Swamping Errors: Comparing the Federal Graduation Rate to Common Proxies in Florida

David G. Martinez and Sherman Dorn

Arizona State University

Paper produced for the Annual Meeting of the National Education Finance Conference, February 10-13, 2016 (Jacksonville, FL).

Author Note

David G. Martinez, Division of Educational Leadership and Innovation, Arizona State University. ORCID ID: 0000-0002-6991-0016

Sherman Dorn, Division of Educational Leadership and Innovation, Arizona State University. ORCID ID: 0000-0002-0818-9288

Correspondence concerning this paper should be addressed to David Martinez, Division of Educational Leadership and Innovation, PO Box 871811, Tempe, AZ 85287-1811. Contact: dmani43@asu.edu
Abstract
Florida’s publication of a times series of county-level graduation rates using the federal cohort-based definition allows comparisons of the new federal definition with several popular proxies used in the decade before the federally-standardized rate. For Florida data, the popular proxies had a low correlation with the new cohort-based rate, with a correlation between any proxy and the federal rate equal to or lower than .56. This low relationship should give us pause about our reliance on insensitive measures and the use of proxies in accountability policies. “Better than nothing” is not always accurate.

Keywords: graduation rate, measures
Swamping Errors: Comparing the Federal Graduation Rate to Common Proxies in Florida

The effort to define and measure graduation rates reflect the political urgency of the issue over the past few decades. The high school graduation rate has become a fundamental indicator of a school’s ability to teach its students (Pinkus, 2006), not only an indicator of success within a school but also a promoter of greater social mobility. For many decades, Rumberger has been the most prominent national researcher on the topic, focusing on sociological perspectives on graduation and attainment factors (e.g., Rumberger, 2011). But in the past 15 years, Balfanz and colleagues have focused on a more public labeling and shaming effort to identify alleged dropout factories (e.g., Balfanz & Legters, 2004). In an era when social scientists could explore complex educational phenomena, measuring school- and district-level performance in attainment was perhaps less important than understanding the issue. Attempts to define various graduation and dropout rates certainly existed but were not defined in a regulatory sense at the local level. But in an era of high-stakes accountability, the mechanisms of accountability require the identification of districts and schools in most need, in detail assess from state to state and city to city those schools that have the lowest concentration of graduation and the types of students not making it past the 12th grade (Darling-Hammond, 2004). Measuring graduation at the school and district level has become a tool of accountability, and measures have both technocratic and political consequences.

This paper compares several well-known graduation-rate proxies to the new federal definition, using Florida county-level data from more than a decade. Like many other states, Florida’s Department of Education now publishes graduation data using the federal definition of adjusted-cohort-based graduation rates. The No Child Left Behind Act (2002) mandated reporting of an accurate on-time graduation rate, and federal regulations in 2008 required the use
of a standardized rate based on an adjusted ninth-grade cohort (Improving the Academic Achievement of the Disadvantaged, 2008). Going beyond federal mandates, Florida has also published a time series of county-level graduation rates from the spring 2001 graduating year to 2013 using the new federal rate and Florida’s longitudinal student database. The existence of this time series data allows the comparison of the proxy measures used in the last decade or more to the new federal rate. We compare rates because the history of concerns over high school graduation is replete with efforts to measure dropping out and graduation as part of the strategy for intervening in school failure.

**Literature Review**

Federal, state and local education policy makers, and legislators have struggled to implement relevant educational policy which has the potential of curbing high school dropouts in marginalized communities. Concerns over U.S. high school dropouts has increased given the perception that all U.S. students must be prepared for the global economy (Orfield, Losen, Wald, & Swanson, 2004). The No Child Left Behind Act increased the attention and concern toward graduation levels, the implementation of a nationally application graduation rate standard, and the accountability impacts of graduation rates as markers of success in education (Swanson, 2004). But the last 15 years of attention on and statistical efforts to measure high school graduation are not in isolation; they are a continuation of a 50-year history of efforts to reduce dropping out, including measuring how students stay in or leave high school (e.g., Dorn, 1996).

In the context of that half-century effort, the creation of a standard national graduation rate thus represents both an important if modest technical advance and a caution about managing important education phenomena through technocratic means. The need: educational policy that could potentially close the achievement gap between middle class Caucasian and marginalized
minority urban students. The consistent technical urge: measure today what is possible to measure. The wait-time for an appropriate measure: more than 40 years. Over those decades, researchers have struggled with the challenges of identifying and analyzing dropping out from high school (e.g., Rumberger, 1987, 2011). But research into graduation and dropping out has not satisfied the urgency of addressing issues at the practice and policy level, especially identifying high dropout numbers in urban poor areas – what Balfanz and Legters (2004) popularized as the dropout-factory crisis—thus the desperate search for proxies and now a standardized cohort-based measure. That search included more than a decade of various graduation rate proxies, which became the most relevant type of research on the problem. But the problem of dropping out included a problem of measurement. This paper demonstrates that the proxies were never capable of measuring small differences in attainment patterns. We could identify so-called dropout factories with the proxies, but the proxies cannot reliably identify anything smaller than gross differences.

Disaggregated graduation statistics show the importance of finding sensitive measures. Nationally, a little more than 80% of all students are graduating high school (Stetser & Stillwell, 2014). But only 73% of Latino students and 69% of African American students graduate within four years of starting ninth grade. Of all high school students who are economically disadvantaged, 72% graduate on time, and of students with limited English proficiency or disabilities, only 59% and 61% graduate on time, respectively. In comparison with an 86% Caucasian graduation rate for four years, the lower attainment of others may be higher than it was 15 years ago, but the need for improvement remains. There will continue to be significant political pressures to continue to measure high school attainment, and to improve those measures.
Before standardizing a graduation rate proxy in response to the No Child Left Behind Act, the National Center on Education Statistics had published three separate graduation measures: a population-based rate that measures the percentage of people in a specified population who have completed high school; a school-based percentage of students who graduated in specific years; and a proxy population-based measure, the ratio of high school graduates to the population aged 17 in any specific year (e.g., Kaufman, Alt, & Chapman, 2004).

In the first stab at official graduation rates after No Child Left Behind, the federal government settled on the Adjusted Freshman Graduation Rate (Seastrom et al., 2006), the ratio of graduates in a year to the average of eight, ninth, and tenth-grade enrollments in the years where an on-time graduate would have attended those grades (Stillwell & Sable, 2013).

Researchers proposed other proxy measures in the 2000s. Miao and Haney (2004) proposed a straightforward ratio of graduates to either the eight-grade or ninth-grade enrollment of years an on-time graduate would have attended those grades (the Boston College Rates, BCR-8 and BCR-9 respectively). Swanson (2004) proposed the Cumulative Promotion Index (CPI), a product of four ratios of enrollment and graduation around the spring of a graduation year.

Today, after the creation and widespread use of the new federal graduation rate, we have the opportunity to compare the first generation of NCLB-era proxy graduation measures to the new federal graduation rate (Title I—Improving the Academic Achievement of the Disadvantaged, 2008). This paper examines the AFGR, BCR-8, BCR-9, and CPI in comparison with the new federal adjusted-cohort-based graduation rate (ACGR), asking one central question: What are the statistical relationships among the proxies and between all of these proxies and the 2008 adjusted-cohort-based rate?
Methods

This project compares proxy graduation rates with the new federal graduation rate for all 67 Florida counties for all graduation years 2002 through 2013. The Florida Department of Education published federal graduation rates for those years (e.g., Florida Education Information & Accountability Services, 2015). This project calculated the proxy measures from official enrollment and academic (standard) diploma measures according to the published definitions of Miao and Haney (2004) for the Boston College Rates (based on both 8th and 9th grade enrollment—BCR-8 and BCR-9), Seastrom et al. (2006) for the Adjusted Freshman Graduation Rate (AFGR), and Swanson (2004) for the Cumulative Promotion Index (CPI).

Boston College Rates (BCR)

Miao and Haney (2004) proposed a simple ratio of graduates in the graduating year’s spring to the enrollment of eighth graders five autumns before (for BCR-8) or the ratio of graduates to the enrollment of ninth graders four autumns before (BCR-9). Both BCR-8 and BCR-9 are simple to calculate for a unified district, BCR-9 simple for a four-year high school. Both can be biased by differential graduation among transfers (both in and out of a school or district) and by the effects of differential retention across grades as well as differential graduation among those retained or promoted. The commonly greater retention rate in ninth grade often leaves a ninth-grade “bulge,” leading to artificially deflated BCR-9.

Adjusted Freshman Graduation Rate (AFGR)

Seastrom et al. (2006) proposed an adjustment to crude rates to accommodate the ninth-grade bulge resulting from disproportionate retention in ninth grade in many high schools. The proposed adjustment in Adjusted Freshman Graduation Rate (AFGR) is to use an average of the eighth, ninth, and tenth-grade enrollment numbers in successive years to substitute for the base
enrollment in the denominator of BCR-9. AFGR assumes that a linear average is an accurate estimate of the base ninth-grade enrollment; both different cohort sizes and different promotion rates across adjacent cohorts may leave different sizes of “second-year” ninth-graders that AFGR attempts to adjust for. In addition, AFGR is vulnerable to the same bias from differential graduation rates for transfer students as BCR-8 and BCR-9.

**Cumulative Promotion Index (CPI)**

Swanson’s (2004) Cumulative Promotion Index (CPI) is not labeled a graduation rate. It is the chained product of one-year ratios, dividing the enrollment in one grade in a single autumn by the enrollment in the prior year, with the final product being the ratio of graduates to twelfth-grade enrollment in the prior autumn. CPI is thus a proxy period measure rather than a proxy longitudinal measure, drawing from enrollment and graduation data from two successive years to assert a general condition of student promotion and graduation between the two autumns. One can more easily understand the CPI as considering it the result of following an imaginary cohort of ninth graders starts in the first autumn. Those who are in the school the next autumn are all put into an imaginary time machine and start as tenth graders the prior autumn, subject to that year’s ratio. The next autumn’s (surviving) eleventh graders move back to start eleventh grade in the prior autumn, and the surviving twelfth graders in this imaginary cohort are likewise returned to start their senior year in the first autumn. In equation form,

\[
CPI(t) = \frac{N_{10}^{t}}{N_{10}^{t-1}} \frac{N_{11}^{t}}{N_{11}^{t-1}} \frac{N_{12}^{t}}{N_{12}^{t-1}} \frac{G_{t}}{N_{12}^{t-1}},
\]

where CPI is the Cumulative Promotion Index for year t, \( N_{10}^{t} \) is the enrollment in tenth grade in the fall of year t, and likewise for all other terms except \( G_{t} \), the number of graduates (with academic diplomas) in the spring of year t.
As with all measures discussed earlier, CPI is vulnerable to differential “survival” rates for transfer students (again, both in-transfers and out-transfers), and as with BCR-9, there is no attempted adjustment for the ninth-grade bulge—in most cases, that first product (from ninth to tenth enrollment) is likely to understate the true measure of CPI assuming perfect knowledge of a starting ninth-grade cohort. In addition,

**Adjusted Cohort Graduation Rate (ACGR)**

As defined in federal regulations (Title I—Improving the Academic Achievement of the Disadvantaged, 2008), the adjusted-cohort graduation rate (ACGR) is a longitudinal measure “defined as the number of students who graduate in four years with a regular high school diploma divided by the number of students who form the adjusted cohort for that graduating class” (34 C.F.R. §200.19(b)(i)(A)). The spirit of the federal regulation is that ACGR be a true longitudinal measure. If there is accurate longitudinal tracking, bias from retention is excluded once a student matriculates for the first time in ninth grade. ACGR includes any differential graduation among in-transfers and excludes differential graduation among out-transfers; that is a political judgment of where responsibility for student success in high school lies. One source of potential bias is differential administrative tracking of students labeled as out-transfers; if there is no auditing of student records, it could be possible that students who leave high school without enrolling in another school are mislabeled as out-transfers.

**Comparisons**

Comparisons used both correlations and an analysis of central tendencies (means, medians, and standard deviations) to measure the relationships among the proxies and between proxies and the official federal graduation rate with Florida county-level data.
Data Sources

Time-series data of enrollment, graduation diploma counts, and the official federal ACGR for this study were obtained from the following sources:

1) National Center for Education Statistics Common Core of Data 1998-2013 (CCD), including 8th-12th grade enrollment, and academic (standard) diplomas awarded through spring 2009 (National Center for Education Statistics, 2015).

2) Florida Department of Education, for 2009-2013 reporting of Florida standard diplomas awarded, with 2009 used as an overlap year to check diploma data from the different sources (Florida Education Information & Accountability Services, 2015).

3) Florida Department of Education, for the 1998-2013 Florida ACGR as calculated using the federal calculation for graduation (Florida Education Information & Accountability Services, 2015).

Florida recalculated and published graduation rates using the new standardized federal definition for cohorts preceding the first reporting year for the federal definition, 2010-2011. For academic diplomas since 2009, the analysis used the Florida Department of Education 2009-2013 reporting of Florida standard diplomas awarded, with 2009 used as an overlap year to check diploma data from the different sources (Florida Education Information & Accountability Services, 2015). The BCR-8, BCR-9, AFGR, and CPI for 2002-2009 were calculated using the definition for standard diplomas, through the common core of data (CCD). These same measures were calculated for 2009-2014 using Florida’s reported and defined standard diplomas through the Florida Education Information and Accountability Services.
Results

We begin with summary measures. Tables 1 displays the summary statistics for the four graduation rate proxy measures (i.e. AFGR, BCR-8, BCR-9, and CPI), as well as the federal graduation rate (ACGR). The mean official federal ACGR across all years and counties was .66, with a standard deviation of 0.10, and a median of .66. The mean and median was within the range of the median and mean for other measures ranging from .61 (BCR-9) to .71 (BCR-8) for mean and .60 (BCR-9) to .71 (BCR-8) for median. The standard deviation for the federal graduation rate was smaller than the other measures—all other standard deviations were 0.12 or higher. While the accuracy of the proxy measures was low (see below as well as Table 2 and Figure 1), at a summary level the official federal rate appears to cluster around the same region if more narrowly than the proxies.

The proxies look far less adequate when examining correlations. Table 2 displays the correlation matrix for the four graduation rate proxy measures (i.e. AFGR, BCR-8, BCR-9, and CPI), as well as against the ACGR federal graduation rate. The federal graduation rate does not have a strong correlation with any of the proxy measures, which are often strongly correlated among each other (solely as proxies). The correlations between the federal ACGR and the proxies range from .50 (with the CPI) to .56 (both AFGR and BCR-9). The BCR-8 and AFGR are the most closely correlated among the proxies, $r(923)=.96$.

Figure 1 is a set of scatterplots charting the proxies in sequence against the official ACGR. Each panel shows the individual the comparison of the graduation rate measure plotted against the federal graduation and the associated correlation. The weak correlations are evident on inspection, and the difficulty of using any of the proxy measures to make fine-grained distinctions between individual counties in the same year or across years.
There are some caveats to this analysis, in addition to the limitations of the individual measures noted above in Methods. The analysis does not take into account the autocorrelation that should result substantively from successive cohorts in the same counties (with similar educational conditions and overlapping years of experience in high school). Nor does this paper address the autocorrelation that is artifactual in the measures: for example, for any county and year, CPI (t) has a set of three enrollment data points in common with both CPI (t-1) or CPI (t+1). A time-series analysis is appropriate for analyzing the federal graduation rate across years but is beyond the scope of this paper.

**Discussion**

The surprisingly weak relationship between graduation proxies and the federal cohort-based rate is an important lesson in measuring graduation going forward. The numbers reported nationally using proxies have often been inaccurate and excluded students who are overlooked by inadequate measures and indifferent bureaucracies (Ladson-Billings, 2006; Orfield, Losen, Wald, & Swanson, 2004). The federal measure is not only theoretically better, it is empirically different—the proxies were never sufficient for fine-grained distinctions among districts the size of Florida’s, let alone individual schools.

In the end, one critical question is the extent of the improvement in measurement from mediocrity. Is it substantial or incremental? Policy must begin to drive education for those students in need of intervention, those students in ethnically diverse communities who have continued to struggle and for whom the achievement gap has in no meaningful way closed. In order to correctly allocate resources preventing high school attrition, a statistically accurate measure of graduation is imperative. Without it, it may become increasingly difficult to provide resources to those students most in need.
References


Title I—Improving the Academic Achievement of the Disadvantaged. 34 C.F.R. § 200 (2008).
Table 1. Summary statistics, graduation measures

<table>
<thead>
<tr>
<th></th>
<th>Fed Rate</th>
<th>AFGR</th>
<th>BCR-8</th>
<th>BCR-9</th>
<th>CPI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum</td>
<td>.325</td>
<td>.148</td>
<td>.160</td>
<td>.146</td>
<td>.143</td>
</tr>
<tr>
<td>Maximum</td>
<td>.954</td>
<td>1.42</td>
<td>1.53</td>
<td>1.35</td>
<td>1.45</td>
</tr>
<tr>
<td>Median</td>
<td>.657</td>
<td>.675</td>
<td>.712</td>
<td>.602</td>
<td>.632</td>
</tr>
<tr>
<td>Mean</td>
<td>.660</td>
<td>.673</td>
<td>.708</td>
<td>.605</td>
<td>.633</td>
</tr>
<tr>
<td>SD</td>
<td>.100</td>
<td>.122</td>
<td>.135</td>
<td>.138</td>
<td>.147</td>
</tr>
</tbody>
</table>

Table 2. Correlation matrix for graduation rate measures

<table>
<thead>
<tr>
<th></th>
<th>Fed Rate</th>
<th>AFGR</th>
<th>BCR-8</th>
<th>BCR-9</th>
</tr>
</thead>
<tbody>
<tr>
<td>AFGR</td>
<td>.56</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BCR-8</td>
<td>.49</td>
<td>.96</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BCR-9</td>
<td>.56</td>
<td>.92</td>
<td>.86</td>
<td></td>
</tr>
<tr>
<td>CPI</td>
<td>.50</td>
<td>.85</td>
<td>.80</td>
<td>.86</td>
</tr>
</tbody>
</table>
Figure 1. Graphic representation of the OLS estimation line of the four proxy measures (i.e. AFGR, BCR-8, BCR-9, and CPI) against the federal graduation rate. See Table 2 for correlations.