



# Associations between Student Attributes and Success

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This report uses logistic regression models to describe the variation in outcomes like retention and graduation by factors like student attributes and academic preparation. The models investigate different cohorts depending on the specific model outcome. All models use the most recent three cohorts of first-time, full-time freshmen available. For instance, for the logistic regression model that investigates freshman retention to the second year, the model uses first-time, full-time freshmen cohorts from FA14, FA15, and FA16. For the model that investigates 4-year graduation rates, the model uses cohorts from FA11, FA12, and FA13 because those three cohorts are the most recent cohorts that have available data on their 4-year graduation rates. Please see footnotes on all tables for detailed information on which groups of students were used for each model.

Tables in this report present logistic regression odds ratios as well as predicted probabilities of the retention or graduation event occurring, assuming all else is equal<sup>1</sup>. Additionally, graphs that show the gap in predicted probabilities by minority status, residency, first-generation status, and Pell recipient status for each index level are included in Appendix A. Descriptive statistics for each regression model are provided in Appendix B.

## Key Findings

Non-residents, Pell recipients, and first-generation students have lower odds of retention and graduation compared to residents, non-Pell recipients, and non-first-generation students, respectively. CDHE Index (the measure of academic preparedness in the models) is positively associated with both retention and graduation. Females have significantly higher odds of graduating compared to males but do not differ from males in terms of retention to the second year. The associations by ethnicity groups are not as clearly defined and outcomes vary by ethnicity group.

## Residency

After controlling for ethnicity, gender, CDHE index, first-generation and Pell recipient status, Colorado residents have higher odds of being retained or graduating in 4, 5, and 6 years compared to non-residents (59%, 20%, 41%, and 49% higher odds; respectively). These higher odds translate into higher predicted probabilities of being retained or graduating in 4, 5, and 6 years when all else is equal. There are 5.3, 4.4, 7.0 and 8.1 percentage point increases in the likelihood of the respective event occurring for residents compared to non-residents.

## Ethnicity

In terms of retention, minority students have similar odds of being retained compared to non-minority students after controlling for residency, gender, CDHE index, first-generation status, and Pell Grant recipient status. There is some variation in results when minority status is partitioned by ethnicity. For instance, African American students have higher odds and probabilities of being retained compared to non-minority students. However, in terms of graduation, minority students have lower odds of graduating in 4, 5, and 6 years compared to non-minority students (14%, 17%, and 14% lower odds; respectively). These lower odds result in predicted

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<sup>1</sup> All else equal assumes the student is a resident, non-minority, female, with an index of about 115 (the average) who is not first-generation or a Pell recipient unless otherwise indicated.



probabilities of graduation that are 3 to 4 percentage points lower than non-minority students (all else equal). Again, results vary by ethnic group.

### **Asian American**

Asian American students have similar odds of being retained and graduating in 4, 5, or 6 years compared to non-minority students after controlling for the other variables in the model. Indeed, odds for these outcomes among Asian American students are almost identical to the odds among non-minority students.

### **African American**

After controlling for other demographic variables and CDHE index, African American students have 57% higher odds of being retained compared to non-minority students. African American students have a likelihood of being retained that is 3.6 percentage points higher than non-minority students. In terms of graduation, African American students have similar odds and probabilities compared to non-minority students assuming all else is equal.

### **Hawaiian/Pacific Islander**

Hawaiian/Pacific Islander students have similar odds of being retained and graduating in 4 or 6 years compared to non-minority students. When considering 5-year graduation patterns, Hawaiian/Pacific Islander students have statistically lower odds of graduating in that time period. The reason the models report varying statistical findings for this group of students may be because the sample size of this group, in particular, is so small.

### **Hispanic**

In terms of retention, Hispanic students have similar odds and probabilities compared to non-minority students. However, Hispanic students have lower odds of graduation compared to non-minority students. The predicted probability of graduation in any time frame is 3.4 to 4.4 percentage points lower for Hispanic students compared to non-minority students (all else equal).

### **Multi-Racial**

Multi-racial students have lower odds and probabilities for being retained and for graduating in 4 or 5 years compared to non-minority students. However, multi-racial students have similar odds of graduation in 6 years compared to non-minority students. The predicted probability of retention and graduation in 4 or 5 years is 3.4 to 6.5 percentage points lower for multi-racial students compared to non-minority students (all else equal).

### **Native American**

Native American students have lower odds and predicted probabilities of graduation in 4 or 5 years compared to non-minority students. In terms of retention and graduation in 6 years, Native American students have similar odds and predicted probabilities as non-minority students. The reason the models report varying statistical findings for this group of students may be because the sample size of this group, in particular, is so small.



## Gender

Females have similar odds of being retained compared to males after controlling for residency, ethnicity, CDHE index, first-generation status, and Pell recipient status. However, females have higher odds of graduating in 4, 5, or 6 years compared to males after controlling for the other variables (95%, 38%, and 24% higher odds; respectively). These higher odds result in the following percentage point gaps: a 16.5 percentage point gap in the likelihood of males graduating in four years compared to females, a 6.6 percentage point gap for males graduating in five years compared to females, and a 4.2 percentage point gap for males graduating in six years compared to females.

## CDHE Index

CDHE index is positively associated with retention and graduation after controlling for demographic variables. For every one point increase in index score a student has 3% higher odds of being retained and about 3.5% higher odds of graduating in 4, 5, or 6 years. A student with an index score of 115 has a predicted probability of being retained that is 1.6 percentage points higher and a predicted probability of graduating in 4, 5, or 6 years that is 3.3 to 4.1 percentage points higher compared to a student with an index score of 110.

## First-Generation Status

First-generation status is negatively associated with retention and graduation after controlling for other demographic variables and CDHE index. First-generation students have 32% lower odds of being retained compared to non-first-generation students after controlling for other demographic and academic variables, which results in a 4.3 percentage point difference in predicted retention rates. First-generation students also have lower odds of graduating compared to non-first-generation students (20%, 35%, and 32% lower odds of graduating in 4, 5, or 6 years). These lower odds result in 5.7 to 9.1 percentage point gaps in the predicted probability of graduating in 4, 5, or 6 years.

## Pell Recipient Status

Pell recipient status is negatively associated with retention and graduation after controlling for other demographic variables and CDHE index. Pell recipients have about 16% lower odds of being retained compared to non-Pell recipients, which results in a 1.7 percentage point gap in Pell recipients' predicted probability of being retained compared to non-Pell recipients (all else equal). Pell recipients also have lower odds (25%, 21%, and 21%) of graduating in 4, 5, or 6 years compared to non-Pell recipients after controlling for the other variables in the model. Pell recipients have predicted probabilities of graduating in 4, 5, or 6 years that are a 4.6 to 7.2 percentage points lower compared to non-Pell recipients (all else equal).

## Conclusions

Retention and graduation patterns vary by demographic group at Colorado State University. Students who are Colorado residents, who are female, and who come into college with a higher level of academic preparedness have higher odds of being retained and of graduating. First-generation students and students who are Pell recipients have lower odds of being retained and of graduating. Retention and graduation patterns vary by ethnicity group.



## Regression Model Output: Odds and Predicted Probabilities

**Table 1. Predicted Probability of Graduation and Retention**

| Predicted Probability <sup>1</sup> | Freshman Retention <sup>2</sup> | 4-year Graduation <sup>3</sup> | 5-year Graduation <sup>4</sup> | 6-year Graduation <sup>5</sup> |
|------------------------------------|---------------------------------|--------------------------------|--------------------------------|--------------------------------|
| Residents                          | 89.2%                           | 56.7%                          | 74.6%                          | 75.5%                          |
| Non-Residents                      | 83.9%                           | 52.3%                          | 67.6%                          | 67.4%                          |
| PP Difference <sup>6</sup>         | 5.3***                          | 4.4***                         | 7.0***                         | 8.1***                         |
| Overall Minority                   | 88.5%                           | 52.9%                          | 70.8%                          | 72.6%                          |
| Non-Minority                       | 89.2%                           | 56.7%                          | 74.6%                          | 75.4%                          |
| PP Difference                      | -0.7                            | -3.8**                         | -3.8***                        | -2.8**                         |
| Asian American                     | 89.8%                           | 56.6%                          | 74.5%                          | 74.1%                          |
| Non-Minority                       | 89.2%                           | 56.7%                          | 74.6%                          | 75.5%                          |
| PP Difference                      | 0.6                             | -0.1                           | -0.1                           | -1.4                           |
| African American                   | 92.8%                           | 53.5%                          | 76.1%                          | 79.6%                          |
| Non-Minority                       | 89.2%                           | 56.7%                          | 74.6%                          | 75.5%                          |
| PP Difference                      | 3.6**                           | -3.2                           | 1.5                            | 4.1*                           |
| Hawaiian/Pac. Islander             | 97.5%                           | 46.8%                          | 51.1%                          | 65.8%                          |
| Non-Minority                       | 89.2%                           | 56.7%                          | 74.6%                          | 75.5%                          |
| PP Difference                      | 8.3**                           | -9.9                           | -23.5                          | -9.7                           |
| Hispanic                           | 88.0%                           | 53.3%                          | 70.5%                          | 71.1%                          |
| Non-Minority                       | 89.2%                           | 56.7%                          | 74.6%                          | 75.5%                          |
| PP Difference                      | -1.2                            | -3.4*                          | -4.0**                         | -4.4**                         |
| Multi-Racial                       | 85.8%                           | 51.4%                          | 68.1%                          | 72.5%                          |
| Non-Minority                       | 89.2%                           | 56.7%                          | 74.6%                          | 75.5%                          |
| PP Difference                      | -3.4*                           | -5.3*                          | -6.5**                         | -3.0                           |
| Native American                    | 85.0%                           | 36.2%                          | 59.2%                          | 64.4%                          |
| Non-Minority                       | 89.2%                           | 56.7%                          | 74.6%                          | 75.5%                          |
| PP Difference                      | -4.2                            | -20.5**                        | -15.4*                         | -11.1                          |
| Female                             | 89.2%                           | 56.7%                          | 74.6%                          | 75.5%                          |
| Male                               | 89.3%                           | 40.2%                          | 68.0%                          | 71.3%                          |
| PP Difference                      | -0.1                            | 16.5***                        | 6.6***                         | 4.2***                         |
| Index 110                          | 87.5%                           | 52.5%                          | 71.4%                          | 72.4%                          |
| Index 115                          | 89.1%                           | 56.6%                          | 74.7%                          | 75.7%                          |
| PP Difference                      | -1.6***                         | -4.1***                        | -3.3***                        | -3.3***                        |
| First-Generation                   | 84.9%                           | 51.0%                          | 65.5%                          | 67.6%                          |
| Non-First-Generation               | 89.2%                           | 56.7%                          | 74.6%                          | 75.5%                          |
| PP Difference                      | -4.3***                         | -5.7***                        | -9.1***                        | -7.9***                        |
| Pell Recipient                     | 87.4%                           | 49.5%                          | 69.9%                          | 70.9%                          |
| Non-Pell Recipient                 | 89.2%                           | 56.7%                          | 74.6%                          | 75.5%                          |
| PP Difference                      | -1.7*                           | -7.2***                        | -4.7***                        | -4.6***                        |

<sup>1</sup>The predicted probability of the specified retention/graduation outcome assumes a resident, non-minority, female, with an index of about 115 (the average) who is not first-generation or a Pell recipient unless otherwise indicated.

<sup>2</sup>Includes first-time, full-time freshmen who started in FA14, FA15, FA16.

<sup>3</sup>Includes first-time, full-time freshmen who started in FA11, FA12, FA13.

<sup>4</sup>Includes first-time, full-time freshmen who started in FA10, FA11, FA12.

<sup>5</sup>Includes first-time, full-time freshmen who started in FA09, FA10, FA11.

<sup>6</sup>Significance level of the coefficient that causes the percentage point (pp) difference in predicted probabilities \*P<.05, \*\* P<.01, \*\*\* P<.001

**Table 2. Logistic Regression Results: Models for Retention and Graduation Outcomes**

|  | Retained <sup>1</sup>   | 4-year Graduation <sup>2</sup> | 5-year Graduation <sup>3</sup> | 6-year Graduation <sup>4</sup> |
|--|-------------------------|--------------------------------|--------------------------------|--------------------------------|
|  | Odds Ratio <sup>5</sup> |                                |                                |                                |
| CO Resident  | 1.585***                | 1.197***                       | 1.407***                       | 1.488***                       |
| Ethnicity <sup>6</sup> (Non-Minority Total) <sup>7</sup> | 1.07                    | 1.16**                         | 1.21***                        | 1.16**                         |
| Asian American   | 1.065                   | 0.996                          | 0.994                          | 0.930                          |
| African American   | 1.569**                 | 0.880                          | 1.084                          | 1.269                          |
| Hawaiian/Pacific Islander                                | 4.687                   | 0.672                          | 0.356*                         | 0.626                          |
| Hispanic   | 0.887                   | 0.872*                         | 0.816**                        | 0.802**                        |
| Multi-Racial   | 0.731*                  | 0.806*                         | 0.728**                        | 0.856                          |
| Native American  | 0.689                   | 0.433*                         | 0.494*                         | 0.588                          |
| Female   | 0.986                   | 1.948***                       | 1.383***                       | 1.237***                       |
| Index  | 1.030***                | 1.034***                       | 1.035***                       | 1.035***                       |
| First-Generation   | 0.682***                | 0.796***                       | 0.647***                       | 0.678***                       |
| Pell Recipient   | 0.845**                 | 0.750***                       | 0.792***                       | 0.793***                       |
| Observations   | 13,588                  | 13,067                         | 13,083                         | 12,863                         |
| Model Chi <sup>2</sup>                                   | 371.66                  | 956.60                         | 793.08                         | 684.73                         |
| Model Degrees Freedom                                    | 11                      | 11                             | 11                             | 11                             |
| Pseudo R <sup>2</sup>                                    | 0.033                   | 0.053                          | 0.047                          | 0.042                          |

<sup>1</sup>Includes first-time, full-time freshmen who started in FA14, FA15, & FA16

<sup>2</sup>Includes first-time, full-time freshmen who started in FA11, FA12, & FA13

<sup>3</sup>Includes first-time, full-time freshmen who started in FA10, FA11, & FA12

<sup>4</sup>Includes first-time, full-time freshmen who started in FA09, FA10, & FA11

<sup>5</sup>\*P<.05, \*\* P<.01, \*\*\* P<.001

<sup>6</sup>All the ethnicities are compared to the reference group of non-minority students which includes international, white, and students who do not report their ethnicity

<sup>7</sup>Coefficients for the non-minority total row are calculated from separate logistic regression models using a dichotomous variable where 0 = minority and 1 = non-minority. All other coefficients presented in this table were calculated from logistic regression models that utilized a disaggregated ethnicity variable.



## Appendix A

Figure 1. Predicted Freshman Retention Rates by Minority Status

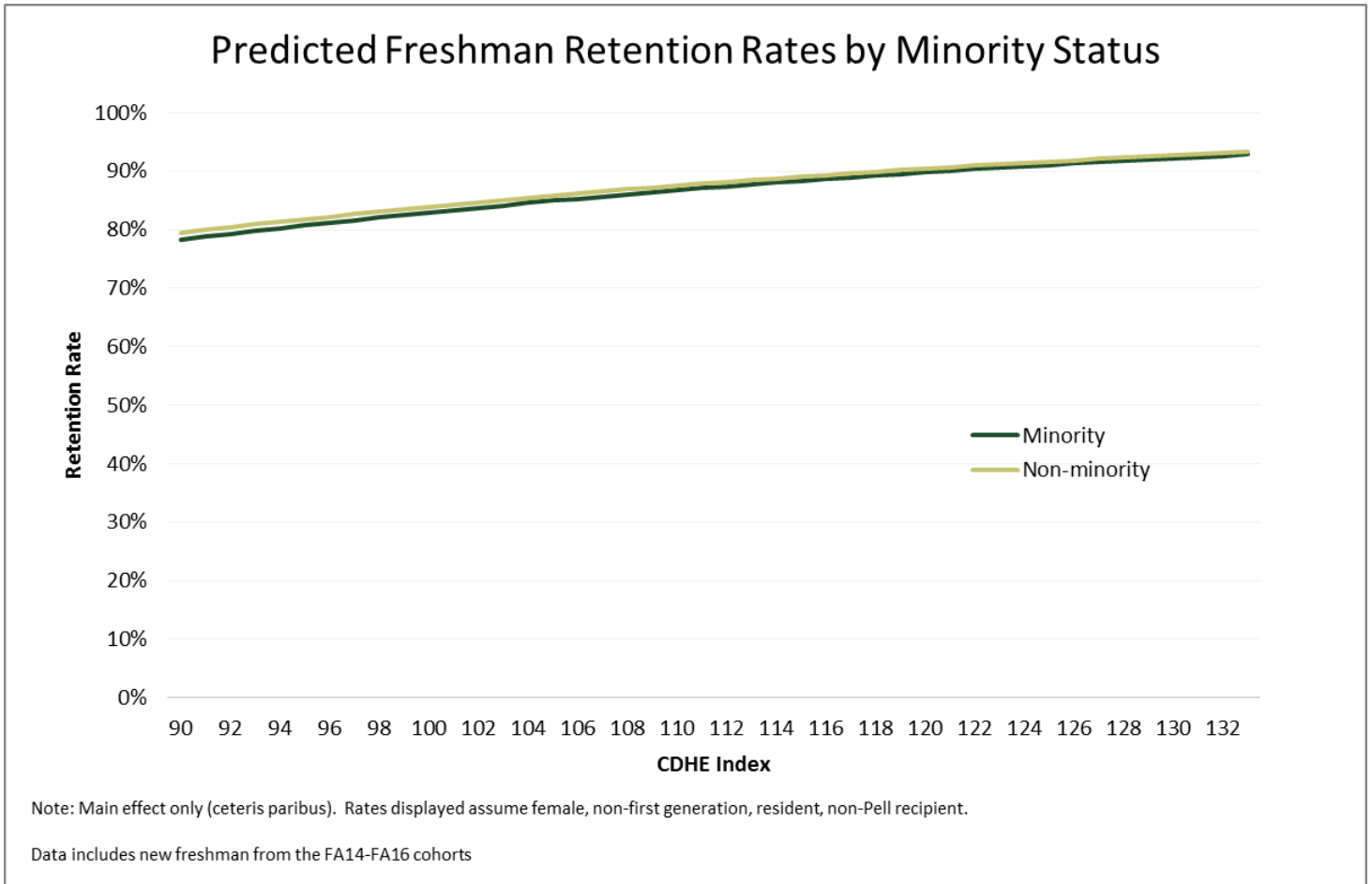




Figure 2. Predicted Six-Year Graduation Rates by Minority Status

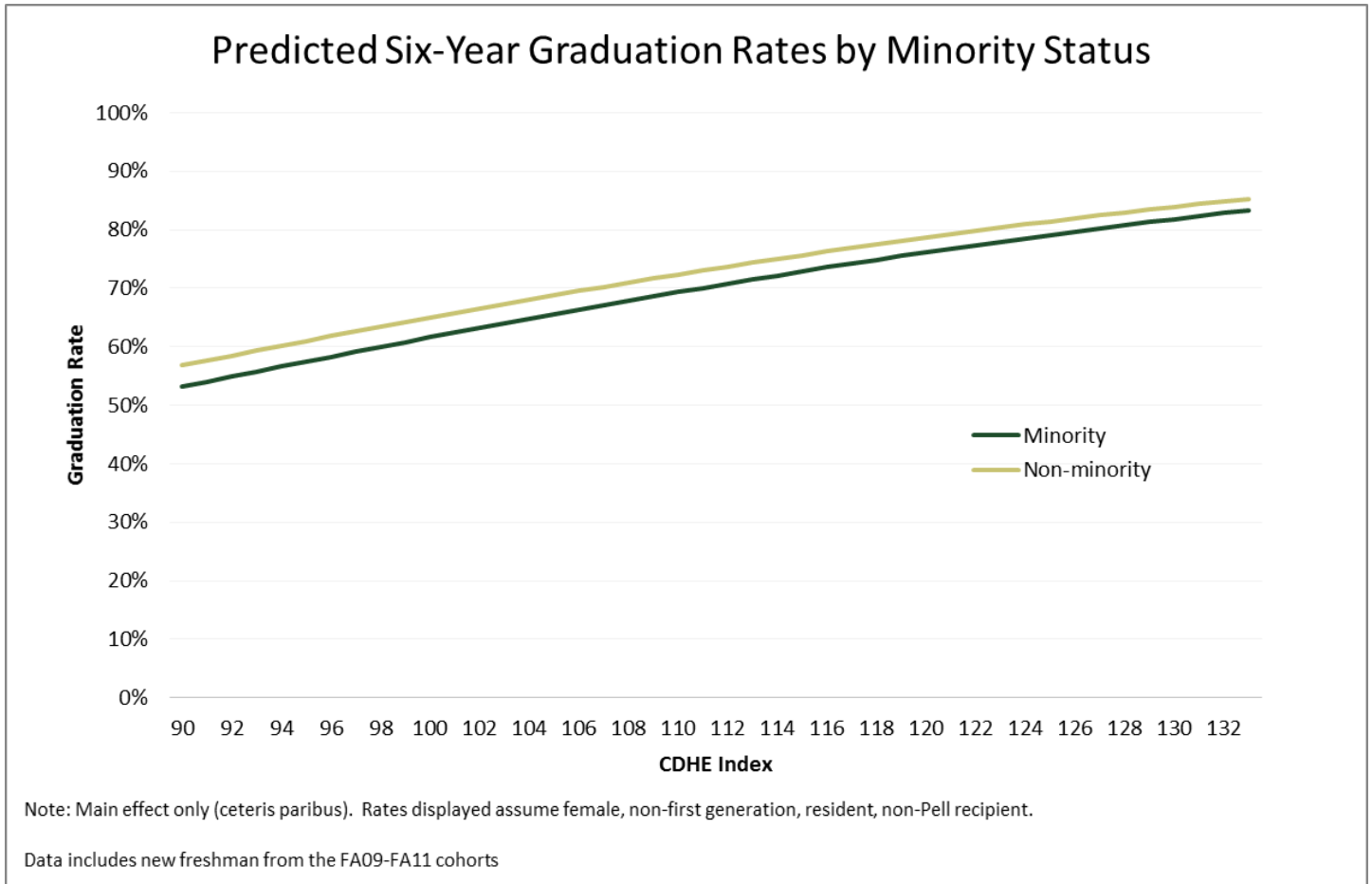




Figure 3. Predicted Freshman Retention Rates by Residency

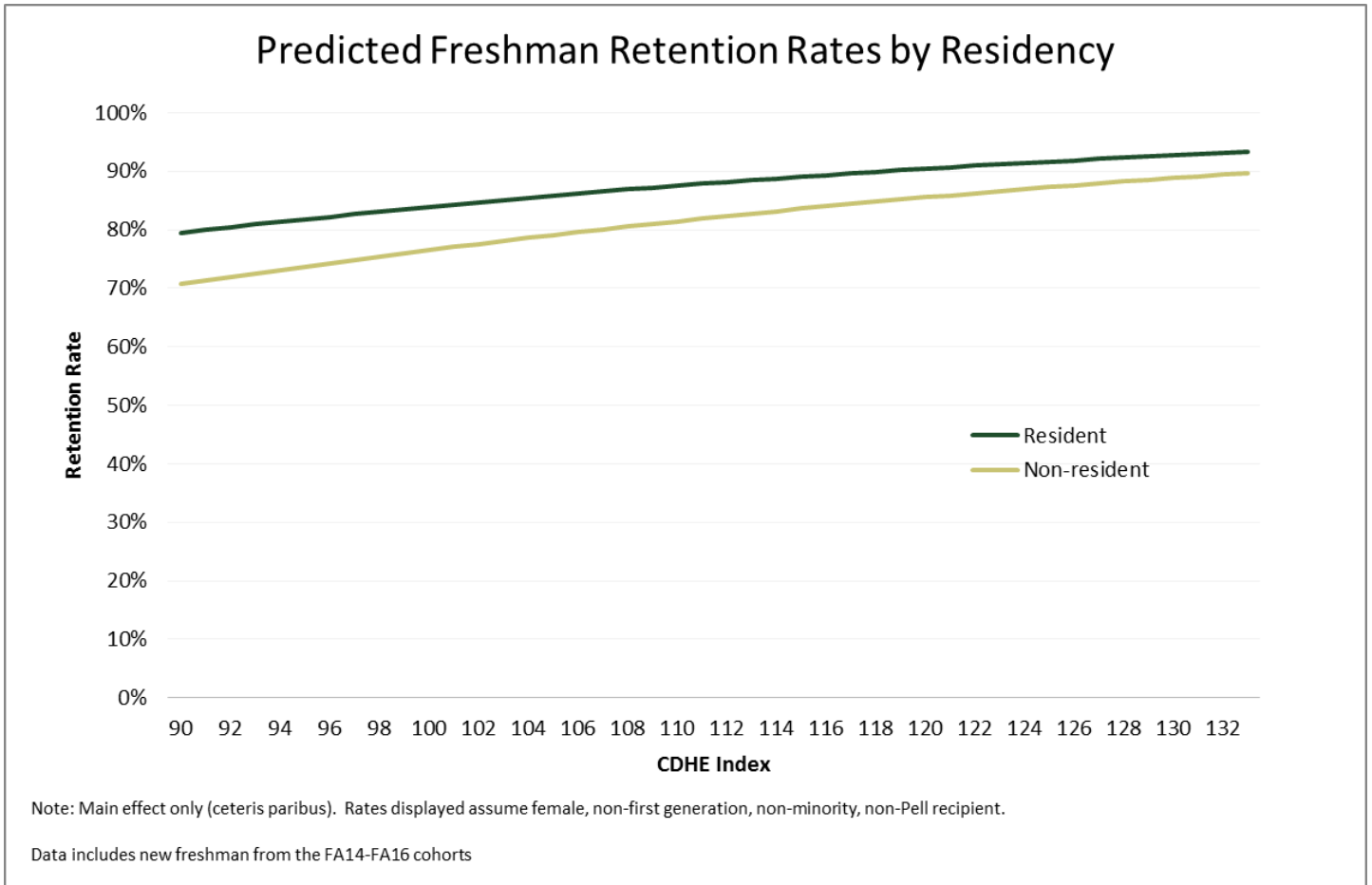






Figure 4. Predicted Six-Year Graduation Rates by Residency

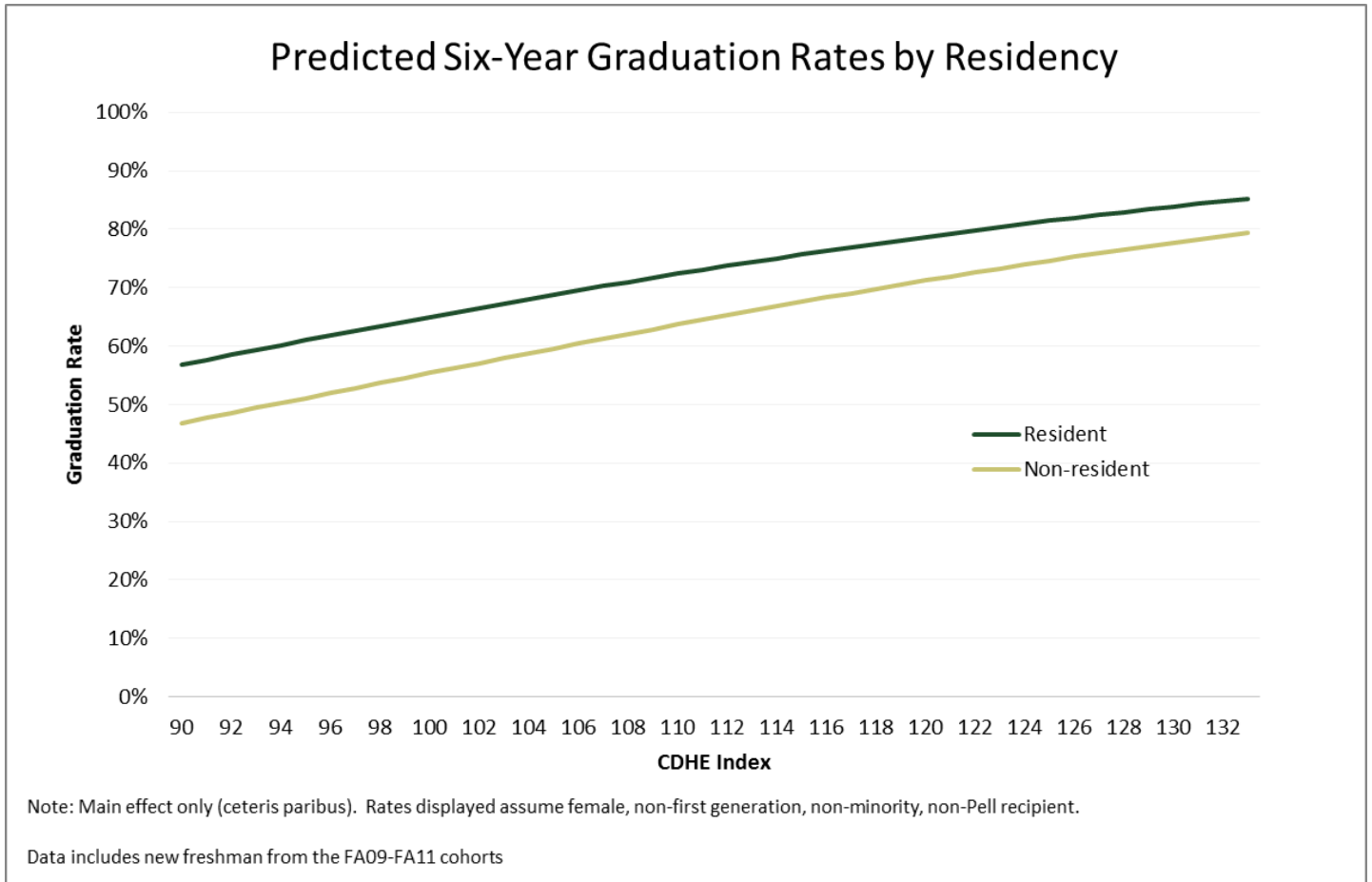




Figure 5. Predicted Freshman Retention Rates by First-Generation Status

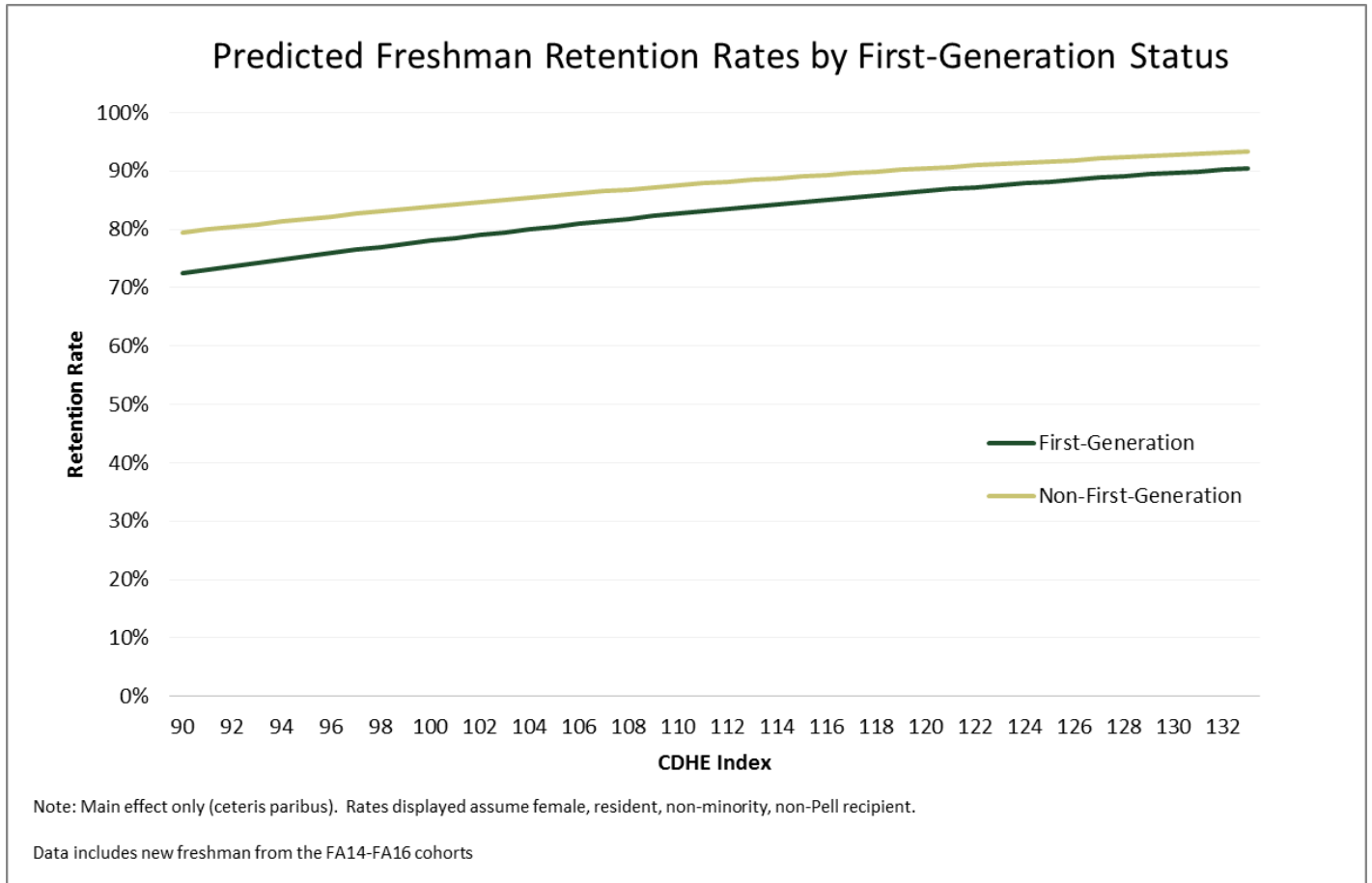




Figure 6. Predicted Six-Year Graduation Rates by First-Generation Status

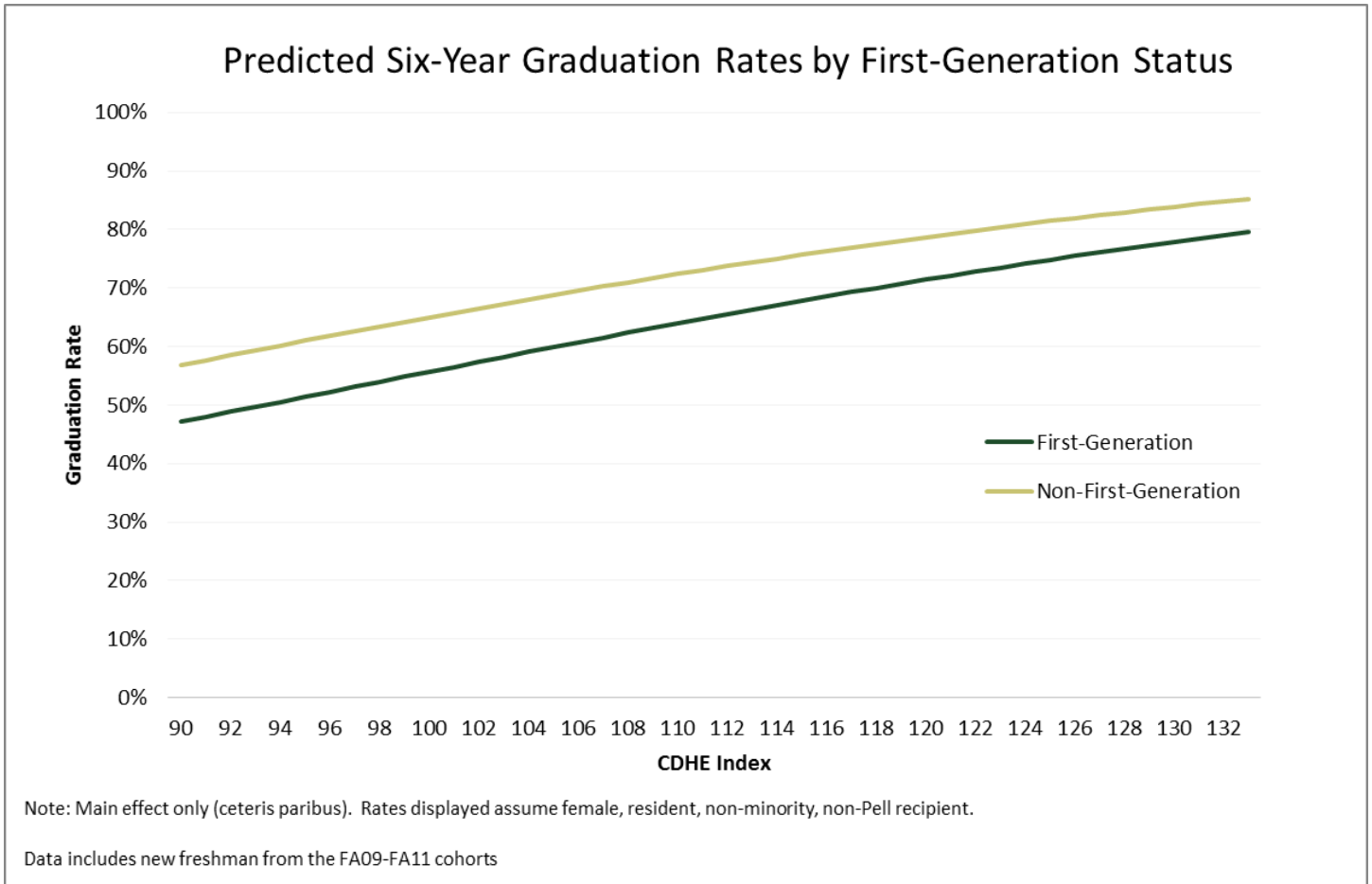




Figure 7. Predicted Freshman Retention Rates by Pell Recipient Status

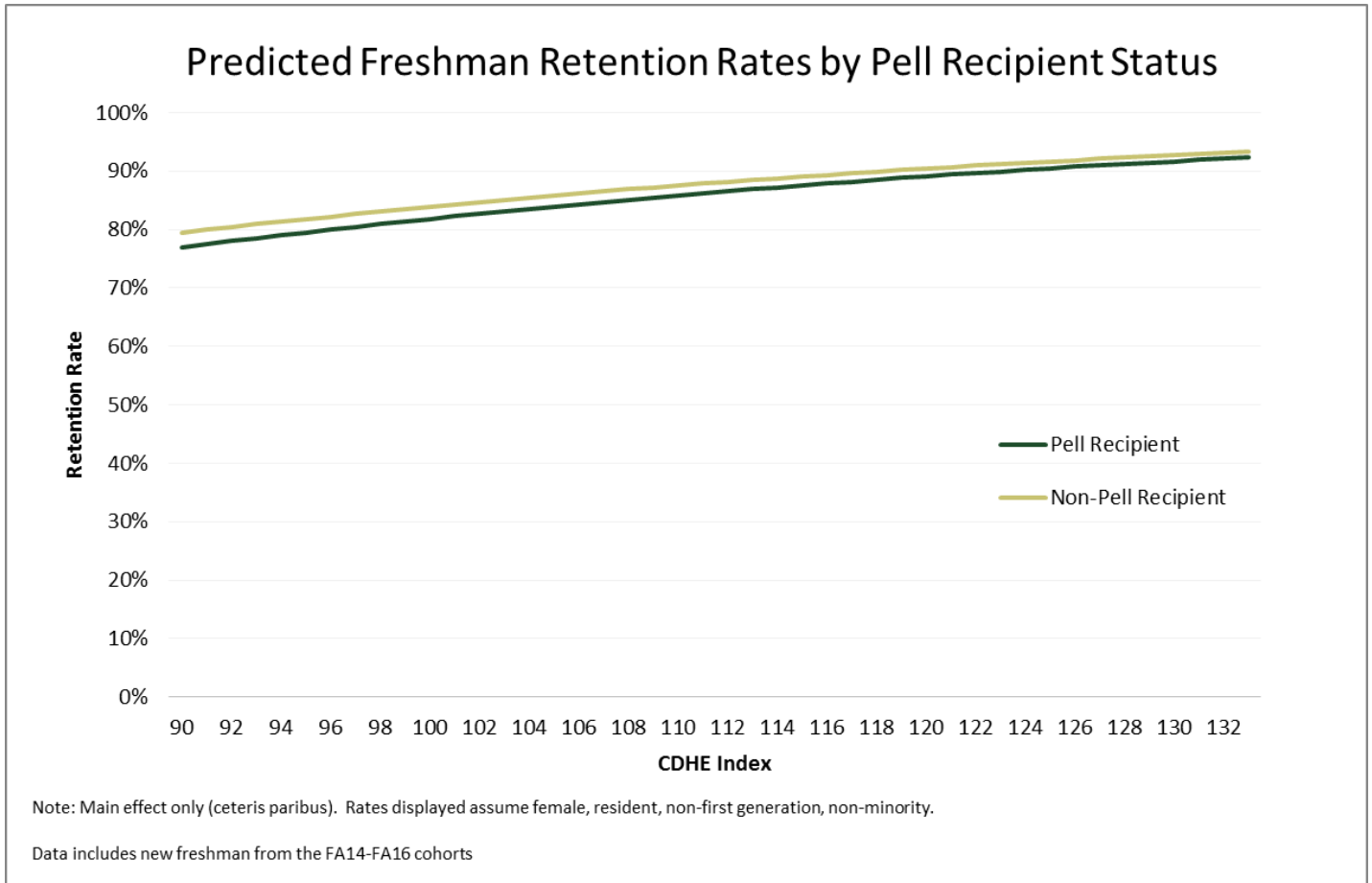
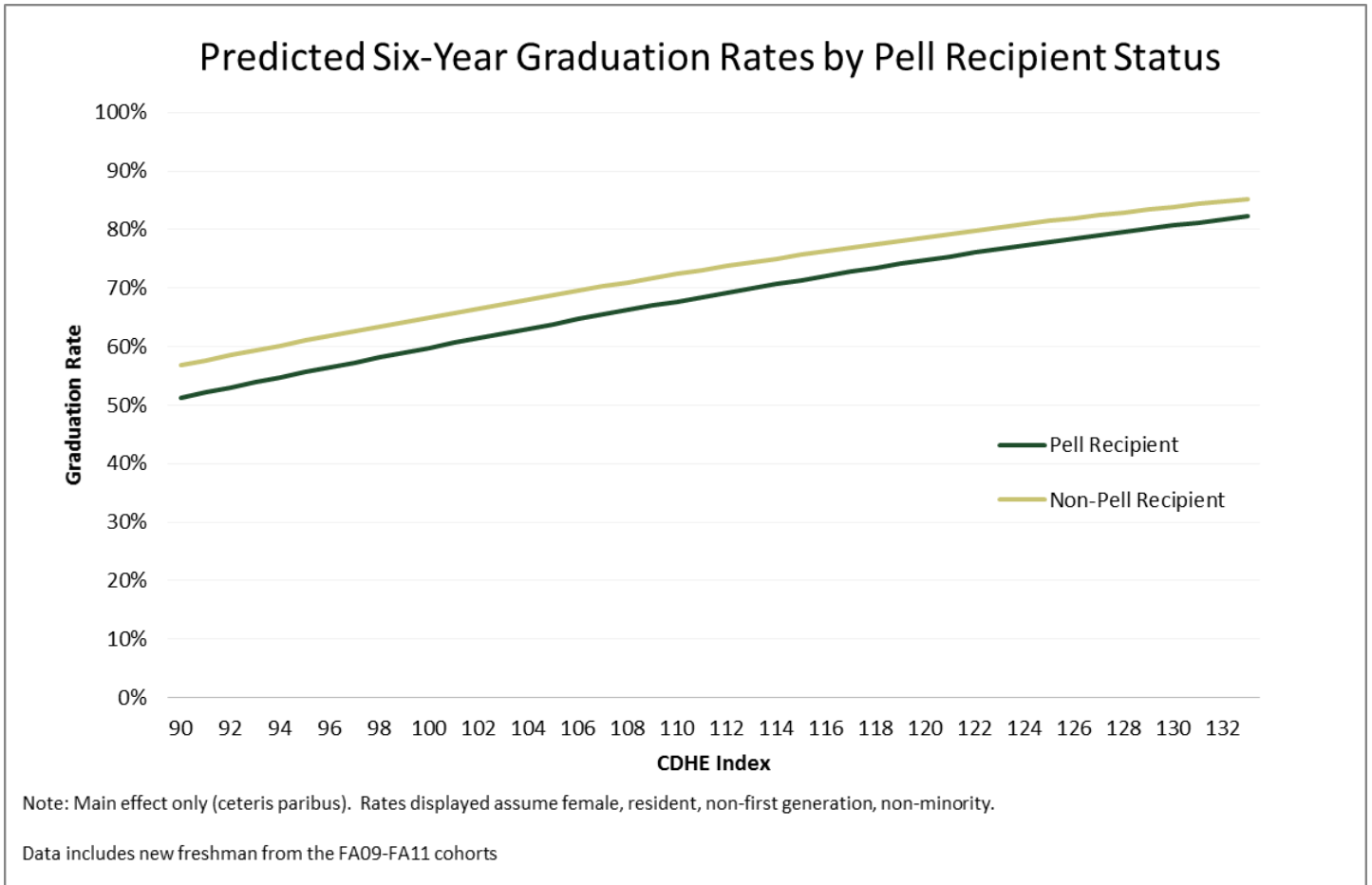




Figure 8. Predicted Six-Year Graduation Rates by Pell Recipient Status





## Appendix B

**Table 3. Descriptive Statistics for the Logistic Regression Predicting Freshman Retention (FA14, FA15, & FA16 cohorts)**

| Variable               | Observations | Proportion | Standard Deviation | Min | Max |
|------------------------|--------------|------------|--------------------|-----|-----|
| Retained               | 13,784       | 85.4%      | 0.353              | 0   | 1   |
| CO Resident            | 13,786       | 70.1%      | 0.458              | 0   | 1   |
| Asian American         | 13,786       | 3.2%       | 0.175              | 0   | 1   |
| African American       | 13,786       | 2.5%       | 0.157              | 0   | 1   |
| Hawaiian/Pac. Islander | 13,786       | 0.2%       | 0.042              | 0   | 1   |
| Hispanic               | 13,786       | 12.9%      | 0.335              | 0   | 1   |
| Multi-Racial           | 13,786       | 2.8%       | 0.164              | 0   | 1   |
| Native American        | 13,786       | 0.6%       | 0.080              | 0   | 1   |
| Non-minority           | 13,786       | 77.8%      | 0.416              | 0   | 1   |
| Female                 | 13,786       | 54.8%      | 0.498              | 0   | 1   |
| Index (mean)           | 13,590       | 115.3      | 11.873             | 61  | 146 |
| First-Generation       | 13,786       | 23.9%      | 0.426              | 0   | 1   |
| Pell Recipient         | 13,786       | 20.5%      | 0.403              | 0   | 1   |

**Table 4. Descriptive Statistics for the Logistic Regression Predicting 4-Year Graduation (FA11, FA12, & FA13 cohorts)**

| Variable               | Observations | Proportion | Standard Deviation | Min | Max |
|------------------------|--------------|------------|--------------------|-----|-----|
| Graduated (4 years)    | 13,230       | 44.8%      | 0.497              | 0   | 1   |
| CO Resident            | 13,241       | 75.3%      | 0.431              | 0   | 1   |
| Asian American         | 13,241       | 2.0%       | 0.140              | 0   | 1   |
| African American       | 13,241       | 2.1%       | 0.144              | 0   | 1   |
| Hawaiian/Pac. Islander | 13,241       | 0.1%       | 0.027              | 0   | 1   |
| Hispanic               | 13,241       | 11.0%      | 0.313              | 0   | 1   |
| Multi-Racial           | 13,241       | 4.0%       | 0.195              | 0   | 1   |
| Native American        | 13,241       | 0.4%       | 0.004              | 0   | 1   |
| Non-minority           | 13,241       | 80.4%      | 0.397              | 0   | 1   |
| Female                 | 13,241       | 55.4%      | 0.497              | 0   | 1   |
| Index (mean)           | 13,078       | 115.1      | 11.529             | 76  | 146 |
| First-Generation       | 13,241       | 25.3%      | 0.435              | 0   | 1   |
| Pell Recipient         | 13,241       | 22.7%      | 0.419              | 0   | 1   |

**Table 5. Descriptive Statistics for the Logistic Regression Predicting 5-Year Graduation (FA10, FA11, & FA12 cohorts)**

| Variable               | Observations | Proportion | Standard Deviation | Min | Max |
|------------------------|--------------|------------|--------------------|-----|-----|
| Graduated (5 years)    | 13,227       | 65.0%      | 0.477              | 0   | 1   |
| CO Resident            | 13,237       | 77.2%      | 0.420              | 0   | 1   |
| Asian American         | 13,237       | 1.9%       | 0.135              | 0   | 1   |
| African American       | 13,237       | 2.3%       | 0.151              | 0   | 1   |
| Hawaiian/Pac. Islander | 13,237       | 0.1%       | 0.037              | 0   | 1   |
| Hispanic               | 13,237       | 9.9%       | 0.299              | 0   | 1   |
| Multi-Racial           | 13,237       | 3.7%       | 0.189              | 0   | 1   |
| Native American        | 13,237       | 0.4%       | 0.061              | 0   | 1   |
| Non-minority           | 13,237       | 81.7%      | 0.387              | 0   | 1   |
| Female                 | 13,237       | 55.7%      | 0.497              | 0   | 1   |
| Index (mean)           | 13,093       | 114.8      | 11.483             | 76  | 146 |
| First-Generation       | 13,237       | 25.0%      | 0.433              | 0   | 1   |
| Pell Recipient         | 13,237       | 23.0%      | 0.421              | 0   | 1   |

**Table 6. Descriptive Statistics for the Logistic Regression Predicting 6-Year Graduation (F09, FA10, & FA11 cohorts)**

| Variable               | Observations | Proportion | Standard Deviation | Min | Max |
|------------------------|--------------|------------|--------------------|-----|-----|
| Graduated (6 years)    | 12,975       | 67.5%      | 0.468              | 0   | 1   |
| CO Resident            | 12,991       | 78.4%      | 0.412              | 0   | 1   |
| Asian American         | 12,991       | 1.9%       | 0.136              | 0   | 1   |
| African American       | 12,991       | 2.3%       | 0.149              | 0   | 1   |
| Hawaiian/Pac. Islander | 12,991       | 0.2%       | 0.046              | 0   | 1   |
| Hispanic               | 12,991       | 9.1%       | 0.288              | 0   | 1   |
| Multi-Racial           | 12,991       | 3.1%       | 0.174              | 0   | 1   |
| Native American        | 12,991       | 0.4%       | 0.066              | 0   | 1   |
| Non-minority           | 12,991       | 83.0%      | 0.376              | 0   | 1   |
| Female                 | 12,991       | 55.7%      | 0.497              | 0   | 1   |
| Index (mean)           | 12,879       | 114.6      | 11.334             | 76  | 146 |
| First-Generation       | 12,991       | 24.5%      | 0.430              | 0   | 1   |
| Pell Recipient         | 12,991       | 21.5%      | 0.411              | 0   | 1   |