EACGI, FGR, AFGR, and GGI; and differences up to 2 percentage points for SCPI and up to 3 percentage points for GLI. Given that differences between means and medians for a population can be an indication of skew in the distribution, additional diagnostic statistics were examined for each of these six indicators.

For each indicator measures of skewness, kurtosis, and the Shapiro-Wilk W measure of normality were examined along with stem-and-leaf, box, and normal probability plots. For school years 2001-02 and 2002-03 these diagnostic statistics support the conclusion that the rates are distributed normally for EACGI, FGR, AFGR, and GGI (W is greater than .95, and there is no marked skewness (less than + 1) or kurtosis (less than + 1.7) (table 2.3). In the case of GLI, although the rates are distributed normally in 2002-03, there is reason for concern in 2001-02—where there is reason to question normality (W=.91), a peaked distribution (kurtosis=5.28), and evidence of a negative skew (skewness=-1.42). In school year 2000-01, the district with the lowest rates showed up in the box plots as an extreme outlier. The rate for that district was removed and the six graduation indicators were recomputed for 2000-01. The resulting diagnostics improved with support for normality (W=.94 to .99), absence of skew (+ 0.01 to 0.36) and little or no kurtosis (+ 0.08 to 1.71).[2] With this deletion, the minimum value in 2000-01 for EACGI was 51 percent and the minimum values for the proxy indicators in 2000-01 ranged from 36 for SCPI to 59 percent for GLI.

[2] One indicator, SCPI also had three additional extreme values, the removal of those items improved the distributional properties but did not change the analytic results described below. In the interest of preserving cases these three districts were retained in the data set.

Table 2.2b. Absolute difference relative to EACGI for mean, standard deviation, minimum, 25th percentile, median, 75th percentile, and maximum of graduation indicators across school districts in State 1, by indicator and school year: 2000-01 through 2002-03

	Indicator[1]					
Statistic	EACGI	FGR	AFGR[2]	GGI[2]	GLI	SCPI
2000-01						
Mean rate[3]	†	3.0	3.4	8.8	13.2	3.0
Standard deviation	†	.3	1.1	1.3	1.3	2.1
Minimum	†	1.5	5.3	24.5	6.1	7.4
25th percentile	†	2.8	5.6	8.8	13.8	5.4
Median	†	1.8	4.7	8.4	15.9	4.5
75th percentile	†	2.9	2.5	7.4	13.4	1.0
Maximum	†	2.2	2.0	11.6	10.2	14.3
2001-02						
Mean rate[3]	†	4.7	1.3	5.8	9.1	.5
Standard deviation	†	1.2	.6	.8	.8	1.1
Minimum	†	15.6	5.7	5.7	12.0	9.2
25th percentile	†	5.4	1.0	6.5	11.5	.2
Median	†	4.5	1.8	5.3	8.9	1.1
75th percentile	†	3.7	1.6	6.0	9.8	1.7
Maximum	†	7.7	7.3	3.1	4.5	.2
2002-03						
Mean rate[3]	†	5.2	.6	5.0	7.8	3.2
Standard deviation	†	.4	1.2	1.5	.9	1.6
Minimum	†	8.0	6.7	5.6	5.5	11.8
25th percentile	†	6.8	2.1	5.1	8.5	3.1
Median	†	5.0	.5	4.8	8.5	1.6
75th percentile	†	3.9	.6	5.4	7.4	2.7
Maximum	†	.8	2.4	1.2	2.9	3.6
Average						
Mean rate[3]	†	4.3	1.8	6.5	10.0	2.2
Standard deviation	†	.6	1.0	1.2	1.0	1.6
Minimum	†	8.4	5.9	12.3	7.9	9.5
25th percentile	†	5.0	2.9	6.8	11.3	2.9
Median	†	3.8	2.3	6.2	11.1	2.4
75th percentile	†	3.5	1.6	6.3	10.2	1.8
Maximum	†	3.6	3.9	5.3	5.9	6.0

† Not applicable

[1] EACGI = Exclusion-adjusted cohort graduation indicator; FGR = Freshman graduation rate, all freshmen; AFGR = Averaged freshman graduation rate, first-time freshmen; GGI = Greene's graduation indicator; GLI = CCD graduation leaver indicator; SCPI = Swanson's cumulative promotion indicator.

[2] First-time 9th-grade counts estimated using Greene's smoothed 9th-grade estimate.

[3] The mean rate is the mean of the means across school districts.

NOTE: Estimates are based on regular school districts.
SOURCE: Data from a state 1 student record system.

Table 2.3. Diagnostic statistics of the distribution of EACGI, FGR, AFGR, GGI, SCPI and GLI across school districts in State 1: 2000-01 through 2002-03

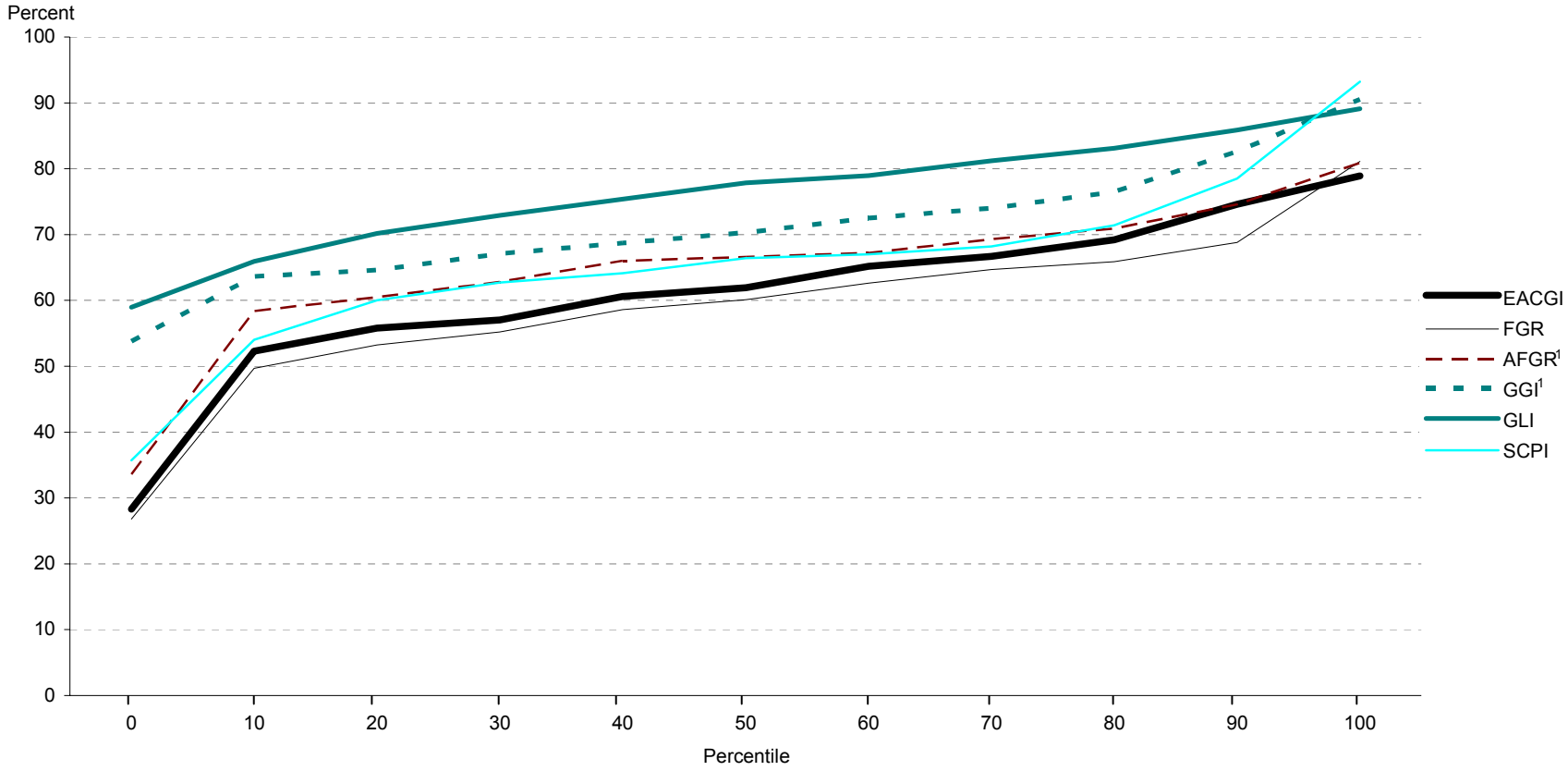
	Indicator[1]					
Statistic	EACGI	FGR	AFGR[2]	GGI[2]	SCPI	GLI
2000-01						
Skewness	-0.68	-0.66	-1.16	0.06	-0.28	-2.53
Kurtosis	2.56	2.02	4.32	-0.15	1.64	12.15
Shapiro-Wilk's W	0.95	0.97	0.93	0.99	0.94	0.82
2001-02						
Skewness	0.12	-0.64	-0.83	0.49	-0.49	-1.42
Kurtosis	0.26	1.02	1.57	0.03	0.91	5.28
Shapiro-Wilk's W	0.99	0.97	0.96	0.98	0.98	0.91
2002-03						
Skewness	0.27	0.26	-0.19	0.05	-0.26	-0.09
Kurtosis	-0.28	-0.04	0.18	-0.30	-0.31	-0.36
Shapiro-Wilk's W	0.98	0.99	0.99	0.99	0.98	0.99

[1] EACGI = Exclusion-adjusted cohort graduation indicator; FGR = Freshman graduation rate, all freshmen; AFGR = Averaged freshman graduation rate, first-time freshmen; GGI = Greene's graduation indicator; SCPI = Swanson's cumulative promotion indicator; GLI = CCD graduation leaver indicator.
[2] First-time 9th-grade counts estimated using Greene's smoothed 9th-grade estimate.

NOTE: Estimates are based on regular school districts.
SOURCE: Data from state 1 student record system.

To better understand the overall distributions of these six graduation indicators, figures 2.3 through 2.5 display the decile cut points of EACGI and each of the proxy graduation indicators. Three patterns emerge from these figures. First, the overall pattern of increase shows relatively smooth patterns between the 10th and 90th deciles, with somewhat larger changes at the extremes of the distribution. Second, as was the case at the state level, the rates for GLI are consistently high relative to the other five indicators. Third, the other four proxy indicators—FGR, AFGR, GGI, and SCPI are relatively close to EACGI, particularly between the 10th- and 90th-deciles.

Figure 2.3. Percentile distribution of graduation indicators EACGI, FGR, AFGR, GGI, GLI, and SCPI, by decile in State 1: 2000-01

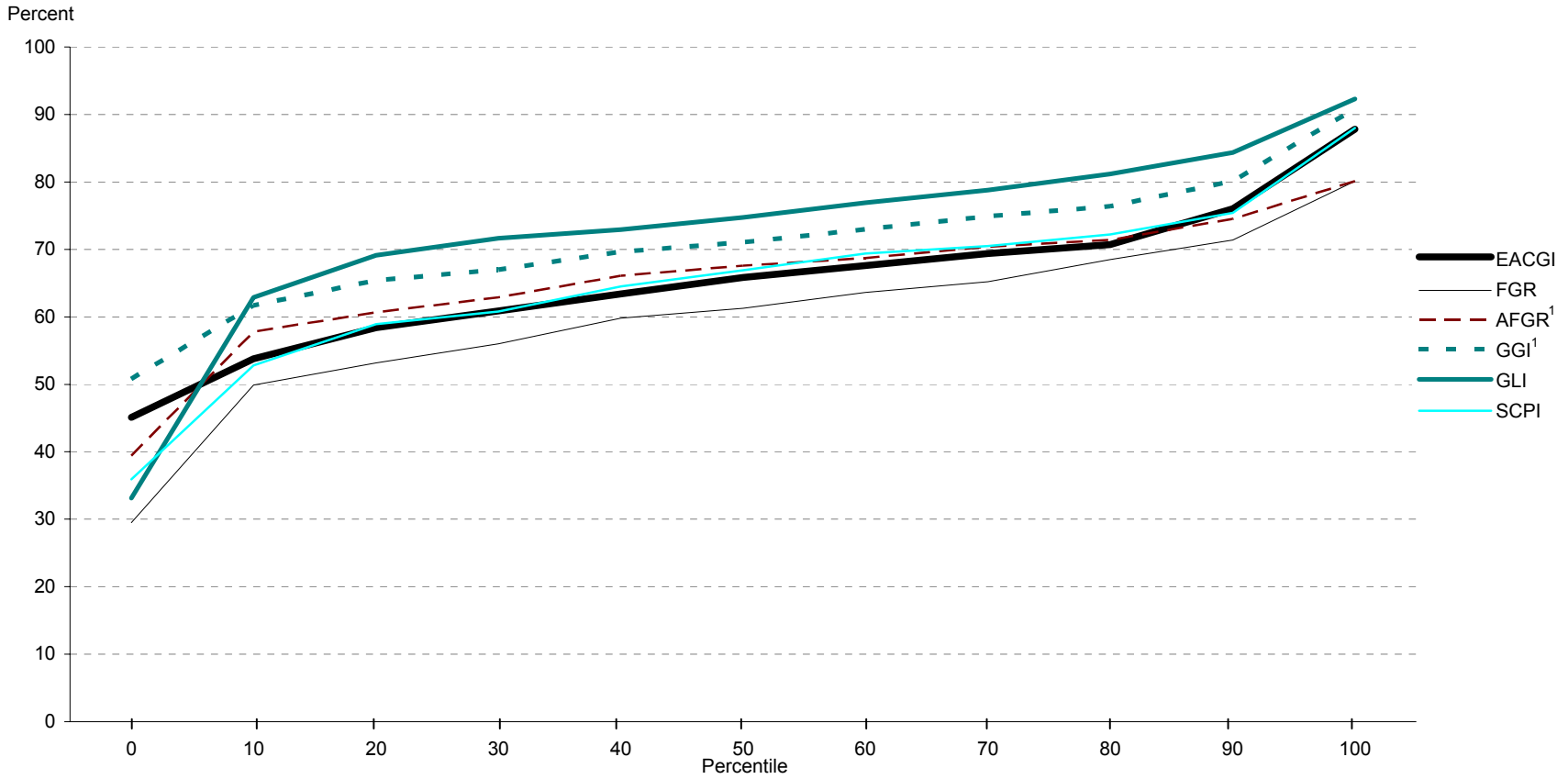


[1] First-time 9th-grade counts were estimated using Greene's smoothed 9th-grade estimate.

NOTE: EACGI = Exclusion-Adjusted Cohort Graduation Indicator; FGR = Freshman Graduation Rate, all freshmen; AFGR= Averaged Freshman Graduation Rate, first-time freshmen; GGI = Greene's Graduation Indicator; GLI=Graduation Leaver Indicator; SCPI = Swanson's Cumulative Promotion indicator.

SOURCE: Data from state 1 student record system.

Figure 2.4. Percentile distribution of graduation indicators EACGI, FGR, AFGR, GGI, GLI, and SCPI, by decile in State 1: 2001-02

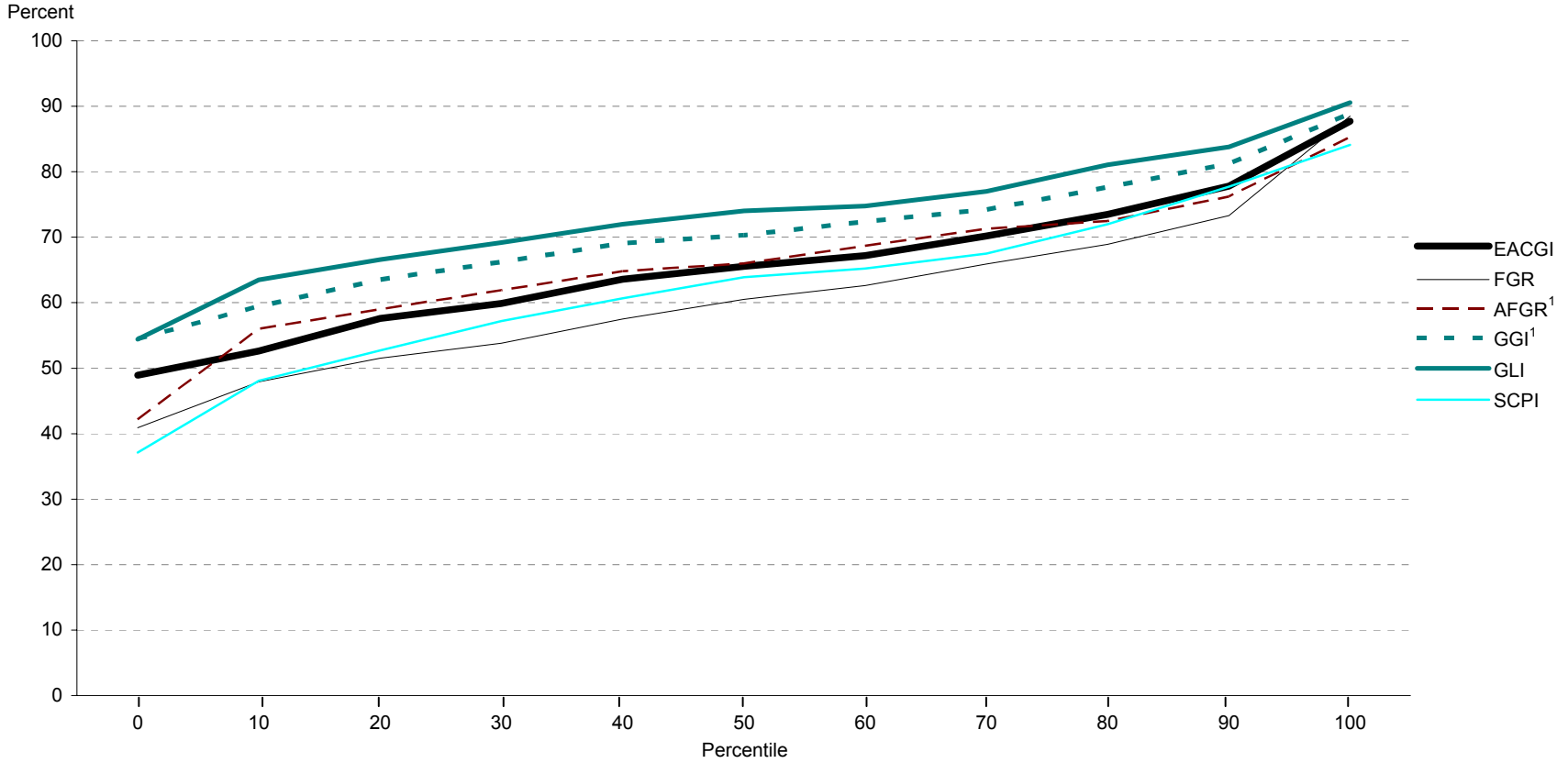


[1] First-time 9th-grade counts were estimated using Greene's smoothed 9th-grade estimate.

NOTE: EACGI = Exclusion-Adjusted Cohort Graduation Indicator; FGR = Freshman Graduation Rate, all freshmen; AFGR= Averaged Freshman Graduation Rate, first-time freshmen; GGI = Greene's Graduation Indicator; GLI=Graduation Leaver Indicator; SCPI = Swanson's Cumulative Promotion indicator.

SOURCE: Data from state 1 student record system.

Figure 2.5. Percentile distribution of graduation indicators EACGI, FGR, AFGR, GGI, GLI, and SCPI, by decile in State 1: 2002-03



[1] First-time 9th-grade counts were estimated using Greene's smoothed 9th-grade estimate.

NOTE: EACGI = Exclusion-Adjusted Cohort Graduation Indicator; FGR = Freshman Graduation Rate, all freshmen; AFGR= Averaged Freshman Graduation Rate, first-time freshmen; GGI = Greene's Graduation Indicator; GLI=Graduation Leaver Indicator; SCPI = Swanson's Cumulative Promotion indicator.

SOURCE: Data from state 1 student record system.

Since the goal of this analysis is to identify the proxy measure that best approximates the values of the true cohort on-time graduate rate (EACGI), at this point GLI is dropped from further analysis for two reasons. First, by definition, it is not an estimate of an on-time rate because students still enrolled in high school after the 4th year are excluded from the denominator. Second, related to this, the smaller denominator for GLI results in rates that are higher than EACGI in almost all instances. As a result, the remaining analyses will focus on comparisons between EACGI and FGR, AFGR, GGI, and SCPI.

Ordinary least squares regression analyses were used to evaluate which of the remaining four proxy measures best approximates the true cohort on-time graduation rate. The Pearson product-moment correlation coefficients (r) between AFGR and EACGI range from .77 to .87 across the three years (table 2.4). The results for FGR are similar, but slightly lower in 2 of the 3 years, with correlation coefficients between FGR and EACGI ranging from .74 to .85. By comparison, over the 3 years, the correlation coefficients between GGI and EACGI range from .54 to .67 and the correlation coefficients between SCPI and EACGI range from .48 to .59.[3]

The slope of the regression line indicates the magnitude of change in the true cohort on-time graduation rate for a unit change in each proxy graduation indicator. In this case, since both variables in each regression equation are rates that are expressed as percentages, the slope represents the percentage point change in the true cohort rate associated with a 1-percentage point increase in the proxy graduation indicator under consideration. The regression results from AFGR and EACGI indicate that in 2000-01, a 1-percentage point increase in AFGR is associated with a .91 percentage point increase in EACGI, for 2001-02 the slope is .85 and for 2002-03 a slope of 1 indicates that a 1 percentage point change in AFGR is associated with a 1 percentage point increase in the true cohort rate. The slopes for the regression lines between FGR and EACGI over the 3 years range from .70 to .81, indicating a 1 percentage point increase in FGR yields approximately seven- to eight-tenths of a percentage point increase in the true cohort rate. The slopes for the regression lines between GGI and EACGI range from .60 to .80. In contrast, the slopes for the regression line between SCPI and EACGI range from .34 to .51. Thus, a 1 percentage point increase in SCPI is associated with a smaller increase in the true cohort rate than is the case for AFGR, FGR or GGI.

The square of the correlation coefficient (r^2) is an indication of how well the regression line between a proxy graduation indicator and the true cohort on-time graduation indicator explains the variation in the true cohort on-time graduation rate.[4] The regression results indicate that across the three years between 60 and 77 percent of the variation in EACGI is explained by AFGR, and in the case of FGR the range in variation explained in EACGI is from 55 to 72 percent. By comparison, between 29 and 46 percent of the variation in EACGI is explained by GGI, and between 23 and 35 percent of the variation in EACGI is explained by SCPI.

[3] For 2000-01, the extreme outlier was excluded from the results reported here; however, when the analyses included the outlier, the pattern of the strength of the correlation between EACGI and each proxy was the same with AFGR and FGR having the strongest correlations, with lower correlations for GGI and SCPI.
[4] In this simple regression, the r^2 is the same as R^2.

Table 2.4 Regression estimates of EACGI on proxy graduation indicators across school districts in State 1, by indicator and school year: 2000-01 through 2002-03

	Indicator[1]			
Statistic	FGR	AFGR[3]	GGI[3]	SCPI
2000-01[2]				
Correlation coefficient	.74	.77	.60	.48
R square	.55	.60	.36	.23
Slope	.70	.91	.62	.34
Standard deviation	5.08	4.80	6.07	6.64
2001-02				
Correlation coefficient	.83	.79	.54	.50
R square	.69	.62	.29	.25
Slope	.73	.85	.60	.44
Standard deviation	4.71	5.17	7.08	7.29
2002-03				
Correlation coefficient	.85	.87	.67	.59
R square	.72	.77	.46	.35
Slope	.81	1.01	.80	.51
Standard deviation	5.02	4.56	6.95	7.61

[1] EACGI = Exclusion adjusted cohort graduation indicator; FGR = Freshman graduation rate, all freshmen; AFGR = Averaged freshman graduation rate, first-time freshmen; GGI = Greene's graduation indicator; SCPI = Swanson's cumulative promotion indicator.
[2] One district was excluded.
[3] First-time 9th-grade counts estimated using Greene's smoothed 9th-grade estimate.

NOTE: Estimates are based on regular school districts.
SOURCE: Data from state 1 student record system.

The r^2 is equivalent to the explained sum of squares divided by the total sum of squares, thus 1 minus r^2 is an estimate of the amount of variation in the true cohort rate that is not explained by the proxy graduation indicator under consideration (i.e., the unexplained sum of squares divided by the total sum of squares). Related to this, the unexplained sum of squares can also be used to compute s^2, the variance about the least squares regression line (unexplained sum of squares divided by the degrees of freedom). The square root of the variance is then, the standard deviation about the least squares regression line. Over the 3 years, these standard deviations ranged from approximately 4.6 to 5.2 for AFGR and FGR and from approximately 6.1 to 7.6 for GGI and SCPI.

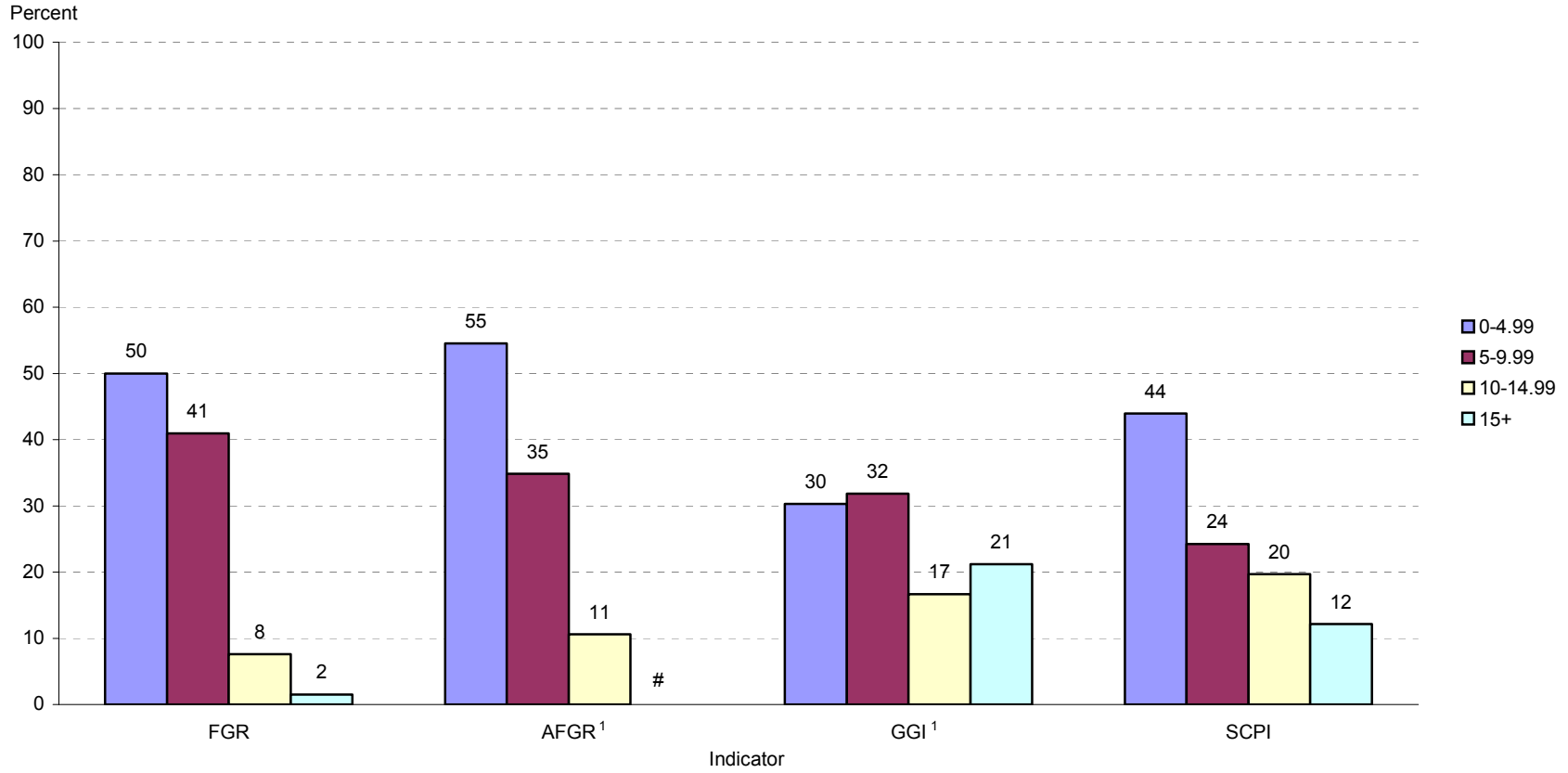
In summary, while AFGR is not an exact approximation of EACGI, it is strongly correlated with EACGI. The variance in EACGI that is explained by the various regression analyses is highest in the case of AFGR; similarly, looking across the four proxy graduation indicators, the size of a unit of change in AFGR is closest to being the

same as a unit of change in EACGI. The AFGR is a better predictor of the true cohort rate than either GGI or SCPI in each of the three years. On the other hand, the performance of AFGR and FGR is relatively close, with AFGR performing somewhat better in 2 of the 3 years used in this analysis. Taken together, these analyses indicate that AFGR, followed closely by FGR, offers the best approximation of the four proxy graduation indicators under consideration.[5]

To better understand the magnitude of the errors in each proxy indicator, the absolute difference between each proxy indicator and the true cohort on-time graduation rate was computed for each regular school district in State 1. This gives an estimate of the size of the error in each proxy indicator. For each proxy graduation indicator the data for the individual school districts were compared to those from EACGI and aggregated in 5 percentage point intervals from 0 to 15 and 15 percentage points or more from EACGI (figures 2.6 – 2.8). Across the 3 years, AFGR has the largest percentage of districts that are within 5 percentage points of the true cohort rate (55 percent in 2000-01, 59 percent in 2001-02, and 71 percent in 2002-03) and the smallest percentage of districts with large errors, with only 10 percent or fewer of the districts with proxy estimates that are 10 percentage points or more from the true cohort rate. The results are similar for FGR, with estimates for approximately 50 percent of the districts within 5 percentage points of the true rate (47, 50, and 50 percent) and 16 percent or fewer of the districts have proxy estimates that are 10 percentage points or more from the true cohort rate. In contrast, SCPI has estimates that are within 5 percentage points of the true cohort rates for 41 to 47 percent of the districts, but 30 to 32 percent of the school districts have proxy estimates that are 10 percentage points or more from the true cohort rate. Similarly, GGI has between 30 to 44 percent of the districts within 5 percentage points of the true cohort rate, but 20 to 38 percent of the school districts have proxy estimates that are 10 percentage points or more from the true cohort rate. These findings are consistent with the correlation results, with smaller errors and higher correlations between AFGR and FGR and the true cohort rate and larger errors and lower correlations between SCPI and GGI and the true cohort rate.

[5] FGR performs almost as well in its' correlation coefficients, in the amount of variation explained in EACGI, and in the portion of the standard deviation in EACGI that is unaccounted for; in addition, FGR is a close second in the analyses of slopes and the amount of variance left unexplained.

Figure 2.6 Distribution of the size of the absolute distance, in percentage points, between graduation indicators FGR, AFGR, GGI, SCPI, and the true cohort rate EACGI for school districts in State 1: 2000-01



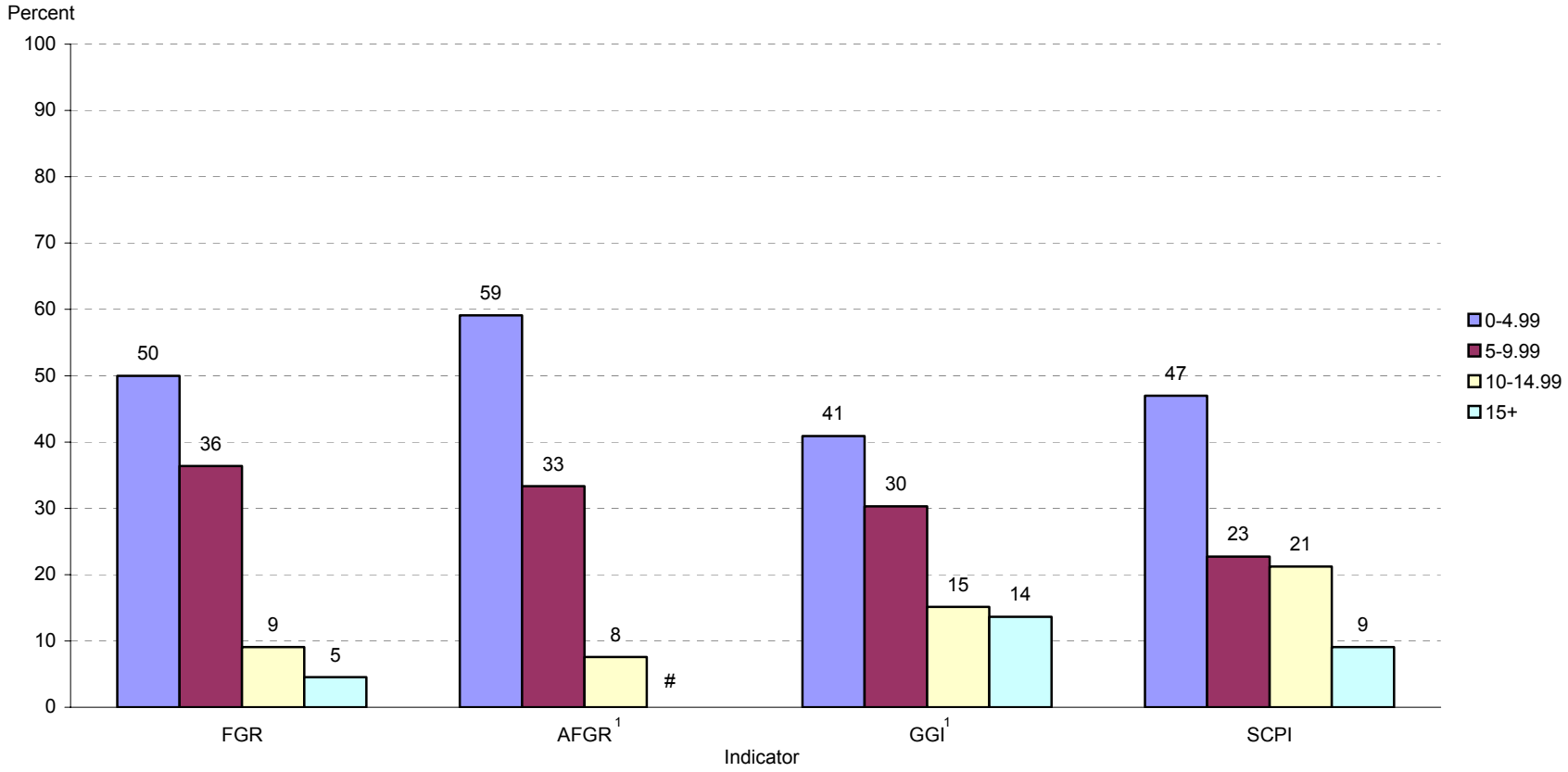
Rounds to zero.

[1] First-time 9th-grade counts were estimated using Greene's smoothed 9th-grade estimate.

NOTE: FGR = Freshman Graduation Rate, all freshmen; AFGR= Averaged Freshman Graduation Rate, first-time freshmen; GGI = Greene's Graduation Indicator; SCPI = Swanson's Cumulative Promotion indicator; EACGI = Exclusion-Adjusted Cohort Graduation Indicator.

SOURCE: Data from state 1 student record system.

Figure 2.7 Distribution of the size of the absolute distance, in percentage points, between graduation indicators FGR, AFGR, GGI, SCPI, and the true cohort rate EACGI for school districts in State 1: 2001-02



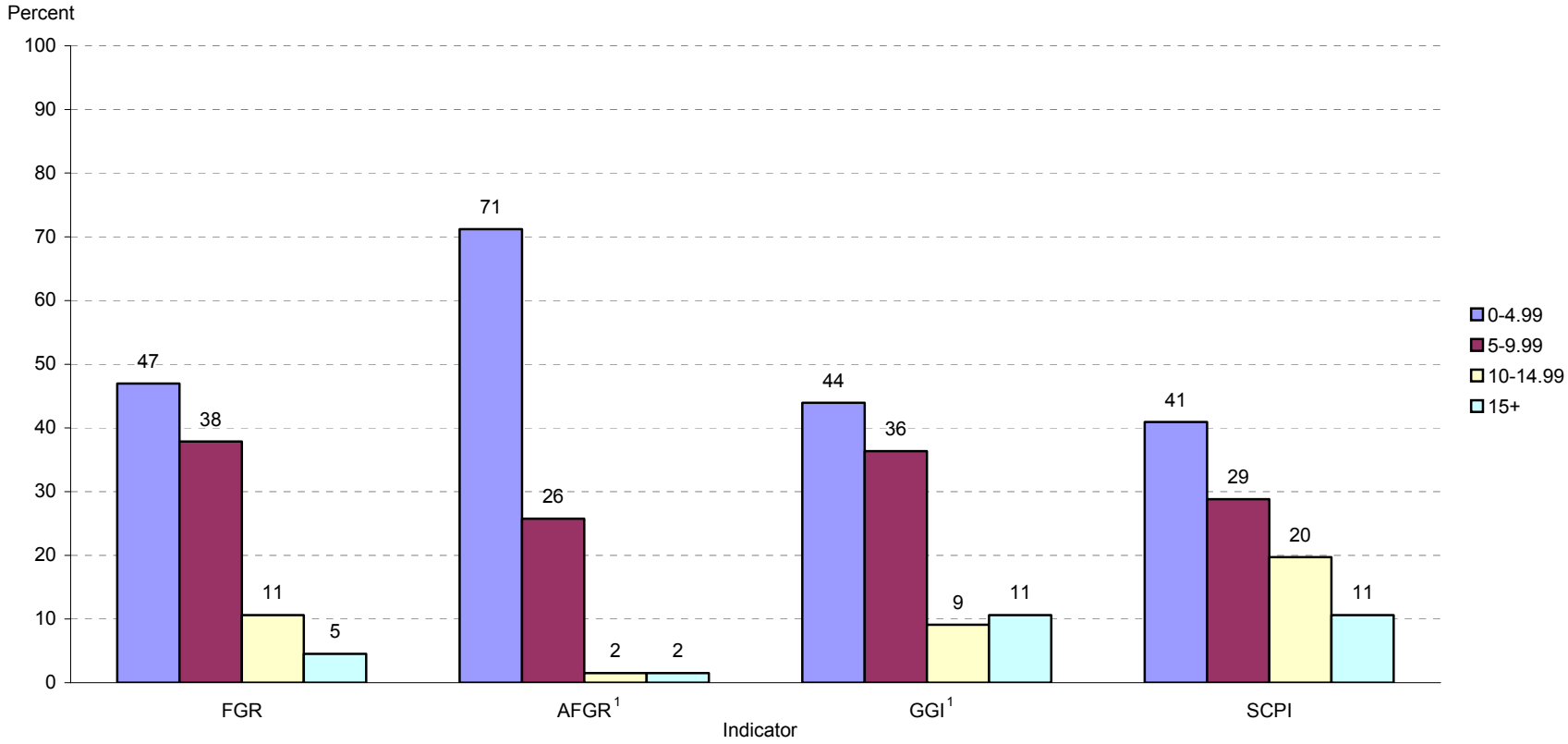
Rounds to zero.

[1] First-time 9th-grade counts were estimated using Greene's smoothed 9th-grade estimate.

NOTE: FGR = Freshman Graduation Rate, all freshmen; AFGR= Averaged Freshman Graduation Rate, first-time freshmen; GGI = Greene's Graduation Indicator; SCPI = Swanson's Cumulative Promotion indicator; EACGI = Exclusion-Adjusted Cohort Graduation Indicator.

SOURCE: Data from state 1 student record system.

Figure 2.8 Distribution of the size of the absolute distance, in percentage points, between graduation indicators FGR, AFGR, GGI, SCPI, and the true cohort rate EACGI for school districts in State 1: 2002-03



[1] First-time 9th-grade counts were estimated using Greene's smoothed 9th-grade estimate.

NOTE: FGR = Freshman Graduation Rate, all freshmen; AFGR= Averaged Freshman Graduation Rate, first-time freshmen; GGI = Greene's Graduation Indicator; SCPI = Swanson's Cumulative Promotion indicator; EACGI = Exclusion-Adjusted Cohort Graduation Indicator.
SOURCE: Data from state 1 student record system.

States, school districts, and schools frequently use measures like graduation rates or dropout rates to report on educational progress. Thus, in addition to evaluating how each of the proxy indicators performs relative to the true cohort rate at the school district level in single years, it is also informative to evaluate the performance of each of the indicators over time within individual school districts. To do this, the correlation between the rates for individual school districts was calculated across adjacent school years for each graduation indicator. Taking EACGI as the standard, the correlations between school years 2000-01 and 2001-02 and school years 2001-02 and 2002-03 were both .82 (table 2.5). The true cohort on-time graduation rates showed evidence of a reasonably strong correlation between the year-to-year estimates, with two-thirds of the variation in the true rate in one year explained by the true rate in the previous year. A 1 percentage point increment in EACGI in one year is associated with approximately nine-tenths of a percentage point increment in the true cohort rate in the next year. This suggests that while there is year-to-year variation over the 3-year time period, the rates within individual districts were more likely to be similar than to show large differences.

Table 2.5 Regression estimates of school district-level graduation indicators in State 1, by indicator: 2000-01 through 2002-03

	Indicator[1]				
Statistic	EACGI	FGR	AFGR[3]	GGI[3]	SCPI
2000-01 vs. 2001-02[2]					
Correlation coefficient	.82	.81	.78	.76	.48
R square	.67	.66	.60	.57	.23
Slope	.87	.90	.85	.80	.42
Standard deviation	4.65	5.15	4.45	4.99	8.40
2001-02 vs. 2002-03					
Correlation coefficient	.82	.76	.72	.59	.64
R square	.67	.58	.52	.35	.41
Slope	.91	.77	.76	.62	.74
Standard deviation	5.40	6.38	5.69	6.35	8.46

[1] EACGI = Exclusion-adjusted cohort graduation indicator; FGR = Freshman graduation rate, all freshmen; AFGR = Averaged freshman graduation rate, first-time freshmen; GGI = Greene's graduation indicator; SCPI = Swanson's cumulative promotion indicator.
[2] One district was excluded.
[3] First-time 9th-grade counts estimated using Greene's smoothed 9th-grade estimate.

NOTE: Estimates are based on regular school districts.
SOURCE: Data from state 1 student record system.

For a proxy indicator to serve as a reasonable approximation of the true cohort rate, similar results should be evident over the same time period. For AFGR, the correlation between the first 2 years was .78 and the correlation between the second two years was .72; between 52 and 60 percent of the variation in AFGR in one year is explained by AFGR in the previous year; and a 1 percentage point increment in AFGR in one year is associated with an increment of about eight- to nine-tenths percentage point percent in

the previous year. For FGR, the correlation between 2000-01 and 2001-02 was .81 and between 2001-02 and 2002-03 it was .76, approximately 58 to 66 percent of the variation in FGR in one year is explained by the FGR in the previous year; and a 1 percentage point increment in FGR in one year is associated with an increment of approximately eight- to nine-tenths of a percentage point in the previous year. By comparison, the correlations for GGI were .59 and .76; with approximately 35 to 57 percent of the variation in GGI in one year explained by GGI in the previous year; and the slopes (i.e. a measure of the change in one year associated with a unit of change in the previous year) were .62 and .80. The correlations for SCPI were .48 and .64, as a result only 20 to 40 percent of the variation in SCPI in one year is explained by SCPI in the previous year; and the slopes were .42 and .74. The correlations across years within each indicator add further support to the evidence that AFGR and FGR are the closest approximations to the true cohort rate.

2.3. Summary

The student record data in State 1 were used to compute the true cohort on-time graduation rate at the school district and state level. The same data were aggregated to create the cross-sectional enrollment, graduate, and dropout variables needed to compute the cross-sectional proxy graduation indicators. The distributional properties of all six graduation indicators were analyzed, and diagnostics procedures were used to examine the distributions for deviations from normality. An examination of the data resulted in a decision to focus the analysis on the four proxy indicators that most closely resemble the true cohort rate—AFGR, FGR, GGI, and SCPI. Then, correlation and ordinary least-squares regression were used to compare the proxy indicators FGR, AFGR, GGI, and SCPI to the true cohort on-time graduation rate, and to examine the amount of variability over time in each of the indicators. In addition, the distance between the proxy indicator and the true cohort rate was examined for each school district to measure the amount of error in the proxy indicators.

At the state level, the rates for AFGR, SCPI and FGR were the closest to the true cohort rates, with average absolute differences relative to EACGI across the 3 years of 3.0, 3.2, and 3.5 percentage points, respectively. GGI had an average absolute difference with EACGI of 7.4 points and GLI had an average absolute difference of 9.3 percentage points.

Analyses at the district level showed that AFGR and FGR (with AFGR taking the lead in 2 of the 3 years) have the strongest correlations with the true cohort on-time graduation rate and the smallest errors relative to the true cohort rates. Furthermore, the examination of the year-to-year correlations within each indicator showed strong associations over time for the true cohort on-time graduation rate and for AFGR and FGR.

Chapter 3

An Application of the Proxy Graduation Indicators and the True Cohort Rate Using Data From the Student Record System in State 2

This chapter extends the analysis of the true cohort on-time graduation rate (EACGI) to data from a second state. The student record system in State 2 differs from that in State 1. The system in State 2 is built and maintained at the school district level and reported up to the state education office, in contrast to the centralized system used in State 1. The staff in the state education office of State 2 provided a cleaned cohort file that was used to compute the EACGI at the state and school district levels for school years 1999-2000, 2000-01, 2001-02, and 2002-03.[6]

Given that the goal of this analysis is to determine how the different cross-sectional proxy graduation indicators perform when individual student record data are not available, the data from the student records and cross-sectional estimates provided by staff in State 2, were used to produce the equivalent of cross-sectional estimates of grade-by-grade enrollments in school years 1995-96 through 2002-03 and of all graduates from school years 1999-2000 through 2002-03. These estimates differ from those used to compute the true cohort on-time graduation rate, in that the enrollments include all students in a specific grade—not just first-time students—and the graduates include all graduates, not just on-time graduates. These data were then used to compute the Freshman Graduation Rate based on all freshmen (FGR), the Averaged Freshman Graduation Rate based on an estimate of first-time freshmen (AFGR), the Greene Graduation Indicator (GGI), and the Swanson Cumulative Promotion Indicator (SCPI).

3.1. State-Level Analysis

The recommended true cohort on-time graduation indicator for regular school districts, EACGI, was 58.4 percent in State 2 in 1999-2000, some 60.0 in 2000-01, some 63.1 in 2001-02 and 64.5 in 2002-03. The average over these 4 years was 61.5 percent (table 3.1). Thus, on average, 62 percent of the students in the entering freshman classes of 1996-97, 1997-98, 1998-99, and 1999-2000 completed high school in 4 years and graduated on time.

State-level estimates of the cross-sectional proxy graduation indicators show patterns similar to those described for State 1. AFGR yielded the highest estimates among these four proxy indicators, with estimates ranging from 62 percent in 1999-2000 and 2000-01to 67 percent in 2002-03 (figure 3.1). FGR estimates were consistently lower than the true cohort rates and the estimates for AFGR, ranging from 56 percent in 2000-01 to 58 percent in 2001-02 and 2002-03. GGI was between FGR and AFGR in the last 3 of the 4 years. SCPI was lower than FGR in 1999-2000 and 2000-01(51 percent and 54 percent), but higher than FGR in 2001-02 and 2002-03 (58 and 59 percent).

[6] The analyses included in this report do not include school-level analyses for two reasons. First, a large number of schools that do not include the 8th grade so it is not possible to compute the estimate of first-time freshmen that is used in AFGR and GGI. Second, at this lower level of disaggregation, the indicators are more sensitive to year-to-year changes associated with transfers in and out of individual schools.

Table 3.1. Graduation indicators EACGI, FGR, AFGR, GGI, and SCPI for State 2, by year: 1999-2000 through 2002-03

	Indicator[1]				
Year	EACGI	FGR	AFGR[2]	GGI[2]	SCPI
1999-2000	58.4	56.3	62.3	56.0	50.8
2000-01	60.0	55.8	62.4	56.5	54.2
2001-02	63.1	57.5	65.4	58.9	58.5
2002-03	64.5	57.6	67.4	60.5	58.8
	Absolute Difference				
1999-2000	†	2.1	3.8	2.4	7.7
2000-01	†	4.2	2.4	3.5	5.8
2001-02	†	5.6	2.3	4.3	4.6
2002-03	†	6.9	2.9	4.0	5.8
Average	†	4.7	2.8	3.5	6.0

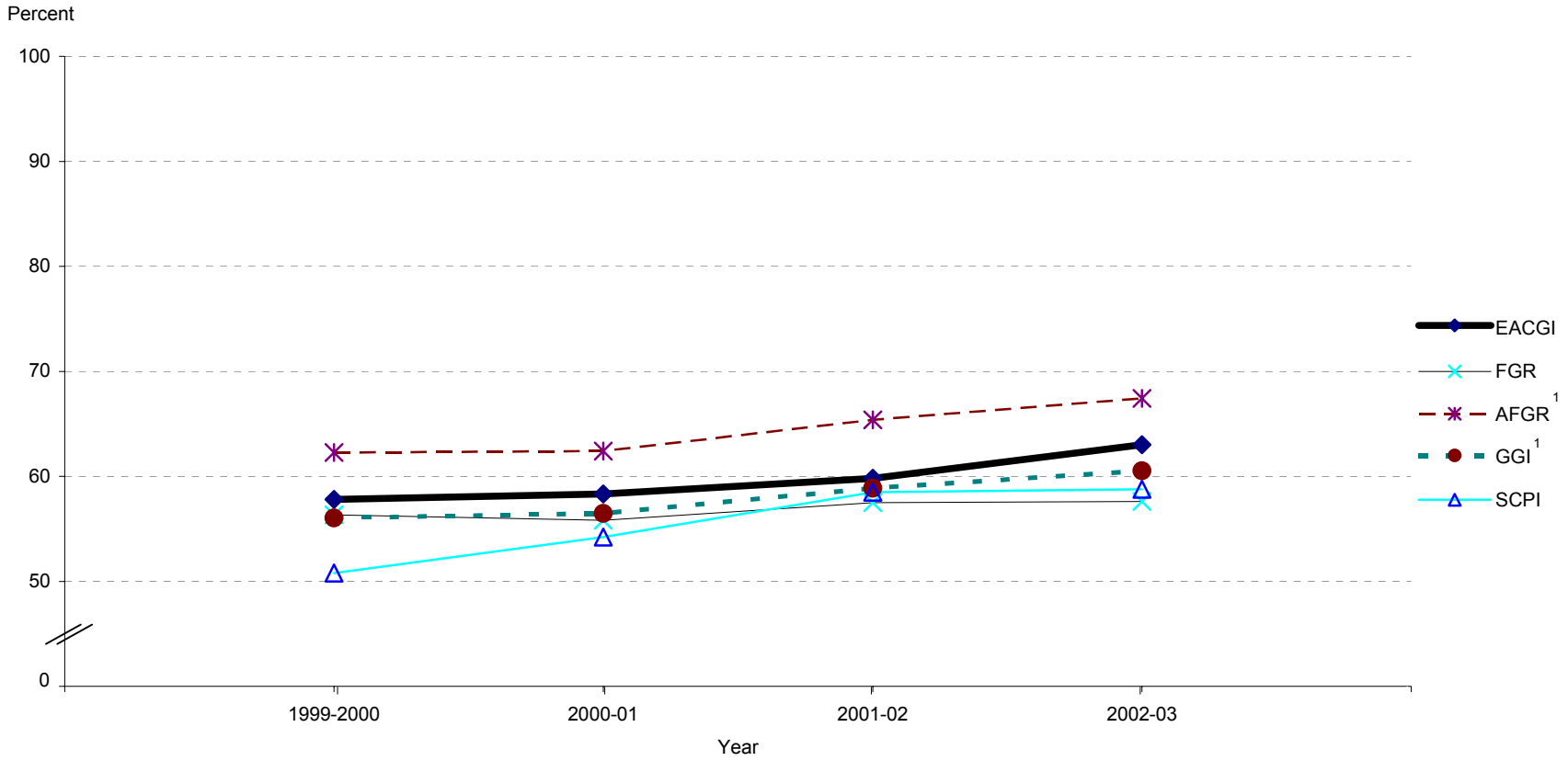
† Not applicable
[1] EACGI = Exclusion adjusted cohort graduation indicator; FGR= Freshman graduation rate, all freshmen; AFGR = Averaged freshman graduation rate, first-time freshmen; GGI = Greene's graduation indicator; SCPI = Swanson's cumulative promotion indicator.
[2] First-time 9th-grade counts estimated using Greene's smoothed 9th-grade estimate.

NOTE: Estimates are based on regular school districts.
SOURCE: Data from State 2 student record system.

A comparison of each of the proxy indicators to the true cohort rate shows that AFGR ranged from 4 to 6 percentage points higher than the true rate over this 4-year time period (figure 3.2). GGI was 1 to 3 percentage points below the true rate. FGR had rates that were 2 to 3 points below the true rate from 1999-2000 through 2001-02, and 5 percentage points lower in 2002-03. SCPI was also lower than the true cohort rate, with differences ranging from 1 to 7 percentage points.

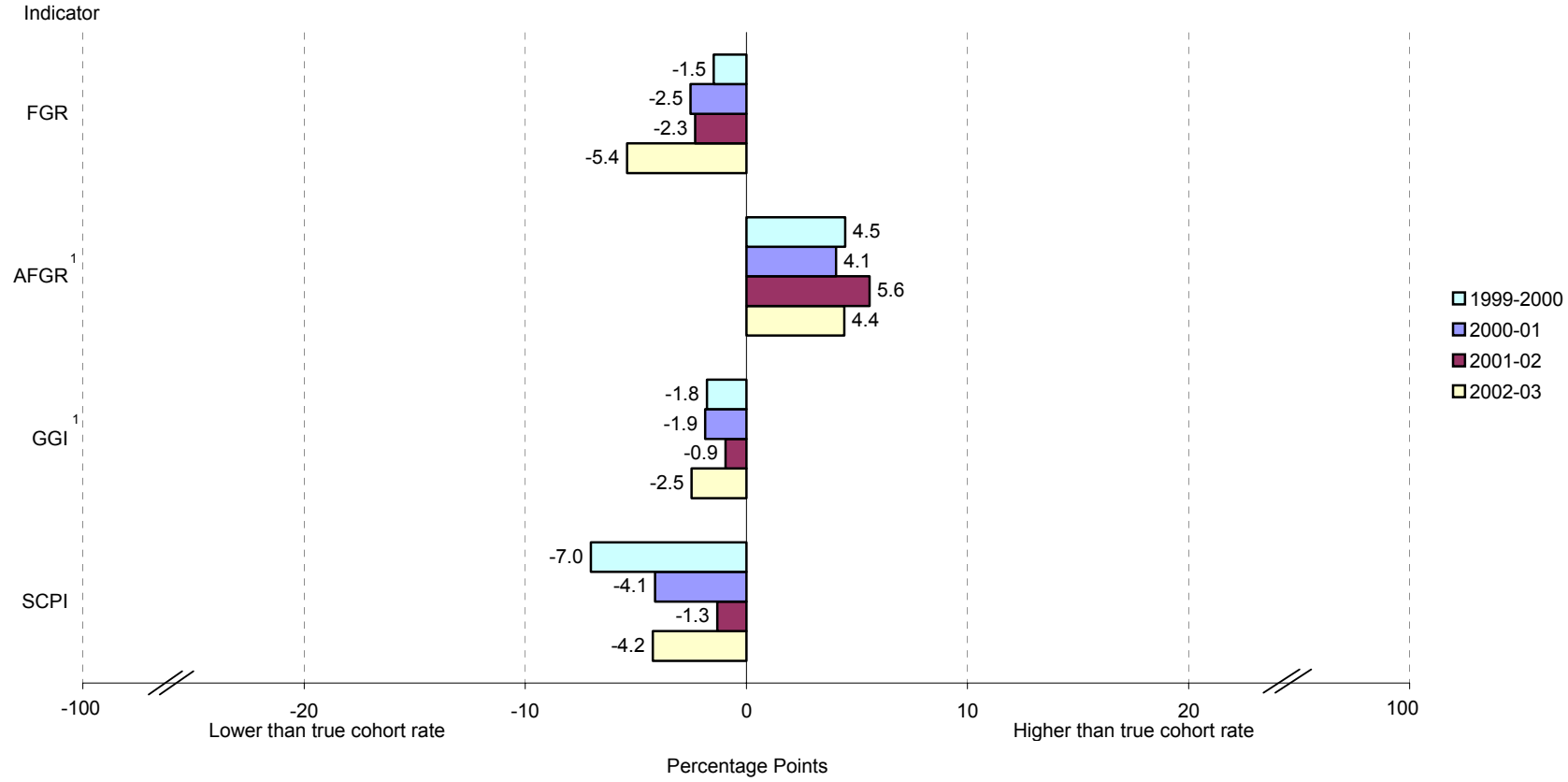
As was done in the analysis of data from State 1, the absolute difference between each graduation indicator and EACGI was computed for each year, and then averaged across the years of available data (table 3.1) to give an indication of the average amount of error in each measure relative to the true cohort rate over the time period. SCPI has an average absolute difference of 6 percentage points; the average absolute difference between FGR and EACGI is close to 5 percentage points; and the averaged absolute difference for GGI is 3.5 percentage points. In contrast, AFGR has an averaged absolute difference relative to EACGI of 2.8 percentage points.

Figure 3.1. Estimates of graduation indicators EACGI, FGR, AFGR, GGI, and SCPI in State 2: 1999-2000 through 2002-03



[1] First-time 9th-grade counts were estimated using Greene's smoothed 9th-grade estimate.
NOTE: EACGI = Exclusion-Adjusted Cohort Graduation Indicator; FGR = Freshman Graduation Rate, all freshmen; AFGR = Averaged Freshman Graduation Rate, first-time freshmen; GGI = Greene's Graduation Indicator; SCPI = Swanson's Cumulative Promotion Indicator.
SOURCE: Data from state 2 student record system.

Figure 3.2. Distance in percentage points, of each graduation indicator FGR, AFGR, GGI, and SCPI from the true cohort rate EACGI in State 2: 1999-2000 through 2002-03



[1] First-time 9th-grade counts were estimated using Greene's smoothed 9th-grade estimate.
NOTE: EACGI = Exclusion-Adjusted Cohort Graduation Indicator; FGR = Freshman Graduation Rate, all freshmen; AFGR= Averaged Freshman Graduation Rate, first-time freshmen; GGI = Greene's Graduation Indicator; SCPI = Swanson's Cumulative Promotion indicator.
SOURCE: Data from state 2 student record system.

3.2. School District-Level Analysis

The data from the student records in State 2 were also used to compute estimates for EACGI and the four proxy indicators for each school district in the state. The summary data in table 3.2a show the distributional properties of each of the indicators. Over the 4-year period, the minimum values of the school district level true cohort on-time graduation rates ranged from 46 percent in 2000-01 to 50 percent in 2002-03. During this period, the highest values of the true cohort on-time rate ranged from 78 percent in 1999-2000 to 87 percent in 2002-03.

In 1999-2000, the minimum estimates across the proxy indicators ranged from 22 percent for SCPI to 45 percent for AFGR. In 2000-01, the minimum estimates ranged from 27 percent for SCPI to 47 percent for AFGR. In 2001-02, the minimum estimates ranged from 31 percent for SCPI to 51 percent for GGI. In the fourth year, 2002-03, the minimum estimates ranged from 32 percent for FGR and SCPI to 43 percent for GGI. In 1999-2000, the maximum estimates ranged from 77 percent for AFGR, FGR, and GGI to 84 percent for SCPI. In 2000-01, the maximum estimates ranged from 77 percent for FGR to 88 percent for AFGR. The 2001-02 maximum rates ranged from 78 percent for GGI to 84 percent for AFGR. In 2002-03, the maximum rates were 87 percent for SCPI and 96 percent for GGI, with rates in excess of 100 percent for both FGR and AFGR.[7]

The school district analysis of absolute differences between each graduation measure and the rates observed for EACGI is repeated for State 2 (table 3.2b). Specifically, averaged absolute differences were computed to provide an indication of the average amount of error in each specific measure relative to the true cohort rate for the same period. The differences between the estimates for FGR and EACGI are largest with an average absolute difference of 5.7 percentage points. SCPI results are more similar to those for EACGI at the school district level than was the case at the state level in this state, with an averaged absolute difference of 2.5 percentage points. However, the district level results for GGI and AFGR are even closer to those observed for EACGI, with averaged absolute differences relative to EACGI of 1.9 percentage points for GGI and 1.5 percentage points for AFGR.

A comparison of the means and medians for each graduation indicator across the 4 years shows differences of up to 2 percentage points. Since differences between means and medians for a population can be an indication of skew in the distributions, additional diagnostics were examined for each of the six indicators.

[7] There were only two estimates that exceeded 100%, and they were both in the same school district. For that district the number of graduates in 2002-03 exceeded both the total number of freshmen 4 years earlier and the averaged freshman estimate for the same year.

Table 3.2a. Mean, standard deviation, minimum, 25th percentile, median, 75th percentile, and maximum of graduation indicators across school districts in State 2, by indicator and school year: 1999-2000 through 2002-03

	Indicator[1]				
Statistic	EACGI	FGR	AFGR[2]	GGI[2]	SCPI
1999-2000					
Mean [3]	61.3	57.1	63.1	59.2	54.0
Standard deviation	7.0	8.3	6.6	6.5	11.4
Minimum	48.3	35.0	44.5	44.3	22.3
25th percentile	56.7	51.3	59.3	55.0	47.0
Median	59.7	56.2	62.5	58.6	54.6
75th percentile	65.4	63.1	68.0	62.5	60.8
Maximum	77.9	76.8	77.1	76.7	83.7
2000-01					
Mean [3]	61.3	56.9	63.2	60.3	56.7
Standard deviation	8.1	8.6	7.8	7.7	9.6
Minimum	45.8	38.1	47.3	43.8	26.8
25th percentile	56.0	50.1	57.5	55.8	50.5
Median	59.9	57.0	63.5	59.2	56.0
75th percentile	66.0	63.0	68.3	62.5	62.8
Maximum	81.2	76.9	87.7	85.7	80.4
2001-02					
Mean [3]	64.9	58.2	65.9	62.5	62.1
Standard deviation	7.3	9.0	7.5	6.1	10.0
Minimum	48.0	35.4	47.2	50.9	31.1
25th percentile	61.0	52.3	60.0	58.2	56.6
Median	64.2	56.9	66.2	61.7	61.7
75th percentile	69.9	63.8	70.7	66.0	68.9
Maximum	83.5	81.4	84.2	77.9	79.8
2002-03					
Mean [3]	67.0	59.5	68.4	64.2	62.5
Standard deviation	7.4	11.3	10.3	8.7	11.4
Minimum	50.0	31.5	41.6	43.0	31.7
25th percentile	62.0	52.4	61.1	59.1	56.5
Median	66.3	59.3	67.8	62.3	63.4
75th percentile	71.2	66.1	73.2	68.7	70.1
Maximum	86.5	103.5	113.8	96.0	86.9

[1] EACGI = Exclusion adjusted cohort graduation indicator; FGR = Freshman graduation rate, all freshmen; AFGR= Averaged freshman graduation rate, first-time freshmen; GGI = Greene's graduation indicator; SCPI = Swanson's cumulative promotion indicator.

[2] First-time 9th-grade counts use Greene's smoothed 9th-grade estimate.

[3] Mean is the mean of the district means.

NOTE: Estimates are based on regular school districts.

SOURCE: Data from State 2 student record system.

Table 3.2b. Absolute differences relative to EACGI for mean, standard deviation, minimum, 25th percentile, median, 75th percentile, and maximum of graduation indicators across school districts in State 2, by indicator and school year: 1999-2000 through 2002-03

	Indicator[1]				
Statistic	EACGI	FGR	AFGR[2]	GGI[2]	SCPI
1999-2000					
Mean [3]	†	4.2	1.8	2.1	7.3
Standard deviation	†	1.3	0.4	0.5	4.4
Minimum	†	13.3	3.8	4.0	26.0
25th percentile	†	5.4	2.6	1.7	9.7
Median	†	3.5	2.8	1.1	5.1
75th percentile	†	2.3	2.6	2.9	4.6
Maximum	†	1.1	0.8	1.2	5.8
2000-01					
Mean [3]	†	4.4	1.9	1.0	4.6
Standard deviation	†	0.5	0.3	0.4	1.5
Minimum	†	7.7	1.5	2.0	19.0
25th percentile	†	5.9	1.5	0.2	5.5
Median	†	2.9	3.6	0.7	3.9
75th percentile	†	3.0	2.3	3.5	3.2
Maximum	†	4.3	6.5	4.5	0.8
2001-02					
Mean [3]	†	6.7	1.0	2.4	2.8
Standard deviation	†	1.7	0.2	1.2	2.7
Minimum	†	12.6	0.8	2.9	16.9
25th percentile	†	8.7	1.0	2.8	4.4
Median	†	7.3	2.0	2.5	2.5
75th percentile	†	6.1	0.8	3.9	1.0
Maximum	†	2.1	0.7	5.6	3.7
2002-03					
Mean [3]	†	7.5	1.4	2.8	4.5
Standard deviation	†	3.9	2.9	1.3	4.0
Minimum	†	18.5	8.4	7.0	18.3
25th percentile	†	9.6	0.9	2.9	5.5
Median	†	7.0	1.5	4.0	2.9
75th percentile	†	5.1	2.0	2.5	1.1
Maximum	†	17.0	27.3	9.5	0.4

See notes at end of table

Table 3.2b. Absolute differences relative to EACGI for mean, standard deviation, minimum, 25th percentile, median, 75th percentile, and maximum of graduation indicators across school districts in State 2, by indicator and school year: 1999-2000 through 2002-03—continued

	Indicator[1]				
Statistic	EACGI	FGR	AFGR[2]	GGI[2]	SCPI
Average					
Mean [3]	†	5.7	1.5	2.1	4.8
Standard deviation	†	1.9	1.0	0.9	3.2
Minimum	†	13.0	3.6	4.0	20.1
25th percentile	†	7.4	1.5	1.9	6.3
Median	†	5.2	2.5	2.1	3.6
75th percentile	†	4.1	1.9	3.2	2.5
Maximum	†	6.1	8.8	5.2	2.7

† Not applicable

[1] EACGI = Exclusion adjusted cohort graduation indicator; FGR = Freshman graduation rate, all freshmen; AFGR= Averaged freshman graduation rate, first-time freshmen; GGI = Greene's graduation indicator; SCPI = Swanson's cumulative promotion indicator.

[2] First-time 9th-grade counts use Greene's smoothed 9th-grade estimate.

[3] Mean is the mean of the district means.

NOTE: Estimates are based on regular school districts.

SOURCE: Data from State 2 student record system.

For each indicator measures of skewness, kurtosis, and the Shapiro-Wilk W measure of normality were examined along with stem-and-leaf, box, and normal probability plots. For school years 1999-2000, 2000-01, and 2001-02, the diagnostic statistics support the conclusion that the rates are distributed normally for EACGI, FGR, AFGR, and SCPI (W is greater than .95), and there is no marked skewness (less than + 1) or kurtosis (less than + 1) (table 3.3). The same is true for GGI in 1999-2000 and 2001-02, however, in 2000-01, there is a possibility that the distribution is not normal (W=.94). In 2002-03, there is some concern over the normality of the distributions for GGI, FGR, and AFGR (W=.92 to.96) and there is evidence of kurtosis (2.5 to 5.1), suggesting a peaking in the distribution.

Table 3.3. Diagnostic statistics of the distribution of EACGI, FGR, AFGR, GGI and SCPI across school districts in State 2: 1999-2000 through 2002-03

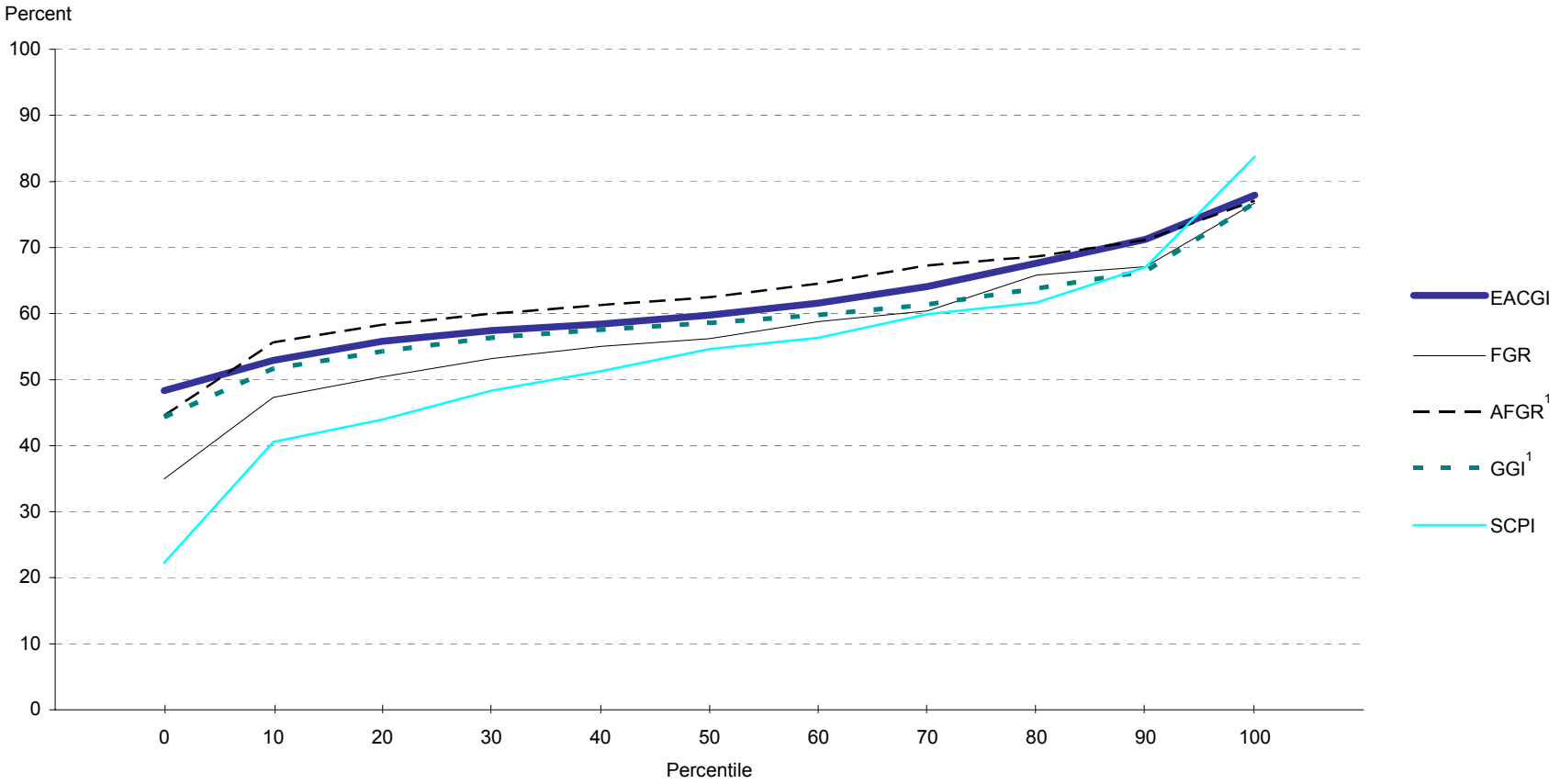
	Indicator[1]				
Statistic	EACGI	FGR	AFGR[2]	GGI [2]	SCPI
1999-2000					
Skewness	0.55	0.07	0.18	0.36	0.09
Kurtosis	-0.33	0.14	0.30	0.68	0.34
Shapiro-Wilk's W	0.96	0.99	0.99	0.98	0.99
2000-01					
Skewness	0.60	0.09	0.41	0.92	0.00
Kurtosis	-0.04	-0.29	0.31	1.26	0.80
Shapiro-Wilk's W	0.96	0.99	0.98	0.94	0.99
2001-02					
Skewness	0.11	0.17	0.03	0.34	-0.59
Kurtosis	-0.06	0.23	0.20	-0.26	0.74
Shapiro-Wilk's W	0.99	0.99	0.99	0.98	0.97
2002-03					
Skewness	0.17	0.83	1.06	1.07	-0.34
Kurtosis	0.28	2.70	5.14	2.55	0.19
Shapiro-Wilk's W	0.99	0.96	0.92	0.93	0.99

[1] EACGI = Exclusion-adjusted cohort graduation indicator; FGR = Freshman graduation rate, all freshmen; AFGR = Averaged freshman graduation rate, first-time freshmen; GGI = Greene's graduation indicator; SCPI = Swanson's cumulative promotion indicator.
[2] First-time 9th-grade counts estimated using Greene's smoothed 9th-grade estimate.

NOTE: Estimates are based on regular school districts.
SOURCE: Data from state 2 student record system.

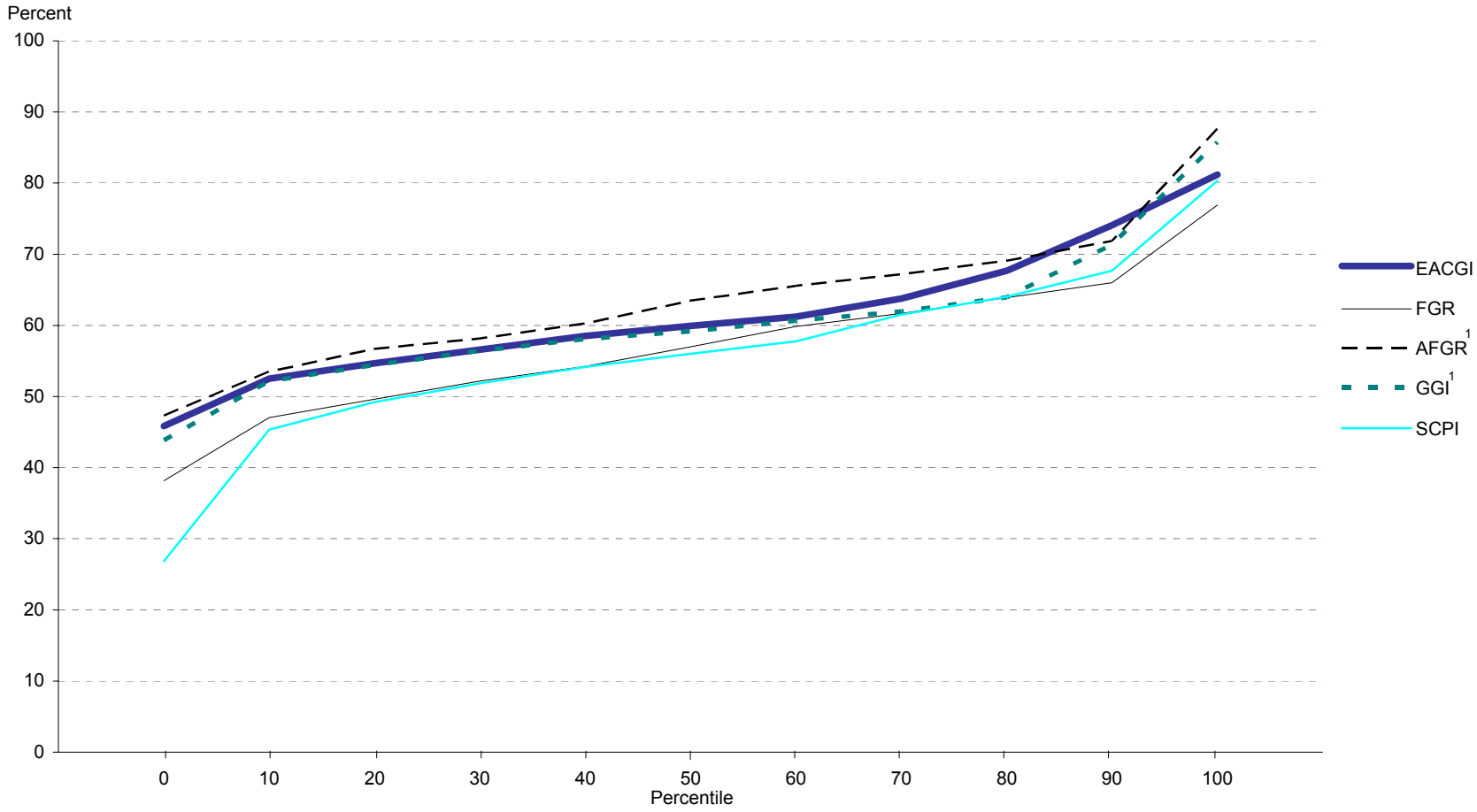
To further understand the overall distributions of these five graduation indicators, figures 3.3 through 3.6 display the decile cut points of EACGI and each of the four proxy graduation indicators. As was the case in State 1, there are relatively smooth patterns between the 10th and 90th deciles, with somewhat larger changes at the extremes of the distribution.

Figure 3.3. Percentile distribution of graduation indicators EACGI, FGR, AFGR, GGI, and SCPI, by decile in State 2: 1999-2000



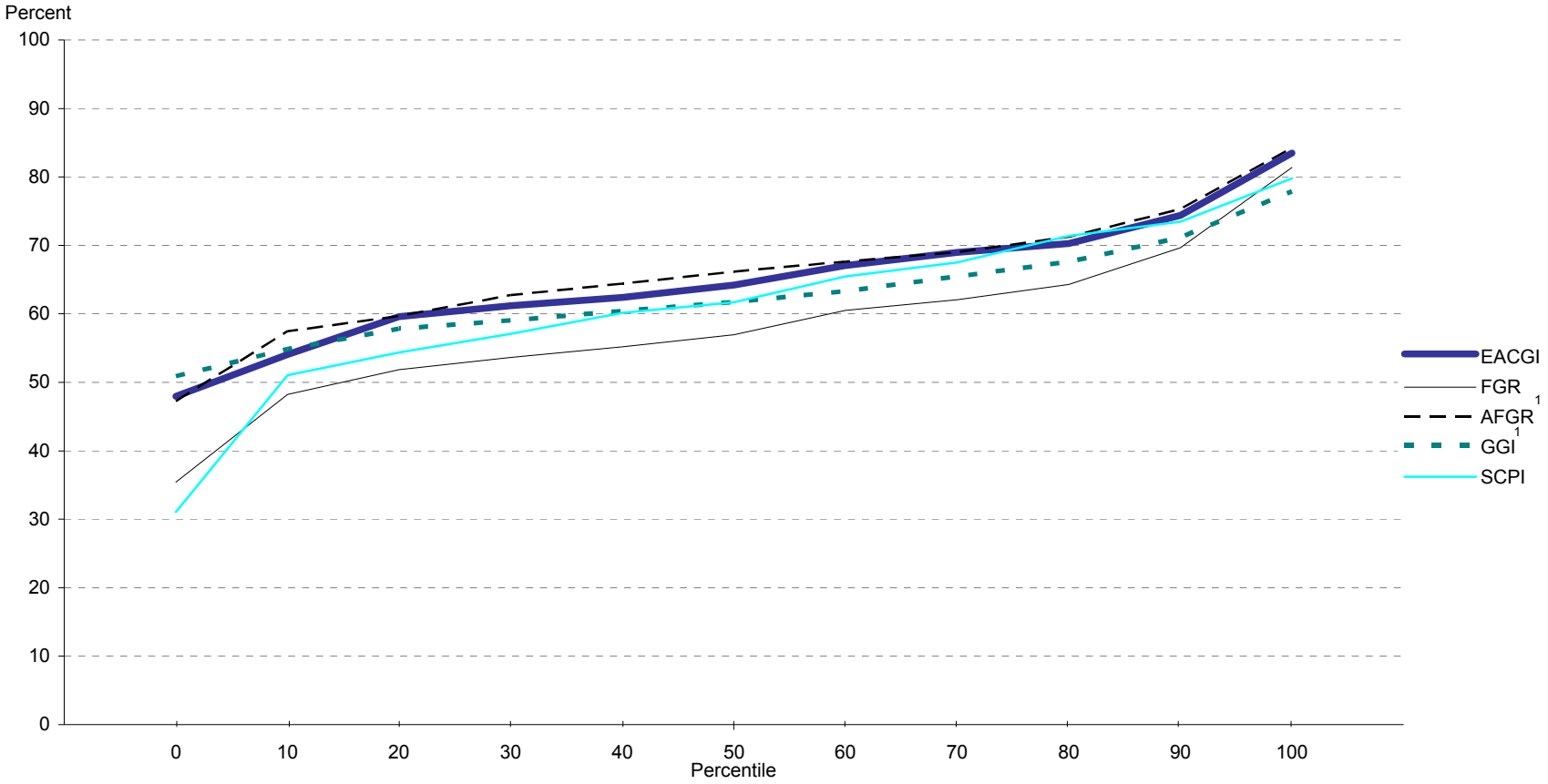
[1] First-time 9th-grade counts were estimated using Greene's smoothed 9th-grade estimate.
NOTE: EACGI = Exclusion-Adjusted Cohort Graduation Indicator; FGR = Freshman Graduation Rate, all freshmen; AFGR= Averaged Freshman Graduation Rate, first-time freshmen; GGI = Greene's Graduation Indicator; SCPI = Swanson's Cumulative Promotion indicator.
SOURCE: Data from state 2 student record system.

Figure 3.4. Percentile distribution of graduation indicators EACGI, FGR, AFGR, GGI, and SCPI, by decile in State 2: 2000-01



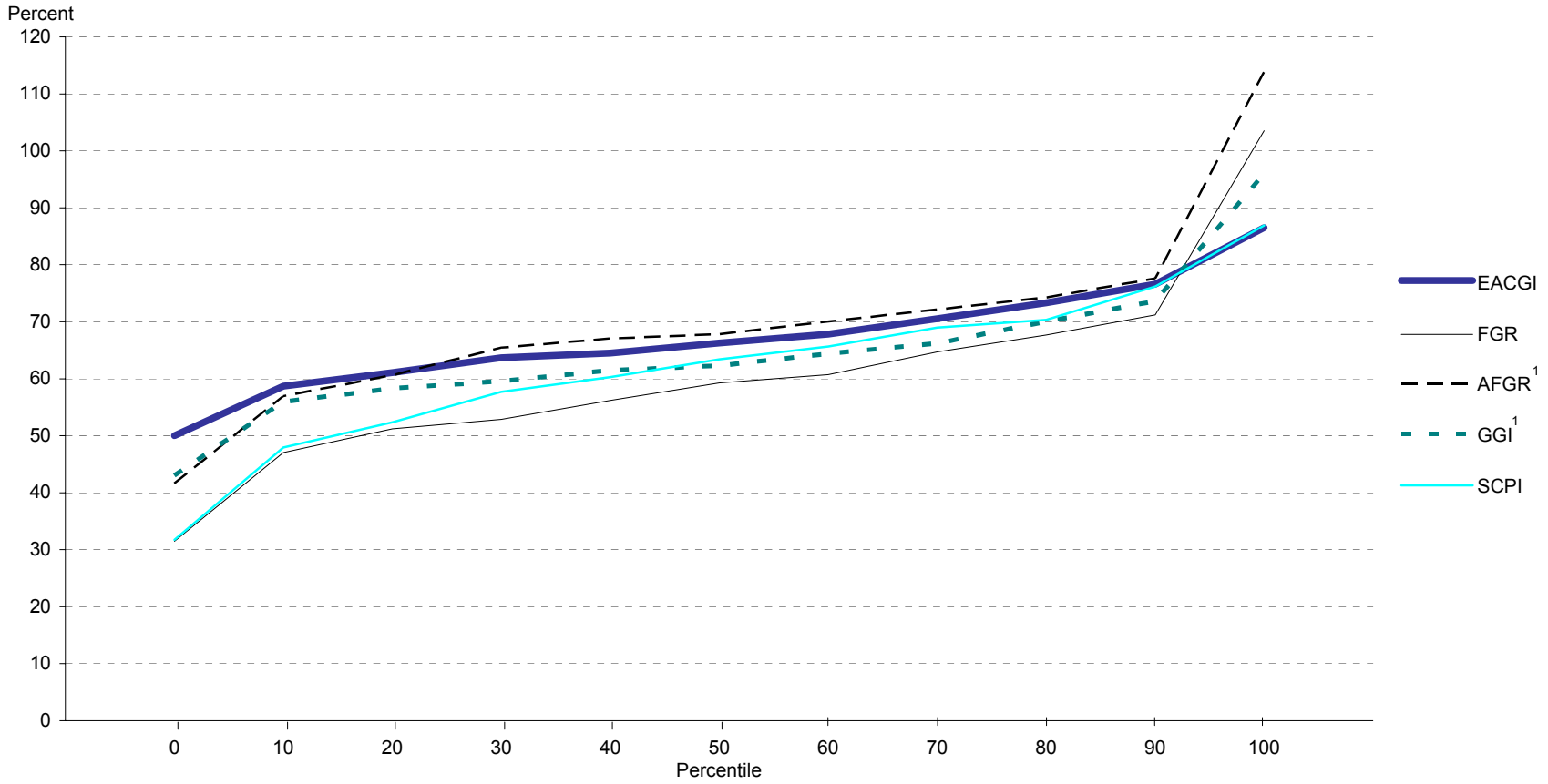
[1] First-time 9th-grade counts were estimated using Greene's smoothed 9th-grade estimate.
NOTE: EACGI = Exclusion-Adjusted Cohort Graduation Indicator; FGR = Freshman Graduation Rate, all freshmen; AFGR= Averaged Freshman Graduation Rate, first-time freshmen; GGI = Greene's Graduation Indicator; SCPI = Swanson's Cumulative Promotion indicator.
SOURCE: Data from state 2 student record system.

Figure 3.5. Percentile distribution of graduation indicators EACGI, FGR, AFGR, GGI, and SCPI, by decile in State 2: 2001-02



[1] First-time 9th-grade counts were estimated using Greene's smoothed 9th-grade estimate.
NOTE: EACGI = Exclusion-Adjusted Cohort Graduation Indicator; FGR = Freshman Graduation Rate, all freshmen; AFGR= Averaged Freshman Graduation Rate, first-time freshmen; GGI = Greene's Graduation Indicator; SCPI = Swanson's Cumulative Promotion indicator.
SOURCE: Data from state 2 student record system.

Figure 3.6. Percentile distribution of graduation indicators EACGI, FGR, AFGR, GGI, and SCPI, by decile in State 2: 2002-03



[1] First-time 9th-grade counts were estimated using Greene's smoothed 9th-grade estimate.
NOTE: EACGI = Exclusion-Adjusted Cohort Graduation Indicator; FGR = Freshman Graduation Rate, all freshmen; AFGR= Averaged Freshman Graduation Rate, first-time freshmen; GGI = Greene's Graduation Indicator; SCPI = Swanson's Cumulative Promotion indicator.
SOURCE: Data from state 2 student record system.

To better quantify the relationships between each of the four proxy graduation indicators and the true cohort on-time graduation rate, correlations and ordinary least squares regression analyses were used to evaluate which of the four proxy measures best approximates the true cohort rate.

The correlations between AFGR and EACGI range from .64 to .72 across the 4 years (table 3.4). The results for FGR range from .61 to .74, but the correlations between FGR and EACGI are lower than those between AFGR and EACGI in 3 of the 4 years. The correlations between GGI and the true cohort rate are lower than those for AFGR and FGR in 3 of the 4 years, ranging from .58 to .66. SCPI has the lowest of the four correlations in 3 of the 4 years, with correlations ranging from .52 to .61, but the correlation of .69 for SCPI is higher than those for the other three proxy indicators in 1999-2000.

Table 3.4. Regression estimates of the true cohort rate, EACGI, on proxy graduation indicators, across school districts in State 2, by indicator and school year: 1999-2000 through 2002-03

	Indicator[1]			
Statistic	FGR	AFGR[2]	GGI[2]	SCPI
1999-2000				
Correlation coefficient	.61	.64	.66	.69
R square	.37	.41	.43	.48
Slope	.52	.69	.71	.43
Standard deviation	5.62	5.44	5.35	5.12
2000-01				
Correlation coefficient	.66	.71	.63	.52
R square	.43	.51	.39	.27
Slope	.62	.74	.66	.44
Standard deviation	6.17	5.74	6.36	7.00
2001-02				
Correlation coefficient	.62	.66	.58	.56
R square	.39	.44	.34	.32
Slope	.50	.64	.69	.41
Standard deviation	5.72	5.49	5.93	6.04
2002-03				
Correlation coefficient	.74	.72	.62	.61
R square	.54	.52	.39	.38
Slope	.48	.52	.53	.40
Standard deviation	5.04	5.14	5.82	5.89

[1] EACGI = Exclusion adjusted cohort graduation indicator; FGR = Freshman graduation rate, all freshmen; AFGR = Averaged freshman graduation rate, first-time freshmen; SCPI = Swanson's cumulative promotion indicator.
[2] First-time 9th-grade counts use Greene's smoothed 9th-grade estimate.

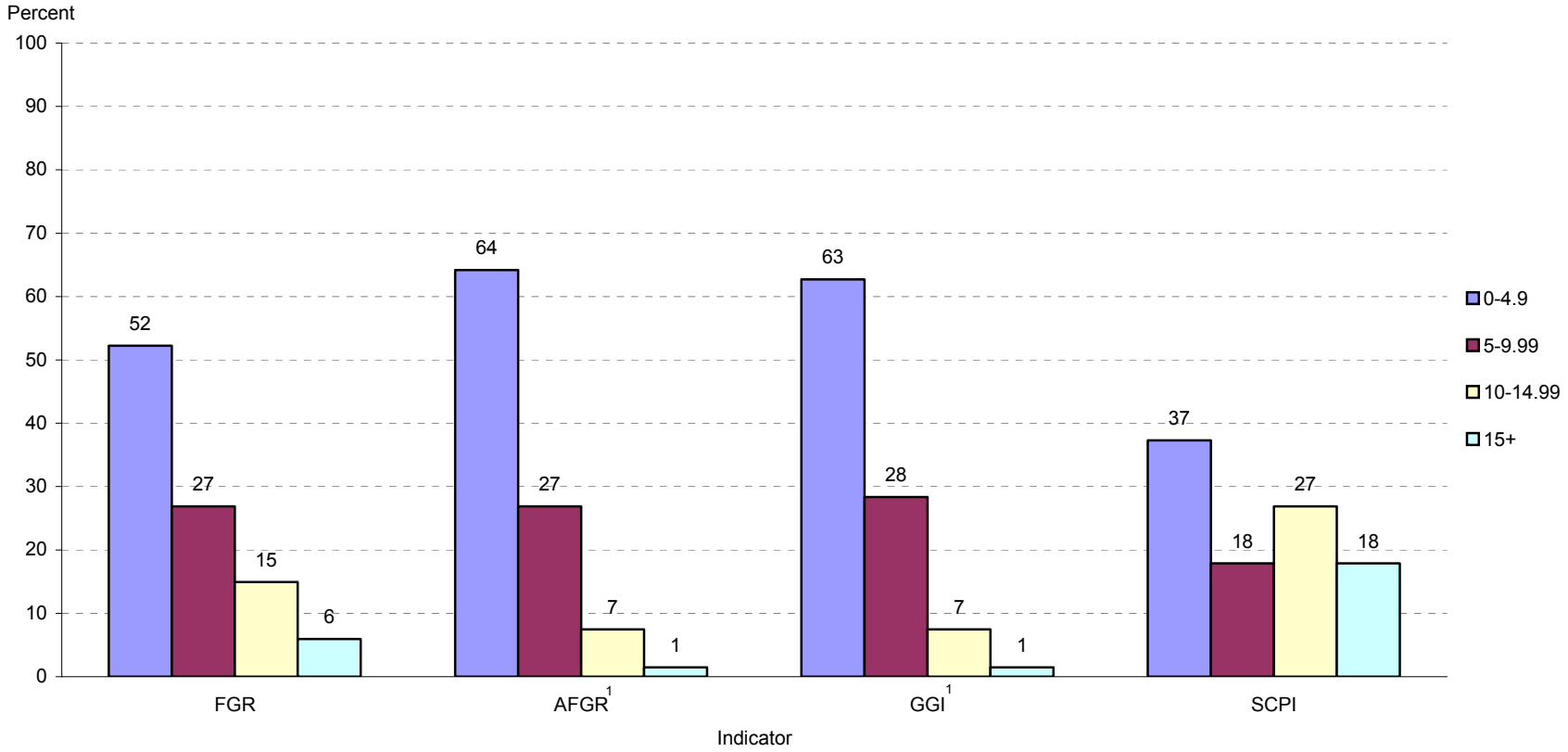
NOTE: Estimates are based on regular school districts.
SOURCE: Data from State 2 student record system.

The regression results indicate that approximately one-half of the variation in EACGI is explained by AFGR in 2 of the 4 years (r^2 = .51 and .52), with 44 percent and 41 percent of the variation in explained EACGI by AFGR in the other 2 years. Some 54 percent of the variation in EACGI in 2002-03 is explained by FGR and approximately 40 percent is explained in the other 3 years (.37 to .43). While 40 to 50 percent of the variation in EACGI in 1999-2000 is explained by SCPI (.48) and GGI (.43), the variation explained in the other 3 years ranges from approximately 30 to 40 percent (.27 to .39).

In summary, although the relationships between the true cohort on-time graduation rate and the proxy indicators AFGR and FGR are not as strong in State 2 as those evident in State 1, the same patterns prevail, with AFGR and FGR showing stronger correlations with the true cohort rate than the other two proxy indicators.

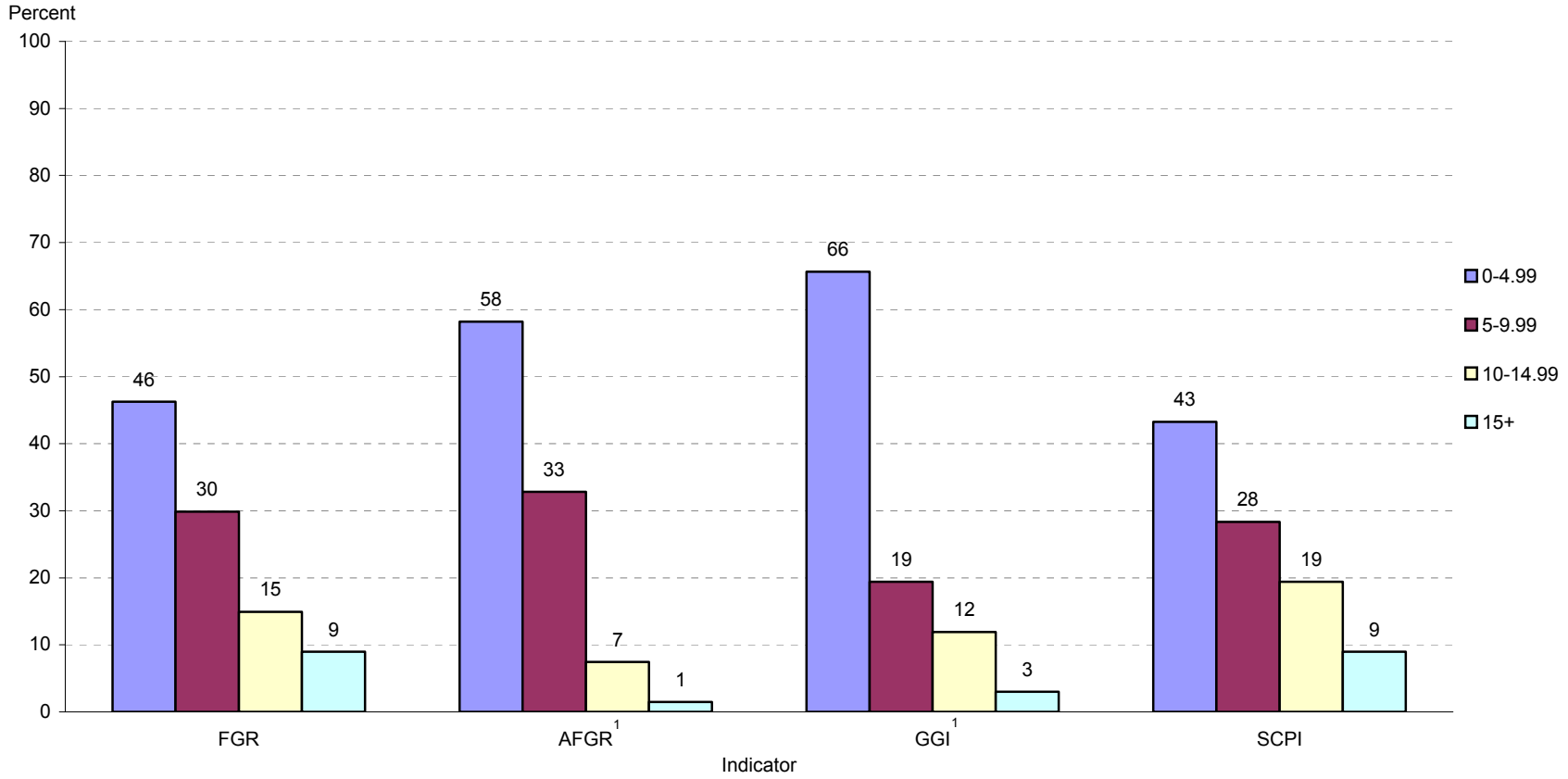
To continue the analysis of the error in each proxy indicator relative to the true cohort rates, figures 3.7 through 3.10 display the distributions of the absolute differences between the proxy indicators for individual school districts and the true rate for each year. For each proxy graduation indicator, the data for the individual school districts were aggregated in 5 percentage point intervals from 0 to 15 and 15 percentage points or more from EACGI. Across the 4 years, AFGR consistently has a majority of school districts with rates close to their true rates, with 58 to 64 percent of the estimates within 5 percentage points of the true cohort rates. The performance of GGI is similar on this dimension, with 52 to 66 percent of the district rates within 5 percentage points of their true rates. SCPI yields estimates that are within 5 percentage points of their true cohort rates for 37 and 43 percent of the districts. The pattern for FGR is less consistent, in the first 2 years (1999-2000 and 2000-01) approximately one half of the districts (52 and 46 percent) had estimates that were within 5 percentage points of their true rates, but in the last 2 years (2001-02 and 2002-03), only 27 percent of the district estimates were within this 5 percentage point margin of error. The patterns are, for the most part, reversed when the percentage of districts with error of 10 percentage points or higher are examined. AFGR has the smallest percentage of districts with large errors, with only 8 to 11 percent of the district estimates 10 or more percentage points from their true cohort rates. GGI is more variable with the percent of districts with large errors ranging from 6 to 18 percentage points. SCPI yields large errors for 23 to 45 percent of the districts. FGR yields estimates with large errors in 21 to 24 percent of the districts in the first 2 years and large errors in 34 to 40 percent of the districts in the last 2 years. Thus, although the correlations with the true cohort rate for FGR and AFGR were similar across the 4 years and were stronger than the correlations with the true cohort rate and SCPI and GGI, this analysis of the magnitude of the errors in each indicator relative to the true cohort rate shows that in this state AFGR outperforms the other three proxy indicators.

Figure 3.7. Distribution of the size of the absolute distance, in percentage points, between FGR, AFGR, GGI, SCPI and the true cohort rate EACGI for school districts in State 2: 1999-2000



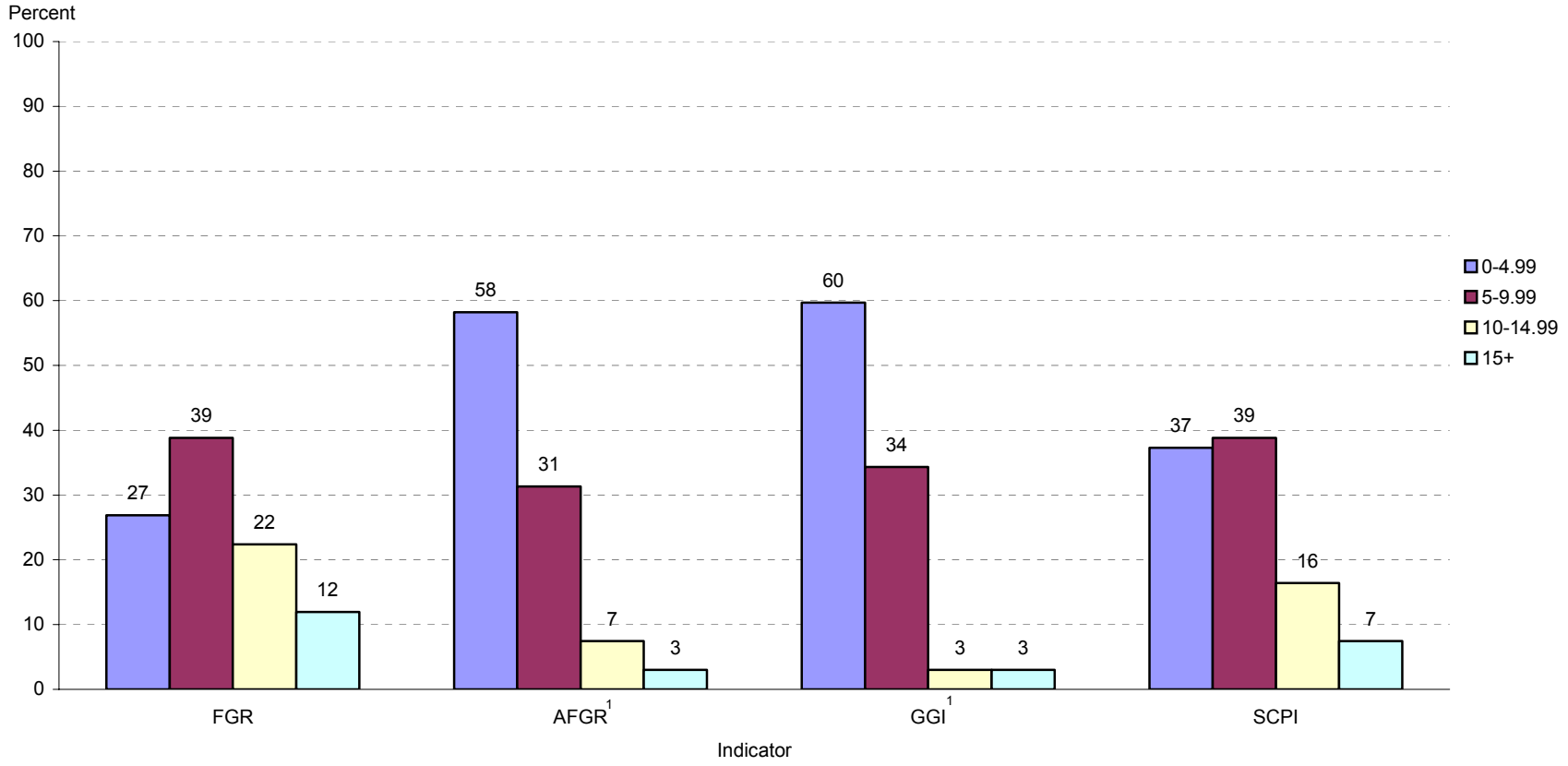
[1] First-time 9th-grade counts were estimated using Greene's smoothed 9th-grade estimate.
NOTE: FGR = Freshman Graduation Rate, all freshmen; AFGR= Averaged Freshman Graduation Rate, first-time freshmen; GGI = Greene's Graduation Indicator; SCPI = Swanson's Cumulative Promotion indicator; EACGI = Exclusion-Adjusted Cohort Graduation Indicator.
SOURCE: Data from state 2 student record system.

Figure 3.8. Distribution of the size of the absolute distance, in percentage points, between FGR, AFGR, GGI, SCPI and the true cohort rate EACGI for school districts in State 2: 2000-01



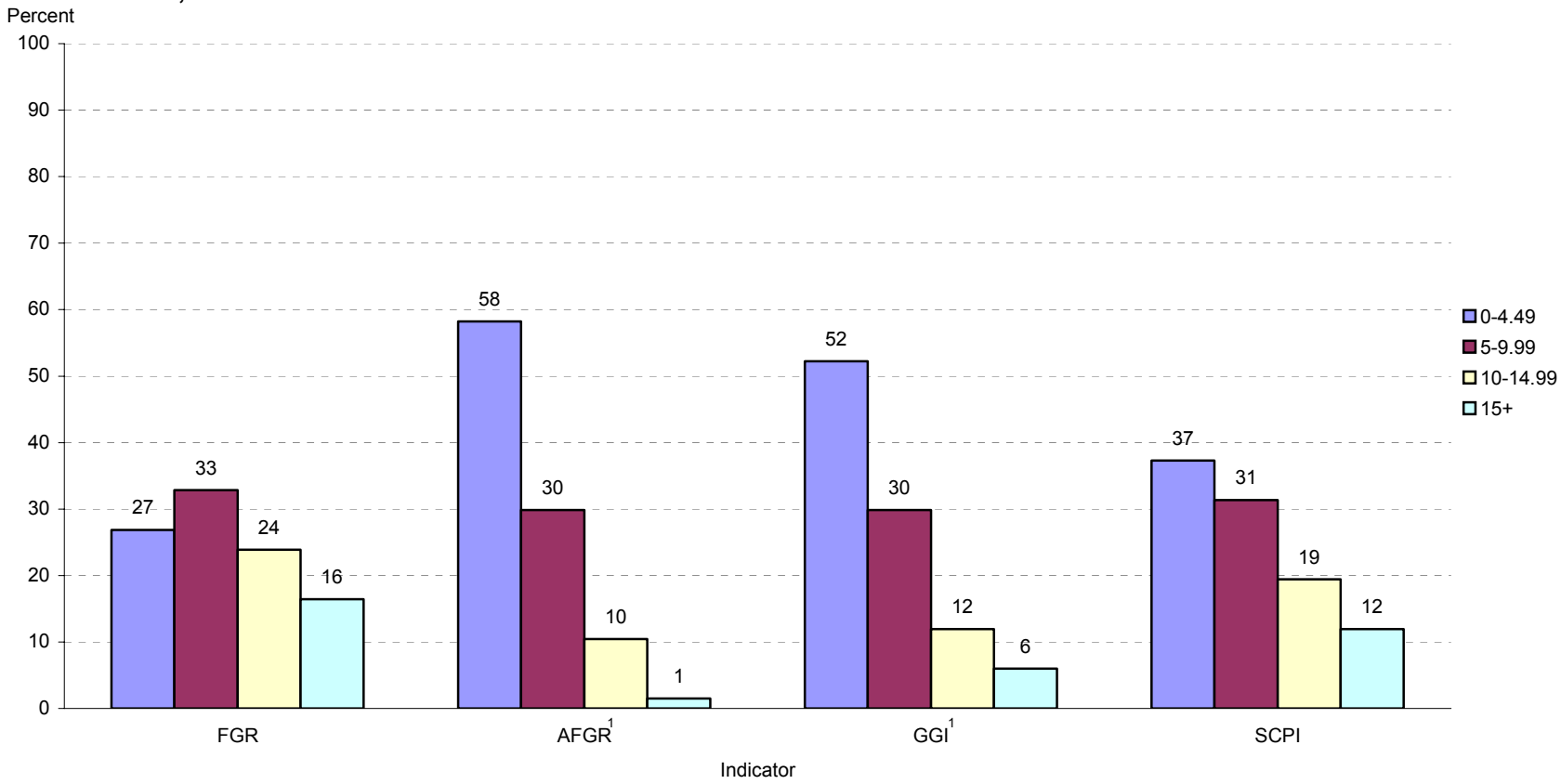
[1] First-time 9th-grade counts were estimated using Greene's smoothed 9th-grade estimate.
NOTE: FGR = Freshman Graduation Rate, all freshmen; AFGR= Averaged Freshman Graduation Rate, first-time freshmen; GGI = Greene's Graduation Indicator; SCPI = Swanson's Cumulative Promotion indicator; EACGI = Exclusion-Adjusted Cohort Graduation Indicator.
SOURCE: Data from state 2 student record system.

Figure 3.9. Distribution of the size of the absolute distance, in percentage points, between FGR, AFGR, GGI, SCPI and the true cohort rate EACGI for school districts in State 2: 2001-02



[1] First-time 9th-grade counts were estimated using Greene's smoothed 9th-grade estimate.
NOTE: FGR=Freshman Graduation Rate; AFGR=Averaged Freshman Graduation Rate; GGI=Greene Graduation Indicator; SCPI=Swanson's Cumulative Promotion Indicator; EACGI=Exclusion-Adjusted Cohort Graduation Indicator.
SOURCE: Data from state 2 student record system.

Figure 3.10. Distribution of the size of the absolute distance, in percentage points, between graduation indicators FGR, AFGR, GGI, and SCPI and the true cohort rate EACGI for school districts in State 2: 2002-03



[1] First-time 9th-grade counts were estimated using Greene's smoothed 9th-grade estimate.
NOTE: FGR=Freshman Graduation Rate; AFGR=Averaged Freshman Graduation Rate; GGI=Greene Graduation Indicator; SCPI=Swanson's Cumulative Promotion Indicator; EACGI=Exclusion-Adjusted Cohort Graduation Indicator.
SOURCE: Data from state 2 student record system.

To this point, the analysis of the district data in State 2 has focused on the performance of each proxy indicator relative to the true cohort rate in individual years. However, because graduation rates are frequently used to monitor the performance of individual school districts over time it is also informative to evaluate the performance of each of the indicators over time within individual school districts. To do this, the correlation between the rates for individual school districts was calculated across adjacent school years for each graduation indicator. Taking EACGI as the standard, the correlations between school years 1999-2000 and 2000-01 and between 2000-01 and 2001-02 were both .79 and the correlation between school years 2001-02 and 2002-03 was .80 (table 3.5). The true cohort on-time graduation rate showed evidence of a strong correlation between the year-to-year rates. This suggests that over the 4-year time period the true cohort rates within individual districts were more likely to be similar than to show large year-to-year differences. For a proxy indicator to serve as a reasonable approximation of the true cohort rate, similar relatively high correlations should be evident over the same time period. For FGR, the correlation was .75 between 1999-2000 and 2000-01, .80 between 2000-01and 2001-02, and .82 between 2001-02 and 2002-03. For AFGR, the correlation between the first 2 years was .69, however, the between year correlations were higher in the last 3 years of the data—.76 between 2000-01 and 2001-02 and .78 between 2001-02 and 2002-03. The year-to-year correlations for GGI and SCPI were lower, with correlations between .63 and .69.

Table 3.5 Regression estimates of school district-level graduation indicators in State 2 across years, by indicator: 1999-2000 through 2002-03

	Indicator[1]				
Statistic	EACGI	FGR	AFGR[2]	GGI[2]	SCPI
1999-2000 vs. 2000-01					
Correlation coefficient	.79	.75	.69	.68	.63
R square	.63	.56	.47	.46	.40
Slope	.92	.75	.81	.81	.53
Standard deviation	4.96	5.74	5.69	5.71	7.51
2000-01 vs. 2001-02					
Correlation coefficient	.79	.80	.76	.63	.63
R square	.63	.64	.57	.40	.40
Slope	.71	.84	.73	.50	.66
Standard deviation	4.44	5.46	4.96	4.77	7.82
2001-02 vs. 2002-03					
Correlation coefficient	.80	.82	.78	.69	.66
R square	.64	.68	.61	.48	.43
Slope	.82	1.03	1.07	.98	.75
Standard deviation	4.41	6.46	6.49	6.30	8.69

[1] EACGI = Exclusion adjusted cohort graduation indicator; FGR = Freshman graduation rate, all freshmen; AFGR = Averaged freshman graduation rate, first-time freshmen; SCPI = Swanson's cumulative promotion indicator.
[2] First-time 9th-grade counts use Greene's smoothed 9th-grade estimate.

NOTE: Estimates are based on regular school districts.
SOURCE: Data from State 2 student record system.

3.3. Summary

At the state level, the rates for AFGR and GGI were closest to the true cohort rates, with average absolute differences from EACGI of 2.8 and 3.5 percentage points. The student record data were used to compute the true cohort on-time graduation rate at the school district level. The same data were aggregated to create the cross-sectional enrollment, graduate, and dropout variables needed to compute the cross-sectional proxy graduation indicators. The distributional properties of all five graduation indicators were analyzed, and diagnostics procedures were used to examine the distributions for deviations from normality. An examination of the data resulted in a decision to focus the analysis on the four proxy indicators that most closely resemble the true cohort rate. That done, correlation and ordinary least squares regression were used to compare the proxy indicators FGR, AFGR, GGI, and SCPI to the true cohort on-time graduation rate, and to examine the amount of variability over time in each of the indicators. In addition, the distance between the proxy indicator and the true cohort rate was examined for each school district to measure the amount of error in the proxy indicators.

The analyses comparing the school district level data for each proxy indicator to the true cohort rate showed that although each proxy measure had a stronger association with EACGI than AFGR in one of the 4 years, AFGR has the most consistent pattern. More specifically, AFGR exhibits stronger correlations with EACGI than FGR in 1999-2000, 2000-01, and 2001-02, and stronger than GGI or SCPI in 2000-01, 2001-02 and 2002-03. Thus overall, at the school district level in State 2, AFGR shows the strongest pattern of correlation with the true cohort on-time graduation rate. Similarly, the analysis of the distribution of the size of the differences between each graduation measure and the true cohort rate showed that in State 2, AFGR had the smallest errors relative to the true cohort rates. Furthermore, the examination of the year-to-year correlations within each indicator showed strong associations over time for the true cohort on-time graduation rate and for AFGR and FGR.

Chapter 4

An Application of the Proxy Graduation Indicators Using Data From the NCES Common Core of Data

The analyses of chapters 2 and 3 provided a basis for comparing the proxy indicators with the true cohort on-time graduation rate for two states. In order to consider how the graduation indicators perform more broadly, the findings from the analyses in the two states are considered using the available cross-sectional data for the nation and individual states. Absent student record system data for all students in the nation, the true cohort rate cannot be computed at the national or state levels. Instead, current national and cross state analyses are limited to those proxy graduation indicators that can be computed using existing cross-sectional data from the Common Core of Data (CCD).

Recall that among the proxy graduation indicators under consideration in the analyses in chapters 2 and 3, the Averaged Freshman Graduation Rate was the most consistent among the best performing measures across levels of aggregation in both states. More specifically at the state level in State 1, AFGR, SCPI, and FGR were, on average across the 3 years, closest to EACGI, with AFGR exhibiting a slight "edge." Then at the state level in State 2, AFGR and GGI were, on average across the 4 years, closest to EACGI, with AFGR in the lead. At the district level in state 1, AFGR and SCPI were the closest to EACGI when the values for the mean of means were compared; however, when regression analysis between the proxy measures and EACGI were examined, AFGR was more strongly correlated with EACGI and more of the variation in EACGI was explained by AFGR, especially relative to SCPI. At the district level in State 2, AFGR and GGI were closest to EACGI when the values for the mean of means were compared; however, in the regression analysis, while the results were more mixed, AFGR was again the most consistent in both correlations with EACGI and in the amount of variation explained. The outcome of the results was similar in the other two sets of district level analyses in both states, with AFGR emerging as one of the two best indicators in each analysis and as the only indicator that held that position across all analyses. As a result, AFGR is taken as the standard in the analyses of the cross-sectional data in this chapter.

Prior to conducting the analysis, it is important to review the sources and types of available cross-sectional data, and to consider any limitations in the data. The CCD is the source of the available school-based data on high school graduation, completion, and enrollment. By way of background, the CCD is an annual survey of the state-level education agencies that provides data about all public elementary and secondary schools, all local education agencies, and all state education agencies throughout the United States. The CCD's goal is to provide comparable education data across all states. The CCD is a set of five surveys that are sent to state education departments: Public School Universe, Local Education Agency (School District) Universe, State Aggregate Nonfiscal Data, State Aggregate Fiscal Data, and School District Fiscal Data. The first three of these surveys include cross-sectional data that can be used to compute the proxy graduation indicators.

The Freshman Graduation Rate (FGR), the Averaged Freshman Graduation Rate (AFGR), the Swanson Cumulative Promotion Indicator (SCPI), and the Greene Graduation Indicator (GGI) can each be computed for the nation and for all states and districts using data from the annual CCD data files—State Nonfiscal Survey of Public Education, the Public School Universe, and the Local Education Agency (School District) Universe surveys. The state universe file can be used at the national and state levels, while school and agency universe files are needed at the district level. In contrast, the Graduation Leaver Indicator (GLI) requires data from the CCD Dropout Component of the Local Education Agency Universe data file, and these dropout data are not yet available for all states and the District of Columbia.[8]

The analysis in this chapter starts with the five proxy graduation indicators that can be calculated with currently available data: FGR, AFGR, SCPI, GGI, and GLI. Before starting the analysis, it is important to note that a review of the work done to date on graduation rates by NCES (2004, 2003), Swanson (2003), Greene (2002), and others makes it apparent that there are different data sources to be used for different graduation indicators, and in some cases multiple data sources that can be used to calculate the same graduation indicators.

In particular, the number of students by grade at the school level from the Public School Survey, and the number of diploma recipients,[9] other high school completers, and dropouts from each of grades 7 through 12[10] from the Local Education Agency (School District) Universe Survey, include the data required to compute the GLI—this indicator can be computed using these data aggregated to the district or state level. In addition, the school-level data for the number of students by grade can be aggregated to the district level, and combined with district-level data for the numbers of diploma recipients to produce district-level estimates of the FGR, AFGR, SCPI, and GGI. These district-level data can then be aggregated to the state level to produce state-level estimates of FGR, AFGR, SCPI, and GGI and ultimately national estimates of the same graduation indicators.

It is also possible to compute state and national estimates for the same four graduation indicators using state-level aggregates of the number of students by grade level in the current school year and diploma recipients and other completers in the previous year using data from the State Aggregate Nonfiscal Data. Thus, state- and national estimates for FGR, AFGR, SCPI, and GGI can be calculated from two different data files. Because the state data file frequently includes students and graduates from special programs that are not included in any district- or school-level data files, the same state level graduation

[8] While GLI was dropped from the analyses in chapters 2 and 3, it is included again here to confirm whether the pattern observed in State 1 is repeated across states.
[9] Prior to 1998-99 data were reported separately for regular diploma recipients and other diploma recipients. Starting in 1998-99, these two categories were combined in the data collection.
[10] The dropout data, although collected within the Local Education Agency (School District) Universe survey, are released separately as the "Dropout Component of the Local Education Agency Universe Survey."

indicator computed using state data in one instance and school and district data aggregated to the state level in another, will not necessarily yield identical results.

Given this range of options to choose from, more information is needed about the details of each dataset. For example, a comparison of the proxy graduation indicators suggested that the population coverage of each data set, the treatment of nonresponse, and the treatment of ungraded students must each be considered.

Looking first at coverage for the 50 states and the District of Columbia, the district-level dropout data that are needed for the GLI are only available for states that are using the prescribed CCD definitions. For the 2000-01 school year, a total of 49 states submitted dropout data to the CCD. Of these, 45 reported using agreed-upon reporting definitions; those that did not were excluded from the CCD dropout data file. (Coverage is up from 12 participating states when the collection was started in 1991-92.) In contrast, the indicators that only require data on enrollments and graduates can be calculated using data from files that include all 50 states and the District of Columbia (i.e., the State Nonfiscal file or the School and School District files combined).

Considering nonresponse next, a review of the CCD file documentation found that nearly all state education offices in the 50 states and the District of Columbia provided counts of all students enrolled in grades 9 through 12 and of diploma recipients at both the state and school levels. In those few instances when these state-level data were not reported, they were imputed. Of course, in the absence of independent audits, there is no way of knowing with certainty whether all students in all schools are reported or whether all diploma recipients in all school districts are reported. Missing data at the school or district level are also missing in the state estimates, although it is not as apparent because the data are reported out as a group at the state level. The picture is not as clear for the other completer counts that are used in the GLI. For example, in 2002-03 there were three states that reported missing some or all of their data on other high school completers. In addition, there were 14 states that reported not having documentation on the other completer category. While this is not nonresponse per se on the part of these 14 states, it does highlight the fact that there are differences across states in the categorization and reporting of different types of high school completers.

The third factor to consider is the treatment of ungraded students. The CCD Dropout Component includes these students by allocating them across the grades served by the schools they attend. However, these students are left in a separate category in the other CCD School District file, the CCD School file and the CCD State Nonfiscal file. Because ungraded students are enrolled in the school and can contribute to the population of high school completers, their exclusion from the denominator of graduation rates computed from these files serves to inflate the estimates of the indicators, FGR, AFGR, SCPI, and GGI, when they are computed using these data (e.g., rates published by Greene and Winters (2002) and Swanson (2003)). Alternatively, ungraded students can be allocated across the grades served by the schools they attend in order to provide a more realistic estimate of an on-time graduation rate. The data used in the analysis in this chapter include the ungraded students allocated across grades.

From this review of data limitations, it is evident that differences in the data elements that are used must be carefully considered in any analysis of graduation indicators. For these reasons, the data used for each indicator in this chapter are carefully defined. Wherever possible, comparisons across indicators are done based on indicators that are calculated using the same data files; and when this is not possible, differences are described.

4.1. Using student record findings for the analysis of CCD data

In addition to a descriptive comparison of the proxy graduation indicators computed using CCD data, the results from the analyses of student record data from States 1 and 2 can be used as an analytic basis for further analysis of CCD based graduation indicators. Although the data required to calculate true cohort on-time graduation rates are not available for other states, since AFGR was identified across analyses at both the state and school district levels as the one proxy measure that was consistently among the best performing indicators relative to EACGI, it is used here as an approximation of the true cohort rate in States 1 and 2, and is taken as the standard for comparison in the analyses in this chapter. In particular, the relationships between AFGR and each of the other proxy graduation indicators are examined to determine if the relative comparison of the indicators across all states is the same as that observed in States 1 and 2.

This analysis is based on a set of assumptions. First, that rates computed using CCD data are strongly correlated with the rates computed using the student record data from States 1 and 2. Second, that the relationships observed between the indicators in the analysis of the student record data are repeated in the CCD data for States 1 and 2. Third, that these assumptions can be generalized to all states.

District-level data are used to test the first two assumptions. Specifically, FGR, AFGR, GGI, and SCPI were computed across school districts using the student record data from State 1 for 2000-01 and 2001-02 and were then correlated with the same rates computed across school districts using CCD data for State 1.[11] This analysis yielded correlations across the graduation measures of .93 to .96 in 2000-01 and of .95 to .96 in 2001-02 for State 1 (table 4.1). Next, the CCD school district rates for FGR, AFGR, GGI, and SCPI in State 1 were regressed against the true cohort rate EACGI from the student record data for each school district in State 1. Regression of each of the rates against EACGI provided information on how each proxy graduation indicator computed with CCD data correlated with EACGI across school districts in State 1, how much of the variance in EACGI could be explained by each CCD proxy graduation indicator, and how much EACGI changes with a 1 percentage point change in each CCD proxy graduation indicator. This analysis showed consistent results within each indicator across the 2 years, with the strongest relationships evident between EACGI and AFGR and EACGI and FGR, and with weaker relationships between EACGI and both GGI and SCPI (table 4.2).

[11] Because district level rates are more subject to population changes, and because errors in reporting can have a profound impact on district level rates, the Districts with CCD rates above 100 percent or below 25 percent were trimmed from the regression analysis.

Table 4.1. Regression estimates of State 1 student record school district estimates on State 1 CCD school district estimates for graduation indicators FGR, AFGR, GGI, and SCPI, by school year: 2000-01 and 2001-02

Statistic	Indicator[1] FGR	AFGR[2]	GGI[2]	SCPI
2000-01[3]				
Correlation coefficient	.96	.93	.95	.93
R square	.91	.87	.91	.87
Slope	.98	.94	.96	.86
Standard deviation	2.37	2.30	2.25	3.90
2001-02				
Correlation coefficient	.96	.96	.96	.95
R square	.93	.92	.92	.90
Slope	.99	0.96	.95	.91
Standard deviation	2.55	2.15	2.11	2.99

[1] FGR = Freshman Graduation Rate, all freshmen; AFGR = Averaged Freshman Rate, first-time freshmen; GGI = Greene's Graduation Indicator; SCPI = Swanson's Cumulative Promotion Indicator.
[2] First-time 9th-grade counts estimated using Greene's smoothed 9th-grade estimate.
[3] One district was excluded.

NOTE: Cases with estimates of less than 25 percent or over 100 percent on any indicator were excluded.
SOURCE: Data from State 1 student record system; U.S. Department of Education, National Center for Education Statistics, Common Core of Data (CCD), "Public Elementary/Secondary School Universe Survey" school years 1996-97 through 2002-03 and "Local Education Agency Universe Survey" school years 2001-02 through 2002-03.

Recall that table 2.3 in chapter 2 showed the relationships between the true cohort on-time graduation rate and each of the proxy graduation indicators when all rates were calculated using student record data. A comparison of the results in tables 4.2 and 2.3 shows that the relative positions of the proxy graduation indicators compared to the true cohort rates are the same using either CCD data or student record data. That is to say, the relationships with EACGI are stronger for AFGR and FGR and weaker for GGI and SCPI.

Table 4.2. Regression estimates of State 1 student record school district estimates for EACGI on State 1 CCD school district estimates, by indicator and school year: 2000-01 through 2001-02

Statistic	Indicator[1] FGR	AFGR[2]	GGI[2]	SCPI
2000-01[3]				
Correlation coefficient	.77	.80	.62	.48
R square	.60	.65	.38	.23
Slope	.75	.96	.65	.31
Standard deviation	4.80	4.50	5.97	6.64
2001-02				
Correlation coefficient	.82	.78	.55	.45
R square	.67	.61	.30	.20
Slope	.74	.84	.60	.38
Standard deviation	4.82	5.27	7.03	7.53

[1] EACGI = Exclusion Adjusted Cohort Graduation Indicator; FGR = Freshman Graduation Rate, all freshmen; AFGR = Averaged Freshman Graduation Rate, first-time freshmen; GGI = Greene's Graduation Indicator; SCPI = Swanson's Cumulative Promotion Indicator.
[2] First-time 9th-grade counts estimated using Greene's smoothed 9th-grade estimate.
[3] One district was excluded.

NOTE: Cases with estimates of less than 25 percent or over 100 percent on any indicator were excluded.
SOURCE: Data from State 1 student record system; U.S. Department of Education, National Center for Education Statistics, Common Core of Data (CCD), "Public Elementary/Secondary School Universe Survey" school years 1996-97 through 2002-03 and “Local Education Agency Universe Survey” school years 2001-02 through 2002-03.

The analysis for State 2 showed that the proxy graduation indicators computed across school districts using student record data were strongly correlated with the same rates computed across school districts using CCD data (.92 to .98) (table 4.3). The analysis in table 4.4 shows that although the relationships are weaker, the relative positions between the proxy measures as compared to the true cohort rates are repeated in State 2 (tables 4.4 and 3.3).

Table 4.3. Regression estimates of State 2 student record school district estimates on State 2 CCD school district estimates for FGR, AFGR, GGI, and SCPI, by school year: 1999-2000 through 2001-02

	Indicator[1]			
Statistic	FGR	AFGR[2]	GGI[2]	SCPI
1999-2000				
Correlation coefficient	.97	.93	.92	.97
R square	.94	.86	.85	.95
Slope	.95	.90	.95	.99
Standard deviation	2.01	2.31	2.46	2.47
2000-01				
Correlation coefficient	.97	.96	.95	.98
R square	.94	.92	.91	.96
Slope	1.02	1.03	1.09	1.03
Standard deviation	2.09	2.23	2.38	2.05
2001-02				
Correlation coefficient	.97	.94	.92	.97
R square	.94	.88	.85	.94
Slope	.99	.95	.88	.97
Standard deviation	2.29	2.65	2.41	2.50

[1] FGR = Freshman Graduation Rate, all freshmen; AFGR = Averaged Freshman Graduation Rate, first-time freshmen; GGI = Greene's Graduation Indicator; SCPI = Swanson's Cumulative Promotion Indicator.
[2] First-time 9th-grade counts estimated using Greene's smoothed 9th-grade estimate.

NOTE: Cases with estimates of less than 25 percent or over 100 percent on any indicator were excluded.
SOURCE: Data from State 2 student record system; U.S. Department of Education, National Center for Education Statistics, Common Core of Data (CCD), "Public Elementary/Secondary School Universe Survey," school years 1995-96 through 2002-03 and “Local Education Agency Universe Survey” school years 2000-01 through 2002-03.

Table 4.4. Regression estimates of State 2 student record school district estimates for EACGI on State 2 CCD school district estimates, by indicator and school year: 1999-2000 through 2001-02

	Indicator[1]			
Statistic	FGR	AFGR[2]	GGI[2]	SCPI
1999-2000				
Correlation coefficient	.58	.62	.67	.67
R square	.34	.38	.44	.45
Slope	.49	.65	.74	.42
Standard deviation	5.78	5.59	5.29	5.26
2000-01				
Correlation coefficient	.63	.68	.61	.48
R square	.40	.47	.38	.23
Slope	.63	.77	.73	.43
Standard deviation	6.33	5.97	6.46	7.16
2001-02				
Correlation coefficient	.60	.62	.52	.51
R square	.35	.39	.27	.26
Slope	.49	.61	.59	.37
Standard deviation	5.87	5.73	6.25	6.27

[1] EACGI = Exclusion Adjusted Cohort Graduation Indicator; FGR = Freshman Graduation Rate, all freshmen; AFGR = Averaged Freshman Graduation Rate, first-time freshmen; GGI = Greene's Graduation Indicator; SCPI = Swanson's Cumulative Promotion Indicator.
[2] First-time 9th-grade counts estimated using Greene's smoothed 9th-grade estimate.

NOTE: Cases with estimates of less than 25 percent or over 100 percent on any indicator were excluded.
SOURCE: Data from State 2 student record system; U.S. Department of Education, National Center for Education Statistics, Common Core of Data (CCD), "Public Elementary/Secondary School Universe Survey," school years 1995-96 through 2002-03 and "Local Education Agency Universe Survey" school years 2000-01 through 2002-03.

Finally, the relationships comparing AFGR to FGR, GGI, and SCPI were examined in both the state student record data for State 1 and the CCD data. The estimates based on student record data are displayed in table 4.5; a comparison of the estimates with comparable estimates using CCD data for State 1 showed that the results were similar across the two sets of estimates.[12] In both analyses the correlations between AFGR and FGR for 2000-01 and 2001-02 were strong (r greater than .90) and more than 84 percent of the variation in AFGR was explained by FGR in both sets of data. In both sets of comparisons GGI outperforms SCPI, but the relationships between AFGR and GGI or SCPI are weaker than the relationship between AFGR and FGR. Again, the same analysis conducted using data from State 2 showed a stronger relationship between AFGR and FGR than between AFGR and GGI or SCPI (table 4.6).

[12] The CCD analysis for States 1 and 2 are not displayed here to protect the identities of the States.

Table 4.5. Regression estimates of AFGR on proxy graduation indicators FGR, GGI, and SCPI with all indicators calculated using student record data for State 1, by school year: 2000-01 and 2001-02

	Indicator[1]		
Statistic	FGR	GGI[2]	SCPI
2000-01[3]			
Correlation coefficient[4]	.92	.71	.48
R square	.84	.50	.23
Slope	.74	.63	.29
Standard deviation	2.55	4.52	5.63
2001-02			
Correlation coefficient	.93	.65	.46
R square	.87	.42	.21
Slope	.76	.66	.38
Standard deviation	2.81	5.95	6.94

[1] FGR = Freshman Graduation Rate, all freshmen; AFGR = Averaged Freshman Graduation Rate, first-time freshmen; GGI = Greene's Graduation Indicator; SCPI = Swanson's Cumulative Promotion Indicator.
[2] First-time 9th-grade counts estimated using Greene's smoothed 9th-grade estimate.
[3] One district was excluded.
SOURCE: Data from State 1 student record system.

Table 4.6. Regression estimates of AFGR on proxy graduation indicators FGR, GGI, and SCPI with all indicators calculated using student record data for State 2, by school year: 1999-2000 through 2001-02

	Indicator[1]		
Statistic	FGR	GGI[2]	SCPI
1999-2000			
Correlation coefficient	.92	.78	.79
R square	.84	.61	.62
Slope	.73	.78	.45
Standard deviation	2.65	4.13	4.06
2000-01			
Correlation coefficient	.90	.77	.70
R square	.81	.59	.50
Slope	.81	.77	.57
Standard deviation	3.41	5.00	5.55
2001-02			
Correlation coefficient	.92	.59	.66
R square	.84	.35	.43
Slope	.76	.72	.49
Standard deviation	3.03	6.11	5.70

[1] FGR = Freshman Graduation Rate, all freshmen; AFGR = Averaged Freshman Graduation Rate, first-time freshmen; GGI = Greene's Graduation Indicator; SCPI = Swanson's Cumulative Promotion Indicator.
[2] First-time 9th-grade counts estimated using Greene's smoothed 9th-grade estimate.
NOTE: Districts 68 and higher were excluded.
SOURCE: Data from State 2 student record system.

While it would, of course, be preferable to have student record system data from a larger subset of states, these analyses lend support to the use of AFGR as the standard in evaluating the performance of the proxy measures across states.

4.2. Graduation indicators at the national level

The FGR, AFGR, GGI and SCPI can all be calculated at the national level using state data. This section focuses on how widely the proxy graduation indicators vary over a 7-year period, the relative position of the indicators over that period, the stability and direction of trends for each indicator, and the relationship between each indicator and underlying demographic changes in the population during the 7 years.

The FGR, AFGR, GGI, and SCPI proxy indicators were estimated using data from the CCD state nonfiscal data file.[13] However, because ungraded students are reported separately in this data file, the ungraded students in grades 9 through 12 were allocated proportional to each state's enrollment in those grades and then added to the grade-

[13] Because missing state-level data are imputed in this data file, the national- and state-level analyses in this chapter are based on data for all states in all years.

specific enrollments. The resulting state-level data for 1995-96 through 2001-02 were aggregated to the national level, and these data were used to compute annual rates for the four indicators (table 4.7).[14]

Table 4.7. National graduation indicators, by year and indicator: 1995–96 through 2001–02

Indicator[1]	1995-96	1996-97	1997-98	1998-99	1999-2000	2000-01	2001-02
FGR	66.5	66.4	66.6	66.0	66.3	66.3	67.0
AFGR[2]	71.0	71.3	71.3	71.1	71.7	71.7	72.6
GGI[2]	66.6	66.4	66.7	67.3	68.8	69.2	69.7
SCPI	66.1	65.4	65.3	65.7	66.6	67.9	69.8

[1] FGR = Freshman Graduation Rate, all freshmen; AFGR = Averaged Freshman Graduation Rate, first-time freshmen; GGI = Greene's Graduation Indicator; SCPI = Swanson's Cumulative Promotion Indicator.
[2] First-time 9th-grade counts estimated using Greene's smoothed 9th-grade estimate.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Common Core of Data (CCD), "State Nonfiscal Survey of Public Elementary/Secondary Education," school years 1991-92 through 2002-03.

The national average for the AFGR ranged from a low of 71 percent to a high of 73 percent over the 7-year period, with an average rate of 72 percent. The national FGR ranged from a low of 66 percent to a high of 67 percent, with an average rate of 66 percent. The national GGI ranged from a low of 66 to a high of 70, with an average of 68 percent. The national average computed for the SCPI ranged from a low of 65 percent to a high of 70 percent, with an average of 67 percent. As was the case in the analysis of data from States 1 and 2, the AFGR yields a higher estimate than the other three measures. In any given year, the point spread between AFGR and lowest of the proxy graduation indicators is approximately 5 to 6 percentage points.

When the proxy graduation indicators are examined over the 7 years, the patterns for the FGR and AFGR were similar (figure 4.1). After a decline from 1995-96 to 1996-97, there was little change between 1996-97 and 2000-01, with a 1 percentage point increase in the indicator based on all freshmen (FGR) and a 2 percentage point increase in the indicator based on first-time freshmen (AFGR). Thus, the difference between the two indicators increased by one percentage point—from just under 5 to just under 6 percentage points. In contrast, the Swanson Cumulative Promotion Indicator and the Greene Graduation Indicator are both on a par with the graduation rate, based on all freshmen (FGR) in 1995-96 and 1996-97. Then after a decrease between 1995-96 and 1996-97, both the Swanson cumulative promotion indicator and the Greene graduation indicator increased gradually between 1996-97 and 2001-02, with the Swanson indicator gaining 5 percentage points and the Greene indicator gaining 4 percentage points over the 6 years. Because the Greene and Swanson indicators increased more than the rate based on all freshmen, the Greene and Swanson indicators end up half way between the freshman graduation rate based on all freshmen and the averaged freshman graduation

[14] There is no national estimate for GLI because not all states report the required data elements.

based on first-time freshmen in 2001-02 (approximately 3 percentage points from each unadjusted indicator).

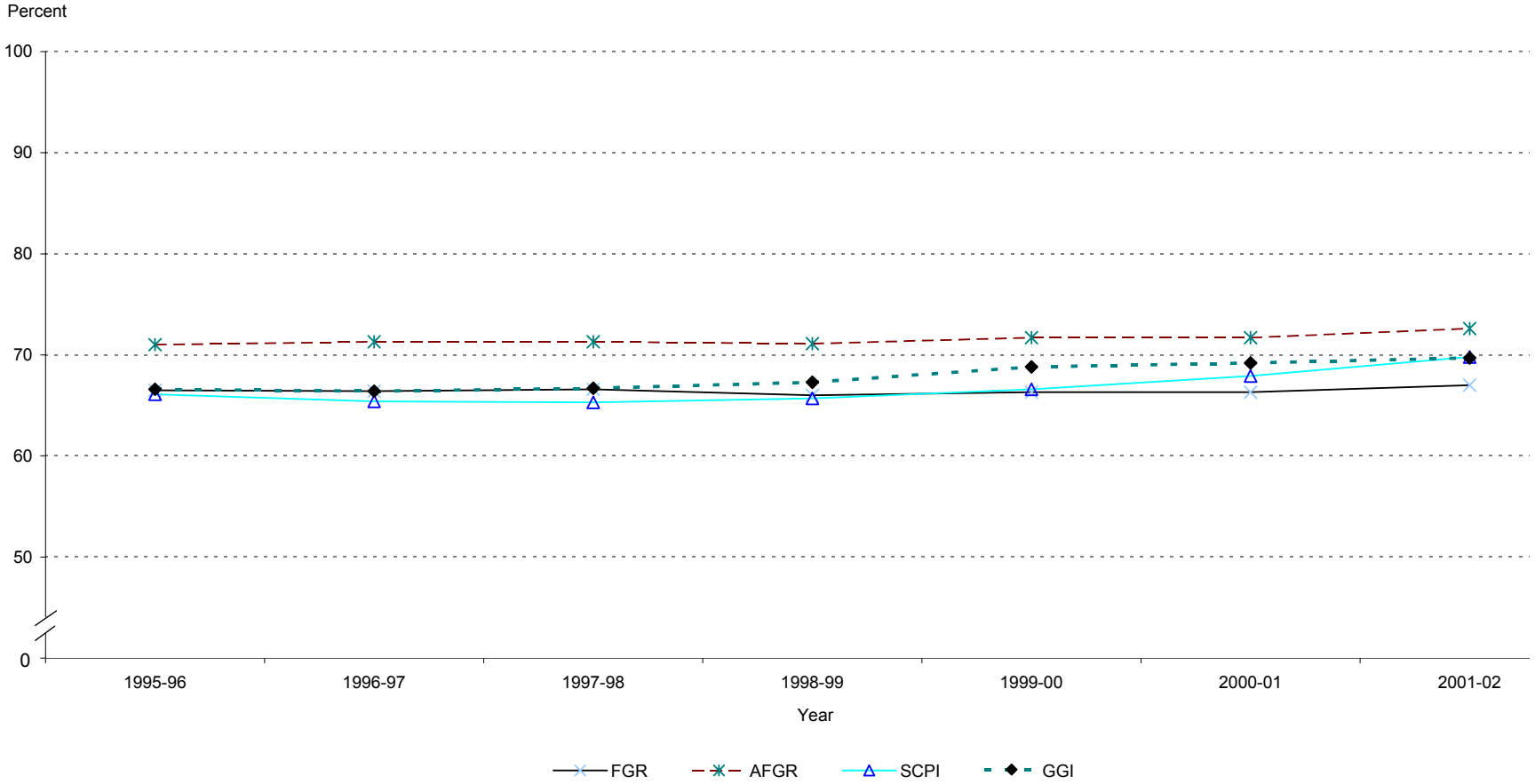
Each of these proxy graduation indicators is influenced by underlying changes in the populations used in the denominators of the indicators. For example, an examination of CCD enrollment data by grade shows that the patterns over time for FGR and AFGR are affected by the fact that the school populations in their denominators are driven by a population that is increasing in size, albeit at a decreasing rate of increase over time (data not shown). CCD enrollment data by grade also show that for SCPI, the estimates are influenced by grade-to-grade differences in the rates of growth between the freshman classes and enrollments in the other grades.[15] Finally, in the case of GGI, an examination of the CCD enrollment data by grade over time shows that the pattern is affected by both the slowing rate of growth in the size of the population entering high school and the size of the population adjustment that is applied to the estimated number of first-time freshmen.

Comparisons of data across the rates reveal that in most cases the all freshmen denominator in FGR is larger than the estimated first-time freshmen denominator in AFGR (data not shown). The difference between estimates of all freshmen and that for first-time freshmen is driven by 9th-grade retention patterns. The averaging across consecutive years' enrollments in grades 8, 9, and 10 is intended to dampen the impact of 9th-grade retentions, thus yielding an estimate of on-time freshmen. Year-to-year changes in the rates of population increase vary by grade and introduce another source of difference between AFGR and FGR over time.

In the same vein, comparisons of data across the rates show that the only difference between AFGR and GGI is in the size of the population adjustment that is applied to the estimate of first-time freshmen to get an estimate of the potential seniors 4 years later for GGI. In GGI, this population adjustment is the ratio of the difference between enrollments in grades 9 through 12 in the senior year and enrollments in grades 9 through 12 four years earlier in the freshman year to enrollments in grades 9 through 12 four years earlier in the freshman year. The application of this ratio is intended to adjust for changes due to migration over the high school years to produce an estimate of the potential number of seniors 4 years later. At the national level during this time period, this adjustment yields an estimate of GGI that is lower than the estimate of AFGR, suggesting that the estimated number of potential seniors enrolled 4 years later is larger than the number of freshmen 4 years earlier. The Greene estimate suggests that there were more potential seniors than the starting number of freshmen in each of the 7 years in the analysis (appendix B). The assumption that this adjustment accounts for the net effect of migration between the freshman and senior years leads to the conclusion that there was a net increase in the size of each high school class in each year between 1996-97 and 2001-02—with the potential for more ending seniors than beginning freshmen in each successive cohort. This is not a realistic assumption.

[15] Important here is the fact that differential rates of change in 9th-grade enrollments relative to enrollments in grade 10-12 impact year to year changes in this proxy graduation rate, independent of the number of graduates.

Figure 4.1. National graduation rates for FGR, AFGR, SCPI, and GGI: 1995-96 through 2001-02



NOTE: FGR=Unadjusted Graduation Indicator, All Freshmen; AFGR=Unadjusted Graduation Indicator, First-Time Freshmen; SCPI=Swanson's Cumulative Promotion Indicator; GGI=Greene Graduation Indicator.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Common Core of Data (CCD), "State Nonfiscal Public Elementary/Secondary Education Survey Universe," school years 1991-92 through 2002-03.

In 2001-02, for example, the GGI adjustment calculation yields a rate of change of 4.1 percent. An examination of data for the freshman classes that make up the student population in grades 9-12 in 2001-02 shows that the freshman class increased in size each year, contributing to one half of the 4 percent increase measured by the Greene approach.[16] In ignoring the growth in the size of the incoming freshman classes, the Greene indicator attributes too much of the change to migration. As a result the GGI artificially inflates the size of the denominator and decreases the graduation indicator. When the Greene Graduation Indicator is adjusted to control the impact of population growth in the incoming freshmen classes, it yields graduation rates that range from 1 to 4 percentage points higher than the current GGI estimates. Thus, instead of rates ranging from 66 to 70 percent, the rates that have been adjusted to reflect only growth in the population between grades 9 and 12 are in the range of 69 to 72 percent. These new estimates are much closer to the estimates of 71 to 73 percent from the Averaged Freshman Graduation Rate.

4.3. Graduation rates at the state level

Analyses similar to the national analyses can be performed at the state level for FGR, AFGR, GGI, SCPI, and in some states GLI. Again, the proxy graduation indicators are compared in terms of their variation over a 7-year period, their relative positions, and the stability and direction of trends over 7 years. In addition, the state level data allow statistical analyses of the relationships between AFGR and the other indicators across the population of states and years. In this analysis, AFGR is taken as the standard because it was found to be the most consistent among the best performing measures in comparisons to the true cohort rate in chapters 2 and 3.

The FGR, AFGR, GGI, and SCPI were computed for all 50 states and the District of Columbia for each of the 7 school years from 1995-96 through 2001-02. Data from the state nonfiscal data files that were used in the national-level analysis were also used for the state-level analysis of these four proxy graduation indicators; as a result any missing data have been imputed and the ungraded students have been allocated to specific grades. The dropout data required for computing the GLI are not available for all states; thus, the GLI was computed for the subset of 30 states that had the needed district- and school-level data available for at least 5 of the 7 years.[17] These data for GLI have the ungraded students allocated, but missing state data have not been imputed.

The national graduation indicators for the four proxy measures that can be computed for all 50 states and DC were around 70 percent (ranging from 65 to 73 percent in individual years) (table 4.7). Looking across all states over the 7 years, it is evident that there is more variability at the state level in each of the proxy measures than there was at the

[16] Since the grade 9-12 population in 2001-02 is comprised of the incoming freshman class for that year and the 3 previous years, the observed value compared to an estimate holding the freshman class size to observed count in 1998-99 shows a 2 percent increase in the size of the incoming population.

[17] GLI is included in this initial analysis of CCD data as a reference because a number of states are currently using GLI as an annual yearly progress (AYP) measure.

national level (tables 4.8-4.14). In particular, over the 7-year period AFGR ranged from yearly lows between 50 and 84 percent to yearly highs between 61 and 89 percent (table 4.15). The rates from FGR ranged from yearly lows between 48 and 84 percent to yearly highs between 54 and 91 percent. The GGI estimates ranged from yearly lows between 53 and 81 percent to yearly highs of 58 to 89 percent. In the case of SCPI, the yearly minimums ranged from 36 to 83 percent and the yearly high estimates ranged from 53 to 102 percent. Finally in the case of GLI, the yearly minimums ranged from 59 to 89 percent between 1997-98 and 2001-02 and the yearly maximums over those 5 years ranged from 66 to 93 percent.[18]

[18] 1995-96 and 1996-97 were not included here because of the relatively small number of reporting states in those years.

Table 4.8. Graduation indicators, by indicator and state: School year 1995-96

State	Indicator[1]				
	FGR	AFGR[2]	GGI[2]	SCPI	GLI
Alabama	57.8	62.7	59.5	56.6	—
Alaska	64.7	68.3	61.6	65.6	—
Arizona	57.9	60.8	54.8	63.6	—
Arkansas	74.4	74.2	70.3	71.8	80.6
California	64.0	67.6	63.4	66.5	—
Colorado	71.6	74.8	68.0	71.6	—
Connecticut	72.0	76.1	73.2	70.7	—
Delaware	65.8	70.4	63.5	64.9	—
District of Columbia	50.4	49.7	54.5	47.8	—
Florida	57.8	62.3	56.6	55.4	—
Georgia	55.0	61.9	56.6	53.4	—
Hawaii	70.0	74.5	67.9	57.5	—
Idaho	79.2	80.5	73.2	79.1	—
Illinois	72.2	75.2	72.0	76.1	—
Indiana	69.2	73.6	71.0	68.1	—
Iowa	82.6	84.3	77.4	81.3	—
Kansas	74.3	77.1	70.9	73.7	—
Kentucky	66.9	71.3	68.9	62.2	—
Louisiana	55.2	61.7	58.9	53.4	—
Maine	71.4	73.7	77.0	75.8	—
Maryland	72.5	78.3	71.3	71.4	—
Massachusetts	75.1	78.0	74.8	73.7	82.9
Michigan	66.6	71.4	69.6	74.5	—
Minnesota	85.3	86.1	77.6	85.5	—
Mississippi	54.7	59.7	58.2	51.9	69.1
Missouri	70.7	75.0	70.1	70.6	74.4
Montana	82.2	83.9	76.4	77.4	—
Nebraska	82.9	85.6	79.0	83.8	81.2
Nevada	65.2	65.8	54.9	65.6	62.8
New Hampshire	74.6	77.5	71.1	72.8	—
New Jersey	78.1	82.8	81.6	79.8	—
New Mexico	59.8	63.7	57.6	54.3	67.1
New York	58.1	63.6	60.8	54.8	—
North Carolina	61.3	66.5	64.6	57.8	—
North Dakota	89.0	89.5	83.1	89.0	—
Ohio	69.4	74.5	70.8	66.9	—
Oklahoma	72.8	75.6	70.2	70.7	—
Oregon	66.3	68.3	65.0	68.4	—
Pennsylvania	74.7	80.0	75.4	74.1	83.1
Rhode Island	69.5	72.7	69.6	67.5	81.0
South Carolina	54.1	60.9	57.8	51.9	—
South Dakota	85.6	84.5	71.8	74.4	—
Tennessee	62.1	66.6	64.1	60.3	—
Texas	58.4	66.1	60.5	58.6	—
Utah	76.8	76.9	69.0	75.3	—
Vermont	89.3	85.3	70.4	77.0	—
Virginia	73.5	76.2	71.5	71.0	—
Washington	72.2	75.5	66.8	71.3	—
West Virginia	74.6	77.0	79.0	75.4	—
Wisconsin	80.0	83.6	75.4	77.9	—
Wyoming	77.8	77.7	71.6	76.2	—

— Not available.

[1] FGR = Freshman Graduation Rate, all freshmen; AFGR = Averaged Freshman Graduation Rate, first-time freshmen; GGI = Greene's Graduation Indicator; SCPI = Swanson's Cumulative Promotion Indicator; GLI = CCD Graduation Leaver Indicator.

[2] First-time 9th-grade counts estimated using Greene's smoothed 9th-grade estimate.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Common Core of Data (CCD), "State Nonfiscal Survey of Public Elementary/Secondary Education," school years 1991-92 through 1996-97 and "Local Education Agency Universe Survey Dropout and Completion Data File," school years 1991-92 through 1995-96.

Table 4.9. Graduation indicators, by indicator and state: School year 1996-97

State	Indicator[1]				
	FGR	AFGR[2]	GGI[2]	SCPI	GLI
Alabama	57.3	62.4	59.6	56.5	—
Alaska	63.8	67.9	61.8	64.3	—
Arizona	61.7	65.3	56.5	58.1	—
Arkansas	69.4	70.6	67.2	70.9	79.9
California	64.9	68.8	62.9	66.4	—
Colorado	72.1	74.7	66.2	69.7	—
Connecticut	72.6	76.7	72.3	70.7	80.7
Delaware	66.7	71.7	63.7	63.2	79.6
District of Columbia	54.4	54.6	60.1	50.7	—
Florida	57.6	62.7	55.9	54.6	—
Georgia	54.8	62.0	56.6	54.5	—
Hawaii	62.8	69.1	65.5	62.6	—
Idaho	78.4	80.1	73.6	74.5	—
Illinois	73.0	76.1	71.6	70.3	—
Indiana	69.7	74.0	72.0	69.7	—
Iowa	82.5	84.6	78.5	80.9	92.7
Kansas	73.6	76.9	71.1	73.4	—
Kentucky	66.5	71.1	70.4	70.5	—
Louisiana	52.3	59.3	57.9	50.1	—
Maine	71.2	75.2	78.5	76.8	—
Maryland	70.0	76.6	70.1	72.4	—
Massachusetts	75.2	78.4	74.0	74.3	84.6
Michigan	68.1	73.5	68.2	62.3	—
Minnesota	77.3	78.6	71.0	78.7	—
Mississippi	54.4	59.6	58.4	54.7	69.3
Missouri	70.2	74.7	71.0	70.7	74.4
Montana	80.6	83.2	77.2	77.9	—
Nebraska	82.4	84.8	77.7	82.9	82.1
Nevada	72.8	73.2	59.8	67.0	63.3
New Hampshire	74.5	77.3	69.8	73.8	—
New Jersey	80.0	83.9	79.5	79.5	—
New Mexico	56.4	62.5	58.6	53.7	66.5
New York	59.2	65.3	63.0	55.7	—
North Carolina	60.2	65.5	62.8	58.4	—
North Dakota	86.9	87.8	81.0	82.5	89.7
Ohio	70.8	76.4	72.2	69.7	—
Oklahoma	71.8	74.8	69.6	71.6	80.9
Oregon	67.1	69.1	65.1	65.0	—
Pennsylvania	74.3	79.8	75.3	74.9	83.4
Rhode Island	69.4	72.9	68.9	66.6	79.6
South Carolina	52.4	59.6	56.9	51.6	—
South Dakota	80.7	84.2	77.3	77.2	—
Tennessee	57.1	61.6	59.2	49.2	—
Texas	58.9	67.0	60.4	59.5	—
Utah	80.7	81.1	74.5	81.1	—
Vermont	81.8	83.6	76.0	78.3	—
Virginia	73.3	76.6	71.1	70.8	—
Washington	71.4	74.0	65.9	70.6	—
West Virginia	73.5	76.7	79.0	76.0	—
Wisconsin	79.5	83.7	75.9	77.5	—
Wyoming	77.7	78.4	72.9	74.2	—

— Not available.

[1] FGR = Freshman Graduation Rate, all freshmen; AFGR = Averaged Freshman Graduation Rate, first-time freshmen; GGI = Greene's Graduation Indicator; SCPI = Swanson's Cumulative Promotion Indicator; GLI = CCD Graduation Leaver Indicator.
[2] First-time 9th-grade counts estimated using Greene's smoothed 9th-grade estimate.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Common Core of Data (CCD), "State Nonfiscal Survey of Public Elementary/Secondary Education," school years 1992-93 through 1997-98 and "Local Education Agency Universe Survey Dropout and Completion Data File," school years 1992-93 through 1996-97.

Table 4.10. Graduation indicators, by indicator and state: School year 1997-98

State	Indicator[1]				
	FGR	AFGR[2]	GGI[2]	SCPI	GLI
Alabama	59.8	64.4	62.3	57.8	70.8
Alaska	65.0	68.9	62.9	69.4	—
Arizona	61.1	65.6	58.5	62.0	—
Arkansas	72.7	73.9	70.6	71.0	75.0
California	66.0	69.6	62.8	67.4	—
Colorado	71.3	73.9	65.5	67.9	—
Connecticut	72.7	76.9	72.0	72.2	80.8
Delaware	68.0	74.1	67.0	62.1	79.0
District of Columbia	53.7	53.9	57.5	36.1	—
Florida	57.0	62.1	54.8	51.8	—
Georgia	51.3	58.2	53.6	51.3	62.0
Hawaii	62.0	68.8	64.5	60.1	—
Idaho	78.5	79.7	75.5	77.8	—
Illinois	73.3	76.8	74.0	70.4	71.0
Indiana	70.3	73.8	72.7	68.7	—
Iowa	81.9	83.9	79.7	80.9	86.7
Kansas	72.8	76.0	70.8	77.6	—
Kentucky	65.6	70.2	68.6	60.8	—
Louisiana	54.2	61.3	61.6	55.3	65.1
Maine	77.6	78.5	75.3	74.9	85.1
Maryland	69.5	76.2	69.9	74.0	79.8
Massachusetts	75.1	78.3	73.0	72.7	83.9
Michigan	69.1	74.6	71.1	70.9	—
Minnesota	83.9	85.0	76.8	82.8	73.9
Mississippi	54.5	59.8	59.5	54.9	70.2
Missouri	71.0	75.2	72.1	71.8	76.5
Montana	79.7	82.2	77.7	78.6	—
Nebraska	84.7	85.6	79.1	80.7	81.8
Nevada	69.7	70.6	59.4	69.0	62.9
New Hampshire	74.2	76.7	68.6	73.4	—
New Jersey	73.0	76.3	72.3	72.7	81.3
New Mexico	56.4	61.6	58.9	57.3	67.2
New York	58.2	63.9	61.4	52.7	—
North Carolina	59.6	65.6	62.7	57.5	—
North Dakota	85.4	86.7	81.3	82.5	89.3
Ohio	73.0	77.0	72.8	69.3	—
Oklahoma	71.9	75.1	70.1	72.9	78.2
Oregon	66.9	69.0	64.6	65.7	—
Pennsylvania	74.0	79.4	75.3	73.7	82.8
Rhode Island	68.5	72.5	69.0	68.3	80.1
South Carolina	52.2	59.3	57.1	49.1	—
South Dakota	75.0	77.7	72.8	61.9	83.9
Tennessee	53.8	58.4	58.9	55.9	77.5
Texas	61.0	69.4	62.7	60.5	—
Utah	80.6	80.7	76.6	81.4	78.9
Vermont	80.5	83.9	76.7	74.7	81.5
Virginia	72.4	76.6	72.2	72.4	80.2
Washington	70.9	73.3	65.5	67.8	—
West Virginia	74.6	77.4	79.9	74.7	83.8
Wisconsin	78.8	83.1	77.5	76.0	72.0
Wyoming	77.4	77.1	73.9	74.7	76.2

— Not available.

[1] FGR = Freshman Graduation Rate, all freshmen; AFGR = Averaged Freshman Graduation Rate, first-time freshmen; GGI = Greene's Graduation Indicator; SCPI = Swanson's Cumulative Promotion Indicator; GLI = CCD Graduation Leaver Indicator.

[2] First-time 9th-grade counts estimated using Greene's smoothed 9th-grade estimate.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Common Core of Data (CCD), "State Nonfiscal Survey of Public Elementary/Secondary Education," school years 1993-94 through 1998-99 and "Local Education Agency Universe Survey Dropout and Completion Data File," school years 1993-94 through 1997-98.

Table 4.11. Graduation indicators, by indicator and state: School year 1998-99

State	Indicator[1]				
	FGR	AFGR[2]	GGI[2]	SCPI	GLI
Alabama	55.5	61.3	61.7	55.3	71.3
Alaska	66.4	70.0	62.3	61.0	—
Arizona	59.9	62.3	53.7	54.3	—
Arkansas	72.2	73.7	72.4	73.8	74.9
California	67.1	71.1	64.1	68.4	—
Colorado	70.3	73.4	65.8	68.3	—
Connecticut	71.3	76.0	70.5	73.4	82.2
Delaware	64.1	70.4	66.4	58.5	79.2
District of Columbia	49.6	52.0	61.9	79.1	—
Florida	56.0	61.4	54.5	52.3	—
Georgia	50.4	57.5	53.4	50.7	62.2
Hawaii	59.7	67.5	65.2	59.5	—
Idaho	77.8	79.5	76.8	79.6	—
Illinois	71.8	76.0	73.9	70.6	70.4
Indiana	70.3	74.3	74.5	70.4	—
Iowa	81.1	83.3	81.6	80.6	87.1
Kansas	74.0	76.7	71.0	73.7	—
Kentucky	64.4	70.0	70.1	61.7	—
Louisiana	53.8	61.1	63.1	56.7	59.3
Maine	74.2	74.7	72.1	73.5	85.6
Maryland	70.5	76.6	69.8	70.5	80.6
Massachusetts	74.5	77.9	72.8	73.5	84.4
Michigan	69.4	73.9	70.0	68.7	—
Minnesota	84.7	86.0	79.4	84.9	75.1
Mississippi	54.0	59.2	60.5	57.3	70.0
Missouri	71.6	75.8	73.4	71.3	77.5
Montana	78.3	81.3	79.2	78.1	—
Nebraska	86.3	87.3	82.8	82.1	82.5
Nevada	70.5	71.0	60.1	68.9	64.1
New Hampshire	72.7	75.3	68.1	72.8	—
New Jersey	74.2	77.5	73.9	72.2	82.5
New Mexico	57.8	63.3	61.8	58.5	68.2
New York	56.1	62.5	61.4	53.5	—
North Carolina	58.6	65.4	62.2	58.7	—
North Dakota	84.5	85.6	82.8	84.8	89.6
Ohio	69.2	75.0	74.7	70.0	—
Oklahoma	72.9	76.4	72.2	72.2	78.7
Oregon	66.3	68.2	63.6	67.5	—
Pennsylvania	73.7	79.1	76.5	75.1	83.7
Rhode Island	67.2	72.2	68.1	67.8	81.7
South Carolina	51.8	59.1	57.7	45.6	—
South Dakota	71.2	74.2	77.1	76.6	84.7
Tennessee	53.9	58.5	59.2	64.5	71.7
Texas	60.6	69.2	63.7	60.6	—
Utah	81.4	81.6	79.9	82.5	78.7
Vermont	79.2	81.9	76.1	78.7	81.2
Virginia	71.6	76.3	72.1	70.3	79.6
Washington	70.6	73.2	67.0	70.2	—
West Virginia	75.1	77.9	81.4	71.5	83.1
Wisconsin	78.1	82.6	79.2	76.3	73.1
Wyoming	76.5	76.6	75.7	70.7	76.8

— Not available.

[1] FGR = Freshman Graduation Rate, all freshmen; AFGR = Averaged Freshman Graduation Rate, first-time freshmen; GGI = Greene's Graduation Indicator; SCPI = Swanson's Cumulative Promotion Indicator; GLI = CCD Graduation Leaver Indicator.

[2] First-time 9th-grade counts estimated using Greene's smoothed 9th-grade estimate.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Common Core of Data (CCD), "State Nonfiscal Survey of Public Elementary/Secondary Education," school years 1994-95 through 1999-2000 and "Local Education Agency Universe Survey Dropout and Completion Data File," school years 1994-95 through1998-99.

Table 4.12. Graduation indicators, by indicator and state: School year 1999-2000

State	Indicator[1]				
	FGR	AFGR[2]	GGI[2]	SCPI	GLI
Alabama	58.9	64.1	66.0	61.9	74.4
Alaska	62.3	66.7	61.1	58.0	—
Arizona	58.7	63.6	58.8	61.8	—
Arkansas	73.1	74.6	74.4	72.4	74.2
California	67.5	71.7	65.6	67.9	—
Colorado	70.4	74.1	68.4	72.3	—
Connecticut	76.7	81.9	75.4	80.4	84.5
Delaware	60.7	66.8	66.8	67.5	77.1
District of Columbia	52.0	54.5	55.4	37.5	—
Florida	55.2	61.0	54.8	49.7	—
Georgia	52.3	59.7	56.1	52.6	65.0
Hawaii	64.1	70.9	69.4	62.2	—
Idaho	76.9	79.4	78.9	76.0	—
Illinois	71.0	76.3	75.7	72.2	68.9
Indiana	67.9	71.8	72.8	67.6	—
Iowa	80.8	83.1	83.0	80.9	87.8
Kansas	73.7	77.1	72.8	74.6	—
Kentucky	64.7	69.7	69.9	69.2	—
Louisiana	54.9	62.2	64.9	57.3	61.0
Maine	76.0	75.9	72.8	74.7	85.5
Maryland	72.1	77.6	71.4	71.2	81.1
Massachusetts	74.3	78.0	72.6	74.6	84.5
Michigan	69.0	75.3	74.2	77.0	—
Minnesota	83.7	84.9	80.2	84.6	74.8
Mississippi	54.2	59.4	61.5	57.2	69.8
Missouri	72.3	76.3	73.9	72.7	79.2
Montana	77.9	80.8	80.6	78.7	—
Nebraska	83.8	85.7	83.7	81.3	84.0
Nevada	68.6	69.7	60.3	55.5	66.4
New Hampshire	73.6	76.1	69.2	73.8	—
New Jersey	79.7	83.6	80.9	84.6	83.4
New Mexico	58.6	64.7	64.8	61.3	70.8
New York	55.4	61.8	60.9	55.2	—
North Carolina	58.7	65.8	62.5	60.1	—
North Dakota	84.1	86.0	86.4	83.0	88.9
Ohio	69.3	75.2	75.9	71.2	—
Oklahoma	72.5	75.8	73.6	71.0	78.8
Oregon	67.2	69.6	65.9	66.5	—
Pennsylvania	73.8	78.7	76.8	74.0	83.9
Rhode Island	68.1	72.8	69.2	69.9	80.6
South Carolina	51.0	58.6	59.3	50.1	—
South Dakota	73.7	77.6	82.8	78.5	85.4
Tennessee	53.9	59.5	58.5	46.3	71.2
Texas	61.9	71.0	66.7	63.8	—
Utah	82.1	82.5	84.0	83.0	79.9
Vermont	77.7	81.0	76.6	74.5	81.0
Virginia	72.0	76.9	73.3	72.2	79.4
Washington	70.8	73.7	68.4	67.2	—
West Virginia	74.5	76.7	82.5	70.3	82.5
Wisconsin	78.0	82.7	80.5	78.8	71.0
Wyoming	75.0	76.3	79.5	76.4	77.4

— Not available.

[1] FGR = Freshman Graduation Rate, all freshmen; AFGR = Averaged Freshman Graduation Rate, first-time freshmen; GGI = Greene's Graduation Indicator; SCPI = Swanson's Cumulative Promotion Indicator; GLI = CCD Graduation Leaver Indicator.

[2] First-time 9th-grade counts estimated using Greene's smoothed 9th-grade estimate.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Common Core of Data (CCD), "State Nonfiscal Survey of Public Elementary/Secondary Education," school years 1995-96 through 2000-01 and "Local Education Agency Universe Survey Dropout and Completion Data File," school years 1995-96 through1999-2000.

Table 4.13. Graduation indicators, by indicator and state: School year 2000-01

State	Indicator[1]				
	FGR	AFGR[2]	GGI[2]	SCPI	GLI
Alabama	58.2	63.7	65.8	61.0	74.3
Alaska	63.8	68.0	63.7	61.4	—
Arizona	70.0	74.2	68.4	81.2	—
Arkansas	72.7	73.9	75.2	75.2	73.8
California	67.6	71.6	66.4	67.7	—
Colorado	69.2	73.2	67.8	68.9	—
Connecticut	72.6	77.5	70.3	73.3	85.4
Delaware	64.5	71.0	69.6	65.5	77.8
District of Columbia	54.5	60.2	68.5	61.1	—
Florida	54.6	61.2	55.7	53.2	—
Georgia	51.4	58.7	55.7	54.5	64.2
Hawaii	60.9	68.3	70.2	66.0	—
Idaho	78.0	79.6	80.5	81.8	—
Illinois	70.7	75.6	73.7	73.2	69.7
Indiana	67.6	72.1	74.1	69.6	—
Iowa	80.4	82.8	83.3	76.6	88.1
Kansas	74.0	76.5	73.2	74.7	—
Kentucky	63.3	69.8	70.0	51.4	—
Louisiana	57.1	63.7	69.1	63.6	63.2
Maine	75.3	76.4	73.6	77.2	85.9
Maryland	73.2	78.7	73.2	73.6	82.6
Massachusetts	74.9	78.9	73.4	68.6	—
Michigan	70.7	75.4	70.5	70.3	—
Minnesota	82.3	83.6	80.4	84.2	77.0
Mississippi	55.0	59.7	62.2	56.5	71.0
Missouri	71.7	75.5	73.5	70.9	80.8
Montana	77.1	80.0	81.2	79.0	—
Nebraska	80.0	83.8	84.1	81.7	82.9
Nevada	68.5	70.0	60.5	54.7	70.3
New Hampshire	75.0	77.8	71.5	74.4	—
New Jersey	81.9	85.4	81.3	94.8	85.0
New Mexico	61.0	65.9	66.3	62.3	72.4
New York	54.7	61.5	61.3	56.8	—
North Carolina	59.4	66.5	63.0	63.4	—
North Dakota	84.0	85.4	88.8	83.2	90.1
Ohio	70.6	76.5	77.3	73.2	—
Oklahoma	73.0	75.8	76.3	73.3	79.2
Oregon	65.9	68.3	65.5	71.1	—
Pennsylvania	74.1	79.0	77.5	77.3	83.8
Rhode Island	68.1	73.5	69.7	67.2	79.7
South Carolina	48.4	56.5	57.2	53.4	—
South Dakota	71.5	77.4	84.6	81.9	84.4
Tennessee	54.4	59.0	58.7	63.4	72.1
Texas	61.9	70.8	67.2	65.8	—
Utah	81.4	81.6	84.7	82.6	81.5
Vermont	76.6	80.2	79.2	81.4	80.7
Virginia	72.7	77.5	73.2	71.5	80.8
Washington	65.9	69.2	66.1	66.1	—
West Virginia	73.2	75.9	84.0	71.1	83.3
Wisconsin	78.2	83.3	81.4	79.6	72.8
Wyoming	72.6	73.4	77.6	73.7	76.4

— Not available.

[1] FGR = Freshman Graduation Rate, all freshmen; AFGR = Averaged Freshman Graduation Rate, first-time freshmen; GGI = Greene's Graduation Indicator; SCPI = Swanson's Cumulative Promotion Indicator; GLI = CCD Graduation Leaver Indicator.

[2] First-time 9th-grade counts estimated using Greene's smoothed 9th-grade estimate.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Common Core of Data (CCD), "State Nonfiscal Survey of Public Elementary/Secondary Education," school years 1996-97 through 2001-02 and "Local Education Agency Universe Survey Dropout and Completion Data File," school years 1996-97 through 2000-01.

Table 4.14. Graduation indicators, by indicator and state: School year 2001-02

State	Indicator[1]				
	FGR	AFGR[2]	GGI[2]	SCPI	GLI
Alabama	57.2	62.1	63.4	64.0	73.5
Alaska	60.7	65.9	64.1	61.8	—
Arizona	69.2	74.7	67.3	88.6	—
Arkansas	73.9	74.8	75.5	74.5	74.2
California	68.5	72.7	68.0	70.6	—
Colorado	69.8	74.7	69.3	70.5	—
Connecticut	74.9	79.7	72.3	76.3	86.5
Delaware	62.0	69.5	67.6	62.0	79.7
District of Columbia	66.8	68.4	70.0	102.4	—
Florida	55.7	63.4	57.1	56.9	—
Georgia	53.6	61.1	57.4	56.7	66.1
Hawaii	64.8	72.1	73.1	65.9	—
Idaho	77.2	79.3	80.4	78.2	—
Illinois	72.1	77.1	73.6	73.5	77.7
Indiana	68.3	73.1	74.9	73.7	—
Iowa	81.0	84.1	86.3	83.0	88.4
Kansas	73.6	77.1	75.6	76.1	—
Kentucky	63.9	69.8	73.8	72.7	—
Louisiana	57.8	64.4	69.6	64.1	65.5
Maine	74.7	75.6	73.0	77.4	85.0
Maryland	73.5	79.7	75.0	75.3	83.1
Massachusetts	73.7	77.6	73.4	76.0	—
Michigan	67.6	72.9	68.2	72.2	—
Minnesota	82.3	83.9	81.3	84.0	78.2
Mississippi	57.3	61.2	63.5	59.8	74.0
Missouri	72.8	76.8	75.4	77.2	82.0
Montana	77.1	79.8	81.8	78.6	—
Nebraska	80.0	83.9	84.8	82.3	83.5
Nevada	70.0	71.9	62.3	59.6	72.0
New Hampshire	74.9	77.8	72.4	78.2	—
New Jersey	82.7	85.8	77.3	86.1	87.5
New Mexico	61.5	67.4	68.1	64.3	73.9
New York	58.7	66.4	65.6	62.5	—
North Carolina	60.6	68.2	63.4	64.7	—
North Dakota	83.7	85.0	90.7	84.7	90.3
Oklahoma	73.0	75.8	76.3	73.3	79.2
Oregon	65.9	68.3	65.5	71.1	—
Pennsylvania	74.1	79.0	77.5	77.3	83.8
Rhode Island	68.1	73.5	69.7	67.2	79.7
South Carolina	48.4	56.5	57.2	53.4	—
South Dakota	71.5	77.4	84.6	81.9	84.4
Tennessee	54.4	59.0	58.7	63.4	72.1
Texas	61.9	70.8	67.2	65.8	—
Utah	81.4	81.6	84.7	82.6	81.5
Vermont	76.6	80.2	79.2	81.4	80.7
Virginia	72.7	77.5	73.2	71.5	80.8
Washington	65.9	69.2	66.1	66.1	—
West Virginia	73.2	75.9	84.0	71.1	83.3
Wisconsin	78.2	83.3	81.4	79.6	72.8
Wyoming	72.6	73.4	77.6	73.7	76.4

— Not available.

[1] FGR = Freshman graduation rate, all freshmen; AFGR = Averaged freshman graduation rate, first-time freshmen; GLI = CCD Graduation leaver indicator; SCPI = Swanson's cumulative promotion indicator; GGI = Greene's graduation indicator.

[2] First-time 9th-grade counts estimated using Greene's smoothed 9th-grade estimate.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Common Core of Data (CCD), "State Nonfiscal Survey of Public Elementary/Secondary Education," school years 1997-98 through 2002-03 and "Local Education Agency Universe Survey Dropout and Completion Data File," school years 1997-98 through 2000-01.

Table 4.15. Minimum, maximum, range, and mean graduation indicator across years, by indicator and state: 1995-96 through 2001-02

	Indicator[1]																			
	FGR				AFGR[2]				GGI[2]				SCPI				GLI[3]			
State	Min	Max	Range	Mean	Min	Max	Range	Mean	Min	Max	Range	Mean	Min	Max	Range	Mean	Min	Max	Range	Mean
Alabama	55.5	59.8	4.3	57.8	61.3	64.4	3.1	63.0	59.5	66.0	6.5	62.6	55.3	64.0	8.8	59.0	70.8	74.4	3.6	72.9
Alaska	60.7	66.4	5.7	63.8	65.9	70.0	4.1	67.9	61.1	64.1	3.0	62.5	58.0	69.4	11.4	63.1	—	—	—	—
Arizona	57.9	70.0	12.1	62.6	60.8	74.7	13.9	66.6	53.7	68.4	14.8	59.7	54.3	88.6	34.2	67.1	—	—	—	—
Arkansas	69.4	74.4	5.1	72.6	70.6	74.9	4.3	73.7	67.2	75.5	8.3	72.2	70.9	75.2	4.3	72.8	73.9	80.6	6.7	76.1
California	64.0	68.5	4.5	66.5	67.6	72.7	5.1	70.4	62.8	68.0	5.2	64.8	66.4	70.6	4.1	67.8	—	—	—	—
Colorado	69.2	72.1	2.9	70.7	73.2	74.8	1.6	74.1	65.5	69.3	3.8	67.3	67.9	72.3	4.4	69.9	—	—	—	—
Connecticut	71.3	76.7	5.5	73.3	76.0	81.9	5.9	77.8	70.3	75.4	5.1	72.3	70.7	80.4	9.7	73.9	80.7	86.5	5.9	83.3
Delaware	60.7	68.0	7.3	64.5	66.8	74.1	7.3	70.6	63.5	69.6	6.1	66.4	58.5	67.5	9.0	63.4	77.1	79.7	2.6	78.7
District of Columbia	49.6	66.8	17.2	54.5	49.7	68.4	18.7	56.2	54.5	70.0	15.5	61.1	36.1	102.4	66.3	59.2	—	—	—	—
Florida	54.6	57.8	3.2	56.3	61.0	63.4	2.4	62.0	54.5	57.1	2.6	55.6	49.7	56.9	7.2	53.4	—	—	—	—
Georgia	50.4	55.0	4.6	52.7	57.5	62.0	4.5	59.9	53.4	57.4	4.0	55.6	50.7	56.7	6.0	53.4	62.0	66.1	4.1	63.9
Hawaii	59.7	70.0	10.3	63.5	67.5	74.5	7.0	70.2	64.5	73.1	8.6	67.9	57.5	66.0	8.5	62.0	—	—	—	—
Idaho	76.9	79.2	2.2	78.0	79.3	80.5	1.2	79.7	73.2	80.5	7.3	77.0	74.5	81.8	7.3	78.2	—	—	—	—
Illinois	70.7	73.3	2.6	72.0	75.2	77.1	1.9	76.2	71.6	75.7	4.1	73.5	70.3	76.1	5.8	72.3	68.9	77.7	8.8	71.6
Indiana	67.6	70.3	2.7	69.0	71.8	74.3	2.5	73.2	71.0	74.9	3.9	73.2	67.6	73.7	6.1	69.7	—	—	—	—
Iowa	80.4	82.6	2.2	81.5	82.8	84.6	1.8	83.7	77.4	86.3	8.9	81.4	76.6	83.0	6.4	80.6	86.7	92.7	6.0	88.5
Kansas	72.8	74.3	1.5	73.7	76.0	77.1	1.2	76.8	70.8	75.6	4.7	72.2	73.4	77.6	4.3	74.8	—	—	—	—
Kentucky	63.3	66.9	3.6	65.0	69.7	71.3	1.6	70.3	68.6	73.8	5.2	70.2	51.4	72.7	21.3	64.1	—	—	—	—
Louisiana	52.3	57.8	5.6	55.0	59.3	64.4	5.1	62.0	57.9	69.6	11.7	63.6	50.1	64.1	13.9	57.2	59.3	65.5	6.2	62.8
Maine	71.2	77.7	6.5	74.3	73.7	78.5	4.7	75.7	72.1	78.5	6.3	74.6	73.5	77.4	3.9	75.8	85.0	85.9	0.9	85.4
Maryland	69.5	73.5	4.0	71.6	76.2	79.8	3.6	77.7	69.8	75.0	5.2	71.5	70.5	75.3	4.8	72.6	79.8	83.1	3.3	81.4
Massachusetts	73.7	75.2	1.5	74.7	77.6	78.9	1.3	78.1	72.6	74.8	2.2	73.5	68.6	76.0	7.3	73.3	83.0	84.8	1.8	84.3
Michigan	66.6	70.7	4.1	68.6	71.4	75.4	4.0	73.9	68.2	74.2	6.0	70.3	62.3	77.0	14.7	70.9	—	—	—	—
Minnesota	77.3	85.3	8.0	82.8	78.6	86.1	7.5	84.0	71.0	81.3	10.4	78.1	78.7	85.5	6.8	83.5	73.9	78.2	4.3	75.8
Mississippi	54.0	57.3	3.3	54.9	59.2	61.2	2.0	59.8	58.2	63.5	5.3	60.6	51.9	59.8	7.9	56.0	69.1	74.0	4.8	70.5
Missouri	70.2	72.8	2.7	71.5	74.7	76.8	2.1	75.6	70.1	75.4	5.3	72.8	70.6	77.2	6.6	72.2	74.4	82.0	7.7	77.9
Montana	77.1	82.2	5.1	79.0	79.8	83.9	4.1	81.6	76.4	81.8	5.5	79.2	77.4	79.0	1.6	78.3	—	—	—	—
Nebraska	80.0	86.3	6.3	82.9	83.8	87.3	3.4	85.3	77.7	84.8	7.1	81.6	80.7	83.8	3.1	82.1	81.3	84.0	2.7	82.6
Nevada	65.2	72.8	7.6	69.3	65.8	73.3	7.4	70.3	54.9	62.3	7.4	59.6	54.7	69.0	14.3	62.9	62.8	72.0	9.3	66.0
New Hampshire	72.8	75.0	2.2	74.2	75.3	77.8	2.5	76.9	68.1	72.4	4.3	70.1	72.8	78.2	5.4	74.2	—	—	—	—
New Jersey	73.0	82.7	9.7	78.5	76.3	85.8	9.5	82.2	72.3	81.6	9.3	78.1	72.2	94.8	22.6	81.4	81.3	87.5	6.2	83.9
New Mexico	56.4	61.5	5.1	58.8	61.6	67.4	5.8	64.1	57.6	68.1	10.5	62.3	53.7	64.3	10.6	58.8	66.8	73.9	7.2	69.8
New York	53.5	59.2	5.8	56.5	60.5	65.3	4.8	62.7	59.7	63.0	3.3	61.2	52.7	56.9	4.2	55.1	—	—	—	—
North Carolina	58.6	61.3	2.7	59.8	65.4	68.2	2.8	66.2	62.2	64.6	2.3	63.0	57.5	64.7	7.2	60.1	—	—	—	—
North Dakota	83.7	89.0	5.3	85.4	85.0	89.5	4.5	86.6	81.0	90.7	9.8	84.9	82.5	89.0	6.5	84.2	88.9	90.3	1.4	89.6
Ohio	69.2	73.0	3.8	70.6	74.5	77.5	2.9	76.0	70.8	77.3	6.6	74.4	66.9	74.3	7.4	70.7	—	—	—	—
Oklahoma	71.8	73.0	1.2	72.5	74.8	76.4	1.5	75.6	69.6	77.9	8.3	72.8	70.7	73.9	3.2	72.2	78.2	80.9	2.7	79.2
Oregon	65.9	68.5	2.6	66.9	68.2	71.0	2.8	69.1	63.6	68.2	4.6	65.4	65.0	72.1	7.2	68.0	—	—	—	—
Pennsylvania	73.7	75.8	2.1	74.3	78.7	80.2	1.5	79.5	75.3	77.5	2.2	76.3	73.7	77.3	3.6	75.0	82.8	85.0	2.2	83.8
Rhode Island	67.2	70.4	3.2	68.7	72.2	75.7	3.5	73.2	68.1	72.1	4.0	69.5	66.6	73.3	6.8	68.7	79.6	81.7	2.1	80.6
South Carolina	48.4	54.1	5.7	51.3	56.5	60.9	4.4	58.8	56.9	59.3	2.4	57.6	45.6	53.4	7.8	50.3	—	—	—	—
South Dakota	71.2	85.6	14.5	76.5	74.2	84.5	10.3	79.2	71.8	84.6	12.8	78.2	61.9	84.5	22.5	76.4	83.9	85.4	1.5	84.6
Tennessee	53.8	62.1	8.3	55.9	58.4	66.6	8.2	60.5	57.3	64.1	6.8	59.4	46.3	64.5	18.1	56.6	71.2	77.5	6.3	73.4
Texas	58.4	64.2	5.8	61.0	66.1	73.5	7.4	69.6	60.4	69.0	8.6	64.3	58.6	67.6	9.0	62.3	—	—	—	—
Utah	76.8	82.1	5.3	80.5	76.9	82.5	5.6	80.7	69.0	84.7	15.7	78.9	75.3	83.0	7.7	81.1	78.7	83.4	4.7	80.5
Vermont	76.6	89.3	12.7	80.5	80.2	85.3	5.1	82.6	70.4	81.5	11.1	76.6	74.5	83.8	9.3	78.3	80.7	81.5	0.9	81.0
Virginia	71.6	73.5	1.9	72.4	76.2	77.5	1.3	76.7	71.1	73.3	2.1	72.2	70.3	72.6	2.3	71.5	79.4	81.7	2.3	80.3
Washington	65.9	72.2	6.4	70.0	69.2	75.5	6.3	73.0	65.5	69.7	4.2	67.1	66.1	71.3	5.2	69.1	—	—	—	—
West Virginia	71.0	75.1	4.1	73.8	74.2	77.9	3.7	76.5	79.0	84.0	5.0	81.1	70.3	76.0	5.7	73.0	82.5	83.8	1.3	83.1
Wisconsin	78.0	80.0	2.0	78.8	82.6	84.8	2.2	83.4	75.4	82.3	6.9	78.9	76.0	80.6	4.6	78.1	71.0	75.8	4.8	72.9
Wyoming	72.6	77.8	5.2	75.7	73.4	78.4	5.0	76.3	71.7	80.2	8.5	75.9	70.7	76.4	5.7	74.1	76.2	77.4	1.2	76.7

— Not available.

[1] FGR = Freshman Graduation Rate, all freshmen; AFGR= Averaged Freshman Graduation Rate, first-time freshmen; GGI = Greene's Graduation Indicator; SCPI = Swanson's Cumulative Promotion indicator; GLI = CCD Graduation Leaver Indicator.

[2] First-time 9th-grade counts estimated using Greene's smoothed 9th-grade estimate.

[3] Data are from 1997-98 to 2001-02.

NOTE: In CCD State Non-fiscal data, grade-level enrollments were adjusted to include ungraded students.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Common Core of Data (CCD), "Local Education Agency Universe Survey," school years 1996-97 through 2002-03; "Local Education Agency (School District) Universe Survey Dropout and Completion Data" 1991-92 through 2001-02; and "Public Elentary/Secondary School Universe Survey," school years 1991-92 through 2002-03.

In general, at the state level, when estimates for GLI are available they are higher than those from the other four indicators. Recall from chapter 2 that GLI was dropped from further analysis once it was determined that it was consistently higher than the true cohort on-time graduation rate and each of the other proxy rates. This can be attributed to the fact that GLI is a leaver rate, rather than an on-time estimate, and does not include students who do not complete on time in the denominator. This, taken together with the fact that GLI is only available for a subset of states, leads to a decision to drop GLI from further analysis here as well.

Next, taking AFGR as the standard, a comparison of the state-level estimates from FGR with those from AFGR over the 7-year period shows that FGR and AFGR were highly correlated (r = .97 to .98); as a result some 95 to 97 percent of the variation in AFGR was explained by the variation in FGR (table 4.16). A 1 percentage point increase in FGR was associated with eight- to nine-tenths of a percentage point increment in AFGR. Approximately 80 percent of the standard deviation in AFGR was accounted for by FGR (the inverse of the coefficient of alienation).

The same comparisons of the state-level estimates from GGI with those from AFGR showed correlations between .88 and .94, with 77 to 88 percent of the variation in AFGR explained by GGI. For the first 3 years of the 7-year period, a 1 percentage point increase in GGI was associated with a 1 percentage point increment in AFGR, but at the end of the following 4 years a 1 percentage point increase in GGI was associated with an increment in AFGR of approximately eight-tenths of a percentage point.

The results of a comparison of the state level estimates from SCPI with those from AFGR were more variable. The correlation coefficients ranged from .77 to .96, with the amount of variation in AFGR that was explained by SCPI ranging from .60 to .92 percent. Over the 7 years the amount of increase in AFGR associated with a 1 percentage point increment in SCPI ranged from under six-tenths to eight-tenths of a percentage point.

Although it is not possible to compare the available proxy measures for individual states directly with the true cohort on-time graduation rates for those states, this analysis compared the performance of FGR, GGI, and SCPI to that of AFGR at the state level to determine if the relative performance of the indicators is the same as that observed in states 1 and 2. The analysis showed that the relative positions of the measures are consistent with the analysis of the data from States 1 and 2. Using the available state-level CCD data, FGR exhibited performance that was most similar to AFGR. GGI did not perform as well as FGR, but outperformed SCPI, and SCPI then had the weakest relationship with AFGR (table 4.16).

Table 4.16. Regression estimates of AFGR on proxy graduation indicators FGR, GGI, and SCPI across states, by indicator and school year: 1995-96 through 2001-02

Statistic	Indicator[1]		
	FGR	GGI[2]	SCPI
1995-96			
Correlation coefficient	.98	.91	.92
R square	.95	.83	.85
Slope	.86	1.03	.80
Standard deviation	1.81	3.49	3.32
1996-97			
Correlation coefficient	.98	.92	.96
R square	.96	.84	.92
Slope	.87	1.01	.81
Standard deviation	1.52	3.19	2.26
1997-98			
Correlation coefficient	.98	.94	.93
R square	.96	.88	.87
Slope	.86	1.03	.75
Standard deviation	1.58	2.78	2.89
1998-99			
Correlation coefficient	.98	.90	.80
R square	.96	.82	.65
Slope	.85	.94	.70
Standard deviation	1.59	3.55	4.91
1999-2000			
Correlation coefficient	.98	.92	.95
R square	.97	.85	.90
Slope	.85	.88	.72
Standard deviation	1.51	3.11	2.52
2000-01			
Correlation coefficient	.98	.88	.87
R square	.96	.77	.77
Slope	.84	.82	.70
Standard deviation	1.47	3.66	3.72
2001-02			
Correlation coefficient	.97	.88	.77
R square	.95	.77	.60
Slope	.83	.79	.57
Standard deviation	1.63	3.49	4.64

[1] FGR = Freshman Graduation Rate, all freshmen; GGI = Greene's Graduation Indicator; SCPI = Swanson's Cumulative Promotion Indicator; AFGR = Averaged Freshman Graduation Rate, first-time freshmen.
[2] First-time 9th-grade counts estimated using Greene's smoothed 9th-grade estimate.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Common Core of Data (CCD), "Local Education Agency Universe Survey," school years 1991-92 through 2002; “Local Education Agency (School District) Dropout and Completion Data,” school years 1991-92 through 1996-97; "Local Education Agency (School District) Universe Survey Dropout and Completion Data," school years 1997-98 through 2001; and “State Nonfiscal Survey of Public Elementary/Secondary Education,” school years 1991-92 through 2002-03.

4.4. Graduation rates at district level

Missing data for individual schools and districts are not imputed in the school and district level CCD data files. As a result, in the data required for an analysis of the same 7 years at the district level, New Jersey was missing both enrollment and diploma counts in 1 year and Arizona, Minnesota, and Washington were each missing diploma counts in 1 year. There are also instances where the data are missing for some districts within reporting states. Over the 9 years of enrollment data required to calculate the proxy graduation indicators, there were 5 years with no additional missing enrollment data (i.e., beyond the states listed above) and the amount of missing district enrollment data ranged from 0.2 to 0.4 percent in the other 4 years. Over the 7 years of graduate data required to calculate the proxy graduation indicators, there was 1 year with no additional missing graduate data and the amount of missing graduate data in the other years ranged from 0.3 to 1.9 percent.

When the available data were used to compute FGR, AFGR, GGI, and SCPI for each district with available data for each of the 7 school years from 1995-96 through 2001-02 a review of those rates showed that the maximum rates frequently exceed 100 percent, and the minimum rates are often as low as 0. This occurs for some of the districts for FGR, AFGR, GGI, and SCPI in each of the 7 years. Thus, although these rates produce results that are within the expected range of 0 to 100 percent at the national and state levels, this is not necessarily the case at the school district level.

Two factors may contribute to the extreme values observed for some school districts—incomplete reporting of either enrollment or graduate data at the district level and population changes. Either of these two factors is more likely to be masked as a result of aggregation when data are reported at the state or national levels, but are more evident at the school district level. For example, estimates over 100 percent arise when the estimate of freshman 4 years earlier is smaller than the number of graduates in the year in question.[19] This could happen as a result of incomplete counting of freshmen in a school district 4 years earlier or could happen when the number of high school age students moving into the district during the 4 years between the freshman and senior years exceeds the number of high school age students moving out of the district during the same period, alternatively it could happen in the case of a merge of two school districts.

On the other hand, graduation rates could be depressed by poor data quality or population changes. For example, graduation rates of zero can arise if all of the members of the senior class move out of the district, drop out and/or fail to graduate in a particular year. In a similar vein, if the number of high school age students moving out of the district during the 4 years between the freshman and senior years exceeds the number of high school age students moving into the district during the same period the resulting graduation rates would be unexpectedly low.[20]

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[19] The percent of districts with one or more proxy graduation indicator over 100 percent was between 15 and 16 percent over the 4 years from 1997-98 through 2000-01, the comparable value was 19 percent for 1996-97 and 2001-02, and it was 21 percent in 1995-96.

[20] In each of the 7 years, between 0.5 and 1.0 percent of the districts had one or more proxy graduation indicators below 25 percent.

Of course, similar changes could also inflate or deflate graduation rates that are not at the extremes of the distribution of rates. While it is possible to review changes in reporting practices or changes in migration patterns of the high school age population at the district level, they are not documented in the national dataset. In general, the smaller the school district, the more sensitive the rates are likely to be to fluctuations in the relevant enrollment or graduation data. As a result, there is no context for evaluating the validity of these rates at the individual district level; this is most likely to be problematic in the case of small districts. Because of these data limitations, an analysis of the CCD data for school districts across the nation is not included in this report.

4.5. Summary

As described at the beginning of this chapter, before drawing comparisons across different proxy graduation indicators, it is important to understand and clearly describe the data elements and sources for those data since subtle differences in the data elements, the data sources, or both, can contribute to the size of observed differences across the set of proxy graduation indicators. Because of this, wherever possible, comparisons across indicators in this report are done based on indicators that are calculated using the same data files; and when this is not possible, differences are described.

Annual data for school years 1995-96 through 2001-02 showed that the estimates from the four proxy graduation indicators that could be calculated using national data ranged, on average, from 65 to 73 percent. In terms of relative ranks, at the national level AFGR yielded the highest rates, with a denominator of only first-time freshmen. Conversely, FGR yielded the lowest rates, with a denominator of all freshmen. GGI includes a growth adjustment to the first-time freshman estimate in the denominator, and since that growth was positive for each of the years in this analysis, the GGI denominator is larger than that of AFGR, but smaller than that of FGR and as a result yielded rates intermediate to those for AFGR and FGR. Finally, SCPI yielded rates similar to those for FGR over the first 5 of the 7 years, but grade-to-grade differences in growth rates brought the SCPI estimates closer to those for AFGR in the latest 2 years.

The state-level analysis added estimates of the CCD Graduation Leaver Indicator (GLI) for the 30 states with available data, and where available, these estimates tended to be higher than those from the other indicators. This is by design in that the denominator of GLI consists solely of students who have left the system and thus is smaller than the denominators of the other proxy indicators—each of which also includes some estimate of students who are still enrolled. These definitional differences, coupled with the lack of data for all states, led to a decision to drop GLI from the detailed analysis in this chapter.

It was noted that the underlying assumptions supporting the selection of those indicators must be carefully considered. To this end, the national analysis included a description of the unintended consequences that changes in the growth rates of the population in specific data elements can have on the estimates. In particular, the changes over time in AFGR, FGR, and GGI are driven by the fact that the denominator is increasing over time, albeit at a decreasing pace. The SCPI is driven by a set of grade-to-grade differences in

the rates of growth between the freshman classes and enrollments in the other grades. Finally, the GGI is further influenced by the assumption that differences in the sizes of the enrolled population of 9th- through 12th-graders in the freshman and senior years can be attributed to growth due to migration. The analysis showed that this assumption ignores the rate of growth in incoming freshmen classes and that as a result the GGI overestimates the pool of potential graduates from the first-time freshmen. The GGI adjusted to control the impact of population growth in the incoming freshman classes yields graduation rates that range from 1 to 4 percentage points higher than the current GGI estimates.

The national patterns were repeated in the state level analysis. Since AFGR was identified in the analyses of data from States 1 and 2 as the proxy measure that was consistently among the best performing indicators relative to EACGI, it was used in this analysis as an approximation of the true cohort rate in States 1 and 2, and was used as the standard for comparison in the analysis of data for other state. In particular, regression analyses were used to compare the relative performance of AFGR, FGR, GGI, and SCPI. The patterns observed in the student record data from States 1 and 2 are repeated in the analyses of CCD cross-sectional data for states. The FGR exhibited the strongest correlations with AFGR, and although the correlations between AFGR and GGI were not as strong, they were stronger than the correlations between AFGR and SCPI.

Chapter 5

Conclusions

Graduation rates provide an indication of the overall success of the educational system in providing a high school education to young adults. As essential an indicator as this is in modern society, the detailed data required to accurately measure high school entry, progression, and successful timely completion do not currently exist at the national level. That is to say, the accurate measurement of high school on-time graduation rates requires the level of detail that is only available with a student record system that includes records on the progression of individual students. By the start of the 2005-06 school year some 28 states reported that they had started or were in the planning stages for developing student records systems that would provide the data needed to produce accurate graduation rates for clearly specified groups of students. However, 4 years of student record data are required for an accurate measure of an on-time high school graduation rate.

The No Child Left Behind Act of 2001 specifically calls for the use of an on-time graduation rate as a measure of educational accountability. Prior to the passage of this 2001 legislation, the primary emphasis in this arena was on monitoring dropout rates and measuring successful high school graduation or completion, independent of time—that is, the emphasis was on measuring the percent of students who left school with a high school diploma as compared to an alternative certification or no certification at all. That emphasis was the impetus for the development of the NCES Graduation Leaver Indicator (GLI) in 1997 using school-based data from the Common Core of Data—a universe data collection of data from public schools, districts, and states throughout the United States. The GLI provides a measure of the percent of students who left high school with a diploma. This measure is based only on those students who have left high school, be it through graduation, some alternative form of completion, or dropping out. Students who are still in school working towards graduation are not included in the computation of this leaver rate. During the same time period, NCES also started using population based data from the Current Population Survey (CPS)—a large scale sample survey conducted by the U.S. Census Bureau—to provide a high school completion rate that measured the percent of young adults in the 18 to 24 year-old age range who were no longer enrolled in high school and who had completed a high school diploma or an alternative such as the GED.[21] Again, the emphasis in the rate computed using CPS data is on determining the educational status of those young adults who are no longer in high school.[22]

[21] Prior to 2002, it was possible to report data for these two credentials separately; however a change in data collection procedures required the combination of the two credentials with the result being one completion rate.
[22] A numerical explanation of the relationship of this measure and the on-time proxy measures is included in volume 1 of this report.

The 2001 call for an on-time graduation rate shifted the emphasis from graduation, or more generally completion, status to timely graduation. The use of an on-time graduation rate as a measure of educational accountability in the No Child Left Behind Act attracted the attention of a number of researchers. In the absence of the student record data needed to accurately calculate on-time graduation rates, researchers promulgated several proxy indicators. Each of the newly proposed indicators attempts to use existing cross-sectional data to approximate an on-time graduation rate. Typically, each newly proposed indicator has been compared to the existing NCES Graduation Leaver Indicator and/or the CPS based graduation or completion rates—although these are not on-time graduation rates—and sometimes to new proxy indicators proposed by other researchers. As the research literature has grown, there has been little consensus as to how best to measure on-time graduation rates (Greene 2002; NISS and the Education Statistics Services Institute (ESSI) 2004; Swanson 2003). There has also been growing confusion over the similarities and distinctions among the various existing and newly proposed indicators. These factors led to the Department of Education's call for the NISS Task Force on Graduation, Completion, and Dropout Indicators. That Task Force recommended the development and use of student record data to accurately measure on-time high school graduation rates (NISS and ESSI 2004).

While agreeing that the accurate measurement of on-time graduation rates can only come from student record data, since four years of student record data are required to compute an on-time graduation rate, it will be several years before the necessary student record data could be available for the states that are starting to plan and develop student record systems. In the interest of determining whether it was feasible to identify an interim measure, the Director of the Institute of Education Sciences asked NCES to conduct an analysis of the array of existing and proposed rates. This report represents that effort.

The first volume of this report took an in-depth look at the various graduation indicators, with a description of the computational formulas, the data required for each indicator, the assumptions underlying each formula, the strengths and weaknesses of each indicator, and a consideration of the conditions under which each indicator does or does not work. This second volume of the report starts with the analysis of student record data from two states that have had student record systems in place for the number of years required to support the calculation of the true cohort on-time graduation rate and the various proxy graduation indicators over several years, and then extends the findings from those two states to an analysis of cross-sectional national and state data for all 50 states and DC.

Chapters 2 and 3 of volume 2 report the data for each of the two states, with a focus on the comparison of each of the proxy measures to the true cohort on-time graduation rate for each state. Chapter 2 starts with a descriptive analysis of the data for State 1 at the state and school district level. A comparison of the average absolute difference between each of the measures and the true cohort rate computed over the 3 years of available data showed that at the state level the rates for AFGR, FGR, and SCPI are each relatively close to the rates for EACGI (average absolute differences of 3.0, 3.5, and 3.2 percentage points, respectively). By comparison, when GGI and GLI are compared to EACGI, the averages of the absolute differences are larger (7.4 and 9.3 percentage points, respectively). A similar analysis, based on the mean of the rates computed for individual school districts, showed that over the 3 years of available data, the

average of the absolute differences between the rates for AFGR and SCPI were relatively close to the rates for EACGI (1.8 and 2.2 percentage points, respectively). By comparison, the average of the absolute differences between the rates for FGR, GGI, and GLI and those for EACGI are larger (4.3 for AFGR, 6.5 for GGI, and 10.0 for GLI).
AFGR, FGR, GGI, and SCPI are the proxy measures that were proposed as estimates of an on-time graduation rate, and they yield estimates closest to EACGI; as a result the analysis is narrowed to these four proxy graduation indicators and EACGI. The distributional properties of the individual indicators (skewness, kurtosis, and normality) were examined at the school district level in preparation for a linear regression of EACGI on each of the proxy graduation indicators, and the decision was made to proceed with regression analyses.

Ordinary least squares regressions were used to examine the association between each proxy graduation indicator and the true cohort on-time graduation rate across school districts within the state. The correlations between EACGI and AFGR (r = .77 to .87) and FGR (r =.74 to .85) are the stronger than the correlations between EACGI and GGI (r =.54 to .67) or SCPI (r =.48 to .59). In addition, a 1 percentage point change in AFGR comes the closest of the four indicators to a 1 percentage point change in EACGI (slopes of .85 to 1, compared to slopes of .70 to .81 for FGR, .46 to .62 for GGI, and .34 to .51 for SCPI). AFGR also explains more of the variance in EACGI than the other three proxy indicators (R^2 of .60 to .77 for AFGR compared to R^2 of .55 to .72 for FGR, .29 to .46 for GGI, and .23 to .35 for SCPI). Finally, the performance of EACGI and each of the proxy graduation indicators was examined over time within individual school districts by regressing each year's estimate on the prior year's estimate. The true cohort rate had the highest correlation with itself (r =.82), followed by FGR (r =.76 to .81) and AFGR (r =.72 to .78).

Looking across the analyses for State 1, while SCPI performed well in the descriptive analyses of the state and school district rates, it did not perform as well as AFGR in the regression analyses. Similarly FGR performed well in the descriptive analysis at the state level, but not as well at the district level, and in the regression analysis FGR outperformed SCPI and GGI, but did not perform quite as well as AFGR. In summary, the analyses in State 1 showed that while AFGR is not an exact approximation of EACGI, it is consistently the most strongly associated with EACGI across the measures examined.

Each of these analyses was replicated using data from State 2. At the descriptive level, a comparison of the state rates for the four proxy measures and the true cohort rate showed that the rates for AFGR and GGI were closest to EACGI in State 2. The average of the absolute differences between AFGR and GGI and EACGI over the 4-years of available data were 2.8 and 3.5 percentage points, respectively. By comparison, the differences were 4.7 percentage points for FGR and 6.0 percentage points for SCPI. When this analysis was repeated using the mean of the school district rates computed across each measure, the rates for AFGR and GGI were closest to those for EACGI (1.5 percentage points for AFGR and 1.9 for GGI). By comparison, the average of the absolute difference between SCPI and EACGI was 2.5 percentage points, and the comparable value for FGR was 5.7 percentage points.

The regression analyses for State 2 showed that although each proxy measure had a stronger association with EACGI than AFGR in one of the 4 years, AFGR had the most consistent

pattern. More specifically, AFGR exhibits stronger correlations with EACGI than FGR in 1999-2000, 2000-01, and 2001-02, and stronger than GGI or SCPI in 2000-01, 2001-02 and 2002-03. Thus, although GGI compared favorable to EACGI in the descriptive analysis, albeit not quite as favorably as AFGR, the regression analyses show stronger correlation coefficients and larger amounts of the variation in EACGI explained for AFGR than for GGI in 3 of the 4 years of available data. Furthermore, the examination of the year-to-year correlations within each indicator showed strong associations over time for the true cohort on-time graduation rate and for AFGR and FGR.

Although the relationships between the true cohort on-time graduation rate and the proxy graduation indicators AFGR and FGR are not as strong in State 2 as those evident in State 1, the patterns are the same. The analyses in State 2 showed that while AFGR is not an exact approximation of EACGI, it is consistently the most strongly associated with EACGI across the measures examined.

Chapter 4 of this volume draws upon the findings from chapters 2 and 3 to examine the performance of the proxy graduation indicators using data from the NCES CCD for individual states.[23] The relative position of each of the proxy graduation indicators that were observed using student record data from States 1 and 2 are evident at the national level in the CCD data—AFGR was the highest over the 7-year period, with an average rate of 72 percent, with average rates over the 7-year period of 68 percent for GGI and 66 percent for FGR and 67 percent for SCPI.

At the state level, data for all 50 states and the District of Columbia were analyzed for AFGR, FGR, GGI, and SCPI; and GLI was computed for the 30 states that had the required data elements. Over the 7-year period the graduation indicators were more variable at the state level compared to the national estimates, with annual state rates ranging from the low 50 percent level to the low 90 percent level.[24]

Because AFGR emerged consistently as the best approximation to the true rate using the state student record data presented in chapters 2 and 3, AFGR was taken as the standard for the analysis of CCD in chapter 4, absent estimates for the true cohort on-time graduation rate for each state and the District of Columbia. This analysis was based on the fact that estimates for AFGR, FGR, GGI, and SCPI computed from CCD data for States 1 and 2 were strongly correlated with the same measures computed using student record data for those states. Also, regression analyses for States 1 and 2 of AFGR, FGR, GGI, and SCPI computed using CCD data with the student record based EACGI showed that the relationships observed between each proxy graduation indicator and EACGI in the student record data are repeated, albeit somewhat dampened. Finally, regressions of AFGR on FGR, GGI, and SCPI using both student record and CCD data yielded similar results, showing the strongest relationships between AFGR and FGR, followed by AFGR and GGI, and then AFGR and SCPI. These analyses provide the basis for the analysis of the CCD state data.

[23] Missing data at the state level were imputed and students reported in ungraded programs were allocated to specific grades.

[24] The one exception was SCPI that had state rates as low as 37 percent.

Thus, the regression analyses conducted using student record data from States 1 and 2 to compare EACGI with AFGR, FGR, GGI, and SCPI were repeated using CCD data to compare state level rates for AFGR to FGR, GGI, and SCPI. These analyses showed that the relative positions of the proxy graduation indicators are consistent with the analyses from States 1 and 2. Specifically, in the analyses of the CCD data, FGR exhibited performance that was most similar to AFGR, GGI outperformed SCPI, and SCPI had the weakest relationship with AFGR.

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APPENDIX A
Notes regarding analyses of student-tracking systems in two states

One point that cannot be stressed enough for states that are developing their own student tracking systems, calculations are greatly simplified if students are assigned a unique student identification number upon entry into the state system and if that identification number is never allowed to change. Though not a significant problem for this study, changing student identification numbers over time would lead to obvious problems for determining what happens to an individual student over time.

Two states agreed to share student tracking system data files for this study. Several key decisions were necessary in order to conduct tests of the different rates using the tracking system data files. These decisions relate to the following points:

1. Different units of analysis were possible in terms of building student-level, school-level, district-level, or state-level cohorts.
2. Some students apparently entered the system without having a corresponding entry code.
3. Some students were reported as being in multiple grades during a given year.
4. Some students were never reported as having been enrolled in 9th grade.
5. Some students had final exit codes that suggested they should have returned the next year, and then lacked records the next year.
6. States differed in terms of who was issued diplomas by their respective school systems.
7. Some students were awarded diplomas during the summer of their graduating year.
8. Some students were issued multiple credentials.
9. Some students graduated and then reenrolled.
10. Some students were enrolled in multiple schools and districts during a given year.

Extensive analyses were conducted to determine how best to address each of these points. The following paragraphs summarize the resulting decisions.

Data files made available to NCES contained multiple records per student per year. Each time the student changed programs in a school, changed schools within a district, changed districts, or left the public school system, the student was given a new record in each year's file. Each record contained student identification information, grade level information, school and district identifiers, entry dates and entry codes, and exit dates and exit codes. To facilitate analysis of such a large amount of data, the data files were sorted by exit dates and one record was developed for each student in each year's file. The yearly files were then merged producing one record per student over multiple years. The records contained data for each change in student status within and across years. The first year a student ended the year as a 9th grader determined the 9th grade cohort of the student.

The approach taken for generating the graduation rate statistics was designed to assure that students were counted once. One outcome code was assigned per student within a state.

Students were not allowed to shift between cohorts as they moved from school to school or district to district. In effect, no graduation rate clocks were allowed to be reset because of student moves within a state's public education system. Lacking information about what happened to students before entering into a state's public school system guarantees that this approach was not consistently applied to all students. Some students coming into a state's system, say as 9th graders, had undoubtedly already completed one year of 9th grade at a private school or at a school outside of the state. Alternative approaches were considered such as building cohorts from the school level up to the state level that allowed students to move into and out of a particular school's first-time 9th-grade population. Because the graduation rates should ultimately measure what happens to each individual student and not a given school or school district population, such approaches were not pursued. Technically, by counting each student once the state level, district level, and school level, student counts summed to the same totals.

Students who entered into the system lacking corresponding entry codes were assigned to a given cohort based on the grade level at which they entered the system. For example, students whose first entry indicated that they were in 10th grade in 1999-2000 were assigned to the cohort of first-time freshmen who were to graduate at the end of the 2001-2002 school year (i.e., they were assumed to have started 9th grade in 1998-99). In most cases, these students were students transferring into the state's public education system from out-of-state, private school, or a home schooling program. If the entry code for the student stated that they were transferring into the system, enrolled at grade 9 or higher, and had not been previously enrolled in the state's public education system, then the student was coded as a transfer student.

Students who were enrolled in multiple grades in a given year were assigned to the last grade level that they were enrolled in during a given year. The student was assigned to a 9th-grade cohort if this grade was 9 and the student was not already assigned to a cohort. That is, if the student had not already attended 9th grade or higher in previous years. More involved were decisions about cohort assignments for students who apparently skipped 9th grade altogether by skipping 9th grade within a given year or skipping 9th grade between school years. Such students tended to graduate early suggesting that they could be treated as members of prior cohorts. For example, students who skipped from 8th grade in 1997 to 10th grade in 1998 were treated as first-time 9th-graders in 1997. In a few cases, students skipped multiple grades. Such cases were assigned to cohorts as though they had entered 9th grade on schedule. For example, if a student skipped from grade 8 in 1997 to grade 11 in 1998, the student was treated as though they had started 9th grade in 1996.

Related cohort assignment decisions had to be made for students who did not reenter the school system though they had exit codes from the previous year indicating that reenrollment was expected. Such students were considered to be part of the cohort to which they were originally assigned. They were considered dropouts from this cohort.

Apart from cohort assignment and adjustment decisions, decisions about how to account for graduates were necessary because states treated different kinds of completers differently. For the most part, if the state considered a student to be a regular high school graduate, we counted the student as a graduate. One key exception was how those who earned diplomas through adult

education programs were treated. In both states, students who earned such diplomas were not counted as graduates.

A second key decision about how to adjust graduate counts involved how to account for students who graduated the summer after their expected senior year. Such students were treated as on-time graduates.

Less straightforward was how to assign students who earned multiple credentials, sometimes from multiple schools. For these rare students, if any of the credentials were a high school diploma, he or she was counted as a graduate. If the student earned more than one diploma and earned them from different schools, the student was assigned to one school and counted as one graduate for purposes of graduate counts. This was done in order to avoid counting individual students as multiple graduates.

Similarly, some students graduated, reenrolled in another school, and then did not graduate from this second school. Such students were considered to be graduates for the school from which they earned their credential. They were treated as though they had not reenrolled and were not counted in graduation rate calculations for the second school.

Finally, many students moved from school-to-school in a given year or across years. Such students were assigned to the final school and district attended for purposes of calculating graduation rates. As noted above, exceptions were made for students who graduated multiple times or who graduated then reenrolled and then did not graduate again.

APPENDIX B
Analysis of Change Component of Greene Graduation Indicator

The Greene Graduation indicator uses the ratio of the difference between the number of students enrolled in grades 9 through12 in the graduating year and the number of students enrolled in grades 9 through 12 in the freshman year to the number of students enrolled in grades 9-12 in the freshman year as a measure of the rate of change in the population to capture the amount of student migration that should be incorporated into the denominator for his graduation indicator. Simply put, if there are more students enrolled in high school the year students graduate than there were the year in which students enrolled, the estimate of first-time freshman is increased to yield a larger denominator of seniors eligible to graduate. Conversely, if there is fewer students enrolled in high school the year students graduate than there were the year in which students enrolled, the estimate of first-time freshman is decreased to yield a smaller denominator of seniors eligible to graduate.

This approach attributes all of the change in the size of the high school population to migration and fails to take into account underlying changes in the size of the entering population of freshmen. In any year, the number of students enrolled in grades 9 through 12 is in part a function of the number of students enrolling as freshmen in each of four consecutive years. Thus, if the number of freshmen increases due to an underlying change in the population structure (e.g., the baby boom-let moving through school), the number of students enrolled in grades 9 through 12 will also increase.

An examination of freshmen enrollment data shows that the number of freshmen has increased over each of the years that are used to compute the Greene graduation indicators for school years 1995-96 through 2001-02 (table B-1). If the freshman class is not growing (or shrinking) over time, the number of students expected in grades 9 through 12, absent migration is simply four times the number of freshmen. The impact of the growth in freshman class can be computed by comparing the sum of four consecutive freshmen classes with the number of freshmen in year one multiplied by four and computing the percentage difference. This percentage then is compared to the overall percent change to determine how much of the change is due to migration that should be accounted for in the denominator of eligible seniors versus the amount that is due to a growth in the number of students entering high school as freshmen. Table B-2 shows the overall rate of change between the freshman and senior years for the senior years from 1995-96 through 2001-02. The rates ranged from 3.5 percent to 7.4. Table B-2 also shows that the rates of changes attributable to population change for the same time period ranged from 1.4 to 5.3 percent and the rates of change due to migration ranged from 1.3 to 3.6 percent. In the individual years the percentage of the overall change that was associated with increases in the size of consecutive freshmen classes ranges from 34 to 81 percent. When the overall rate of change is used in the Greene graduation indicator, the graduation rates range from 66.4 to 70.1 percent (i.e., population change as a percent of the overall rate of change). However, when the lower rates of change associated with migration (i.e., controlling for growth in the entering population) are used in the Greene graduation indicator, the adjusted rates range from 68.7 to 71.9 percent.

Table B-1. Number of freshmen students in the public schools in the United States: 1990-91 through 2001-02

School year	Freshmen
1990-91	3,233,541
1991-92	3,379,488
1992-93	3,416,533
1993-94	3,549,274
1994-95	3,664,898
1995-96	3,766,542
1996-97	3,852,120
1997-98	3,873,128
1998-99	3,911,292
1999-2000	3,986,992
2000-01	4,005,781
2001-02	4,050,398

SOURCE: U.S. Department of Education, National Center for Education Statistics, Common Core of Data (CCD), "State Nonfiscal Survey of Public Elementary/Secondary Education," school years 1991-92 through 2001-02.

Table B-2. Rate of change components of Greene graduation indicator and resulting estimates: 1995-96 through 2001-02

School year	Overall rate of change	Migration change	Population change	Greene indicator	Adjusted Greene indicator
1995-96	6.6	1.3	5.3	68.3	71.9
1996-97	7.4	3.0	4.5	66.4	69.2
1997-98	7.0	3.6	3.4	66.7	68.9
1998-99	5.6	3.4	2.2	67.3	68.7
1999-2000	4.1	2.7	1.4	68.8	69.8
2000-01	3.5	1.7	1.8	69.2	70.5
2001-02	4.1	2.1	2.0	70.1	71.4

SOURCE: U.S. Department of Education, National Center for Education Statistics, Common Core of Data (CCD), "State Nonfiscal Survey of Public Elementary/Secondary Education," school years 1991-92 through 2001-02.