



Associations Between Student Attributes and Success

This report uses logistic regression models to illustrate the associations between student attributes (e.g., gender, race/ethnicity, high school GPA, etc.) and measures of persistence and graduation. Both full-time, first-time (FTFT) and transfer students with fall or summer start dates are included in the analyses and inspected separately. All models use the most recent three cohorts of students for which data are available, which means that each model pertains to a different set of cohorts depending on the outcome of interest. For example, logistic regression models that investigate associations between student attributes and 2nd fall persistence include the cohorts FA19, FA18, and FA17 while models that investigate 4-year graduation as an outcome include the cohorts FA16, FA15, and FA14 because these are the most recent cohorts for which 4-year graduation rates are available.

Key Findings

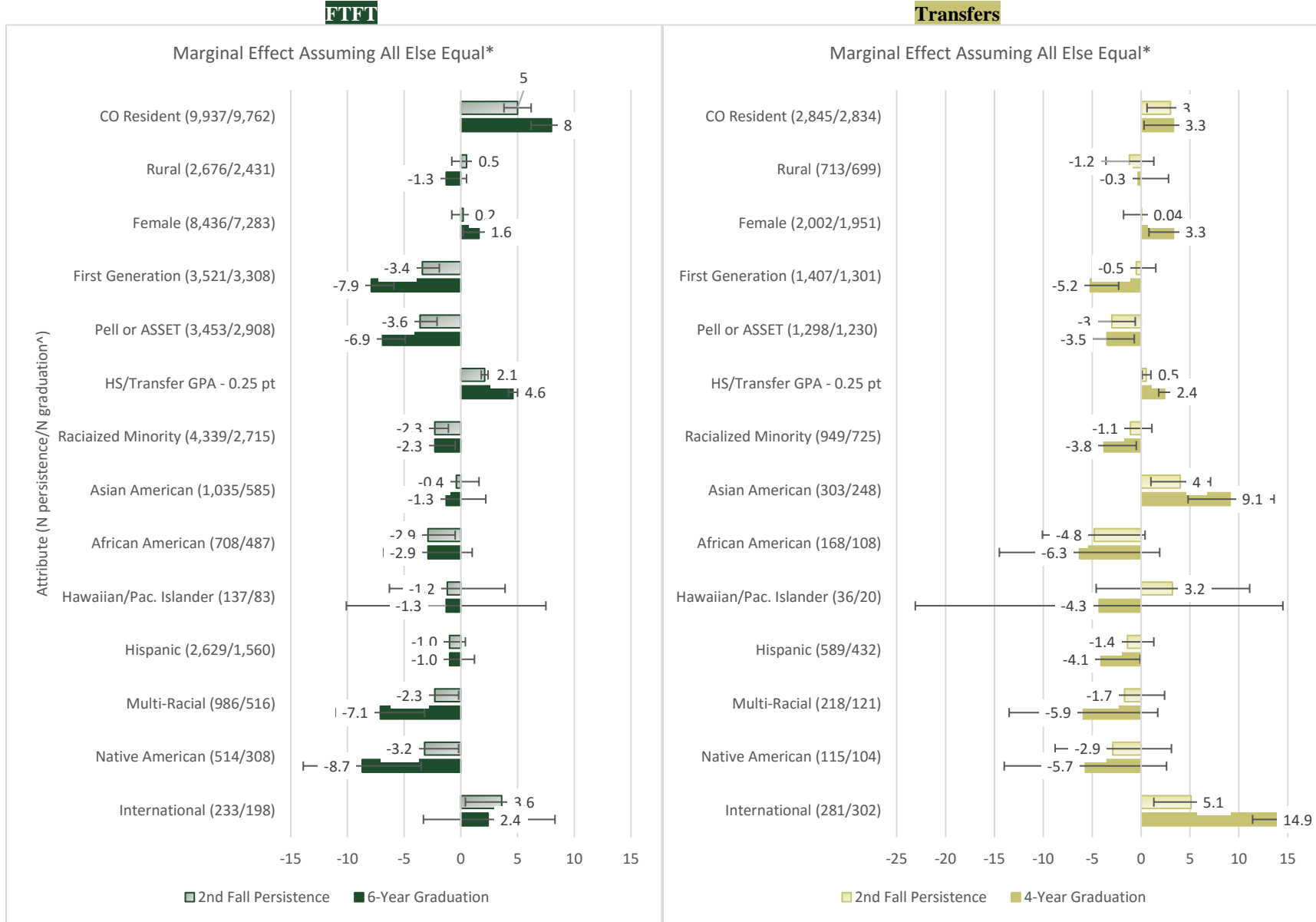
For both full-time, first-time (FTFT) and transfer students, resident females with higher high school (HS)/transfer GPAs who are non-first generation and non-Pell/non-ASSET students have greater odds of persisting to 2nd fall and graduating within 4 to 6 years – all else equal.

Among FTFT, racially minoritized students have lower odds of persisting and graduating, especially those identifying as Multi-Racial and/or Native American. Meanwhile, among transfers, racially minoritized students have about the same odds of persisting to 2nd fall and graduating within 5 or 6 years; however, they are less likely to graduate on a 4-year timeline. Separately, transfers of Asian American and International identities have higher odds of persisting and graduating compared to their peers, all else equal.

Figure 1 below summarizes the main findings from our logistic regression models, displaying the marginal effect of each unique student attribute on the probability of persisting/graduating, holding all other attributes of the student constant. In other words, Figure 1 displays how much more (or less) likely a student is to persist to 2nd fall or graduate within 6 (FTFT) or 4 (transfer) years by having a certain attribute, relative to another student who is identical along other demographic characteristics except for that one attribute. The marginal effect of each attribute is displayed as a singular point estimate value; and that point estimate is contained within a 95% confidence interval, bounded by a lower value and upper value. Interpretation-wise, we are 95% confident that each interval, separately, contains the “true” or “correct” numerical association between the attribute and success outcome of interest.

As a concrete example, the FTFT panel in Figure 1 shows that the “marginal effect” of being a Colorado resident on 2nd fall persistence is 5 percentage points (PP). In other words, our logistic regression model predicts that a FTFT having Colorado residency is 5PP more likely to persist to 2nd fall compared to a FTFT nonresident who is identical along other attributes (e.g., gender, race/ethnic identity, etc.). This 5PP point estimate falls within a confidence interval ranging from 3.8 to 6.2PP. The “true” association between residency and 2nd fall persistence may not be exactly 5PP; however, we are 95% confident that the true association falls somewhere between 3.8 and 6.2PP and is therefore positively associated with persistence (i.e. not zero).

Figure 1. Marginal effects of student attributes on likelihoods of persisting/graduating by entry status



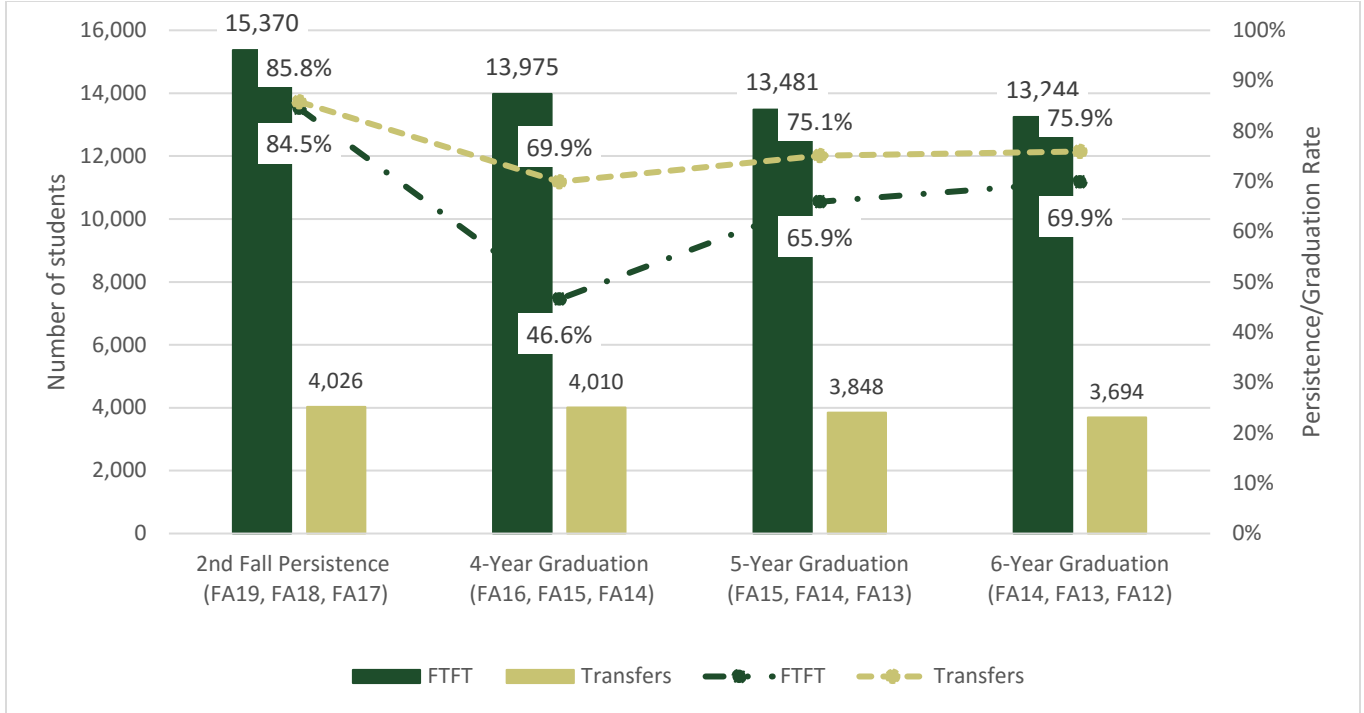
* The predicted probability of the specified persistence/graduation outcome assumes an urban, CO resident, non-rationally minoritized, female, with a HS/Transfer GPA of 3.53 (the mean) who is not first generation nor a Pell recipient nor an ASSET student unless otherwise indicated.

^ The Ns specify the number of students having that attribute within each separate logistic regression sample (e.g., 2nd fall persistence, 4-year graduation, etc.)

Student Attribute Comparisons

The four student success outcomes we estimate logistic regression models for are 2nd fall persistence, 4-year graduation rate, 5-year graduation rate, and 6-year graduation rate. Each of these models are run for different cohorts based on which three are most recently available with data. Figure 2 shows the counts (primary y-axis) of both FTFT and transfer students included in each logistic regression, separately, as well as the cohorts they belong to (x-axis). Plotted next to these student counts are the relevant persistence/graduation rates (secondary y-axis) of both FTFT and transfers by logistic regression outcome as well.

Figure 2. Number of students and rates of student success by logistic regression outcome and entry status



For example, when we investigate student attributes associated with 2nd fall persistence, we include students in cohorts FA19, FA18, and FA17. Of this group, 15,370 are FTFT while 4,046 are transfers; 84.5% of all FTFT and 85.8% of all transfers persist to their 2nd fall semester.

Table 1 displays descriptive statistics for FTFT students in each of the logistic regression models, while Table 2 does the same for transfer students. Within each outcome panel, the first column summarizes the proportion of students with each corresponding attribute (e.g., Colorado resident, female, etc.) within the entire regression sample. The second column summarizes the proportions of students with each corresponding attribute who did not meet the outcome criteria (i.e., the proportion who did not persist to their 2nd fall semester, or outcome=No). Last, the third column summarizes the proportions of students with each corresponding attribute who did meet the outcome criteria (i.e., the proportion who did persist to their 2nd fall semester, or outcome=Yes).

For example, among transfer students (Table 2) in the logistic models for 4-year graduation, 70.9% of all students in the model are from an urban area, while 75.4% of students who did not graduate in 4-years are from an urban area, and 69.0% of students who did graduate in 4-years are from an urban area.

Table 1. Descriptive statistics by logistic regression outcome for FTFT

	FTFT											
	2 nd Fall Persistence			4-Year Graduation			5-Year Graduation			6-Year Graduation		
	All	No	Yes	All	No	Yes	All	No	Yes	All	No	Yes
<i>N</i>	15,370	2,378	12,992	13,975	7,460	6,515	13,481	4,591	8,890	13,244	3,982	9,262
CO Resident	64.7%	59.5%	65.6%	70.0%	68.4%	71.7%	71.9%	68.8%	73.5%	73.7%	70.2%	75.2%
Rural	17.4%	16.4%	17.6%	18.1%	18.0%	18.2%	17.8%	17.6%	17.9%	18.4%	18.5%	18.3%
Urban	77.8%	78.8%	77.6%	75.7%	75.4%	76.1%	75.8%	75.5%	76.0%	75.6%	75.2%	75.8%
Rural Status Missing ¹	4.8%	4.8%	4.8%	6.2%	6.6%	5.7%	6.3%	6.9%	6.1%	6.0%	6.3%	5.9%
Female	54.9%	51.6%	55.5%	54.7%	47.2%	63.3%	54.1%	49.5%	56.5%	55.0%	51.3%	56.6%
First Generation	22.9%	29.8%	21.7%	24.3%	27.5%	20.7%	24.8%	30.9%	21.7%	25.0%	32.1%	21.9%
Pell or ASSET	22.5%	29.3%	21.2%	21.4%	24.6%	17.8%	21.3%	27.1%	18.4%	22.0%	27.8%	19.5%
HS/Transfer GPA ²	3.66 (0.470)	3.50 (0.457)	3.69 (0.467)	3.61 (0.451)	3.50 (0.434)	3.73 (0.436)	3.60 (0.438)	3.46 (0.416)	3.68 -0.43	3.60 (0.423)	3.46 (0.402)	3.65 (0.420)
Racially Minoritized ³	28.2%	34.7%	27.0%	22.8%	24.6%	20.6%	21.1%	24.4%	19.5%	20.5%	24.3%	18.9%
Asian American	6.7%	6.9%	6.7%	5.3%	5.3%	5.3%	4.6%	4.5%	4.7%	4.4%	4.5%	4.4%
African American	4.6%	6.8%	4.2%	4.0%	4.6%	3.5%	3.6%	4.7%	3.1%	3.7%	4.9%	3.1%
Hawaiian/Pac. Islander	0.9%	1.1%	0.8%	0.7%	0.7%	0.6%	0.6%	0.6%	0.6%	0.6%	0.7%	0.6%
Hispanic	17.1%	20.7%	16.4%	13.4%	14.7%	12.0%	12.5%	14.9%	11.2%	11.8%	13.9%	10.9%
Multi-Racial	6.4%	7.8%	6.2%	3.4%	4.0%	2.6%	3.2%	4.1%	2.8%	3.9%	5.2%	3.3%
Native American	3.3%	4.5%	3.1%	2.0%	2.6%	1.3%	2.1%	2.9%	1.7%	2.3%	3.5%	1.8%
International	1.5%	1.5%	1.5%	1.9%	2.4%	1.4%	1.8%	2.1%	1.7%	1.5%	1.6%	1.4%

¹ Students with missing rural status are those for which data on their home city’s population are missing.

² There were 712 students (1.4% of overall sample) for whom a high school/transfer GPA was missing. We impute values for these missing observations using a regression approach that uses variation in other non-missing attributes of each student to predict a high school/transfer GPA. The standard deviation of all HS/Transfer GPAs (non-missing and imputed) is in parentheses beneath the mean for each sample.

³ The racially minoritized variable equals 1 for students who identify as Asian American, African American, Hawaiian/Pacific Islander, Hispanic, Multi-Racial, and/or Native American. The separate, disaggregated racially minoritized variables are equal to 1 for students who identify as that racial/ethnic status and 0 otherwise. Students can identify as multiple racial/ethnic identities and are counted as part of each identified racial/ethnic category.

Table 2. Descriptive statistics by logistic regression outcome for transfers

	Transfers											
	2 nd Fall Persistence			4-Year Graduation			5-Year Graduation			6-Year Graduation		
	All	No	Yes	All	No	Yes	All	No	Yes	All	No	Yes
<i>N</i>	4,026	572	3,454	4,010	1,209	2,801	3,848	958	2,890	3,694	890	2,804
CO Resident	70.7%	68.0%	71.1%	70.7%	71.0%	70.5%	72.9%	73.8%	72.6%	75.0%	76.9%	74.4%
Rural	17.7%	19.4%	17.4%	17.4%	17.5%	17.4%	17.9%	18.7%	17.6%	18.4%	19.9%	18.0%
Urban	72.5%	73.6%	72.4%	70.9%	75.4%	69.0%	69.9%	74.0%	68.5%	68.9%	73.5%	67.5%
Rural Status Missing ¹	9.8%	7.0%	10.2%	11.6%	7.1%	13.6%	12.2%	7.3%	13.8%	12.6%	6.6%	14.6%
Female	49.7%	48.8%	49.9%	48.7%	43.6%	50.8%	48.7%	45.9%	49.7%	47.8%	44.2%	49.0%
First Generation	34.9%	37.8%	34.5%	32.4%	38.0%	30.0%	32.9%	37.4%	31.4%	32.5%	39.7%	30.2%
Pell or ASSET	32.2%	38.3%	31.2%	30.7%	36.1%	28.3%	30.5%	37.5%	28.2%	31.7%	38.4%	29.6%
HS/Transfer GPA ²	3.21	3.14	3.22	3.209	3.10	3.26	3.21	3.10	3.25	3.20	3.09	3.24
	(0.544)	(0.528)	(0.546)	(0.515)	(0.515)	-0.507	(0.516)	(0.520)	(0.509)	(0.523)	-0.529	(0.517)
Racially Minoritized ³	23.6%	26.6%	23.1%	18.1%	22.2%	16.3%	16.3%	19.0%	15.4%	15.8%	19.2%	14.8%
Asian American	7.5%	4.7%	8.0%	6.2%	3.1%	7.5%	5.4%	2.6%	6.4%	4.8%	2.7%	5.5%
African American	4.2%	6.3%	3.8%	2.7%	4.0%	2.1%	2.5%	4.1%	2.0%	2.5%	4.2%	2.0%
Hawaiian/Pac. Islander	0.9%	0.7%	0.9%	0.5%	0.7%	0.4%	0.4%	0.2%	0.4%	0.2%	0.3%	0.2%
Hispanic	14.6%	17.0%	14.2%	10.8%	13.6%	9.6%	9.4%	11.4%	8.7%	9.3%	11.5%	8.6%
Multi-Racial	5.4%	6.3%	5.3%	3.0%	3.9%	2.6%	2.7%	3.8%	2.3%	2.4%	3.5%	2.0%
Native American	2.9%	3.7%	2.7%	2.6%	3.4%	2.2%	2.3%	3.2%	2.0%	2.1%	3.0%	1.7%
International	7.0%	4.2%	7.4%	7.5%	2.7%	9.6%	8.0%	2.2%	9.9%	8.2%	1.7%	10.2%

¹ Students with missing rural status are those for which data on their home city’s population are missing.

² There were 712 students (1.4% of overall sample) for whom a high school/transfer GPA was missing. We impute values for these missing observations using a regression approach that uses variation in other non-missing attributes of each student to predict a high school/transfer GPA. The standard deviation of all HS/Transfer GPAs (non-missing and imputed) is in parentheses beneath the mean for each sample.

³ The racially minoritized variable equals 1 for students who identify as Asian American, African American, Hawaiian/Pacific Islander, Hispanic, Multi-Racial, and/or Native American. The separate, disaggregated racially minoritized variables are equal to 1 for students who identify as that racial/ethnic status and 0 otherwise. Students can identify as multiple racial/ethnic identities and are counted as part of each identified racial/ethnic category.

The unconditional means in Tables 1 and 2 show that several student attributes are overrepresented among those who succeed in persisting to their 2nd fall semester and those graduating on a 4-, 5-, or 6-year timeline. Non-racially minoritized, female, non-first generation, and non-Pell/non-ASSET students are overrepresented among those who persist and graduate within a 6-year horizon (outcome=Yes) among both full-time FTFT and transfer students. Colorado residents are overrepresented among FTFT who succeed in persisting to 2nd fall and graduating within 4 to 6 years. Meanwhile, International students are overrepresented among transfer students who succeed in persisting and completing their degree at CSU.

Student Attributes and Success Outcomes

To estimate the relative relationship between student attributes and success outcomes beyond raw proportions, we run logistic regression models that include a wide range of student attribute covariates. We discuss each attribute and its association with student success outcomes in more detail below. [Tables 5](#) and [6](#) in the [Appendix](#) display odds ratios for logistic regressions for FTFT and transfer students, respectively.

Tables 3 and 4, below, translate these odds ratios into predicted probabilities of success based on student attributes for FTFT and transfer students as well. The predicted probability of the specified persistence/graduation outcome assumes an urban, CO resident, non-racially minoritized, female, with a HS/Transfer GPA of 3.53 (the mean) who is not first generation, nor a Pell recipient, nor an ASSET student unless otherwise indicated (“all else equal”).

To describe the correlation between an attribute and success outcome, holding all other attributes equal, we display the 95% confidence intervals for each probability of success rather than a singular probability estimate. For example, the first column of Table 3 shows that the expected probability of persisting to 2nd fall semester for a FTFT Colorado resident falls between 87.2% and 89.1%, while the expected probability of persisting for nonresidents falls between 81.9% and 84.5%. We are 95% confident that each of these intervals separately contains the “true” or “correct” probability of persisting by residency status, assuming our models accurately capture all variables correlated with persistence.

It is important to note, however, that this is a big assumption, and likely not true. We attempt to control for relevant observed student characteristics for which we have data, but we are not able to include other variables such as unobserved student characteristics (e.g., underlying motivation, work status, etc.) that may be associated with student success. In addition, our models may not capture the full suite of observed student characteristics that could possibly affect their likelihood of persisting or graduating, such as financial aid dollars. Our logistic regression approach is limited in these ways; and therefore, our estimates should be interpreted as our best guess of the association between student attributes and student success outcomes, accounting only for the baseline student characteristics we include in our models.

Below each of the predicted probability interval ranges in Tables 3 and 4, we also calculate the confidence interval around the “marginal effect” of residency on persistence (the values displayed in [Figure 1](#)). In this instance, we find that Colorado FTFT residents – all else equal – are between 3.8 and 6.2 percentage points (PP) more likely to persist to 2nd fall than their nonresident peers. We are 95% confident that the “correct” marginal effect is contained within this interval. Please note that this range on the marginal effect of residency is an estimate that is inferred separately from the range on the predicted probabilities for residents and nonresidents. The confidence interval range around the marginal effect tells us the likely location of the “true” numerical association between a student attribute and a success outcome. The prediction intervals tell us where we can expect to find a predicted probability of persisting/graduating by student attribute based on the distribution of data in our sample.

Table 3. 95% confidence intervals of predicted probabilities and marginal effects¹ of outcomes for FTFT

FTFT				
	2nd Fall Persistence ²	4-Year Graduation ³	5-Year Graduation ⁴	6-Year Graduation ⁵
<i>N</i>	15,370	13,975	13,481	13,244
CO Resident	87.2% – 89.1%	54.8% – 58.0%	71.5% – 74.3%	75.5% – 78.1%
Nonresident	81.9% – 84.5%	47.8% – 51.7%	63.1% – 67.0%	66.9% – 70.7%
Marginal Effect (ME) Range	3.8 – 6.2	4.7 – 8.6	6 – 9.7	6.2 – 9.8
Rural	87.3% – 90.0%	52.4% – 57.1%	69.9% – 74.2%	73.5% – 77.4%
Not Rural	87.2% – 89.1%	54.8% – 58.0%	71.5% – 74.3%	75.5% – 78.1%
ME Range	-0.8 – 1.7	-3.9 – 0.6	-2.8 – 1.1	-3.2 – 0.5
Female	87.2% – 89.1%	54.8% – 58.0%	71.5% – 74.3%	75.5% – 78.1%
Male	87.0% – 88.9%	42.0% – 45.2%	68.9% – 71.8%	73.9% – 76.5%
ME Range	-0.8 – 1.2	11.1 – 14.6	1 – 4.1	0.2 – 3
First Generation	83.1% – 86.5%	47.3% – 52.2%	63.7% – 68.2%	66.7% – 71.2%
Non-First Generation	87.2% – 89.1%	54.8% – 58.0%	71.5% – 74.3%	75.5% – 78.1%
ME Range	-4.8 – -1.9	-8.9 – -4.4	-9 – -4.9	-9.8 – -5.9
Pell or ASSET	82.9% – 86.3%	45.3% – 50.5%	61.8% – 66.7%	67.6% – 72.2%
Not Pell or ASSET	87.2% – 89.1%	54.8% – 58.0%	71.5% – 74.3%	75.5% – 78.1%
ME Range	-5 – -2.1	-10.8 – -6.2	-10.9 – -6.5	-8.9 – -4.9
HS/Transfer GPA 3.78	89.4% – 91.0%	61.6% – 64.7%	77.1% – 79.6%	80.1% – 82.4%
HS/Transfer GPA 3.53	87.2% – 89.1%	54.8% – 58.0%	71.5% – 74.3%	75.5% – 78.1%
ME Range of 0.25 GPA point	1.8 – 2.4	6 – 6.9	5.1 – 5.9	4.2 – 5
Racially Minoritized ⁷	84.4% – 87.3%	51.3% – 56.1%	68.9% – 73.3%	72.4% – 76.5%
Non-Minority	87.2% – 89.1%	54.8% – 58.0%	71.5% – 74.3%	75.5% – 78.1%
ME Range	-3.5 – -1.1	-4.9 – -0.5	-3.8 – 0.1	-4.2 – -0.5
Asian American	85.2% – 89.5%	49.2% – 57.3%	68.7% – 76.1%	71.7% – 78.8%
Not Asian American	86.7% – 88.7%	54.5% – 57.7%	71.2% – 74.0%	75.2% – 77.8%
ME Range	-2.3 – 1.6	-6.8 – 1.1	-3.8 – 3.3	-4.7 – 2.2
African American	82.2% – 87.5%	50.1% – 59.6%	66.3% – 74.9%	69.6% – 77.7%
Not African American	86.8% – 88.7%	54.4% – 57.6%	71.3% – 74.1%	75.2% – 77.8%
ME Range	-5.4 – -0.5	-5.7 – 3.5	-6.3 – 2	-6.8 – 1
Hawaiian/Pac. Islander	81.3% – 91.6%	43.2% – 64.9%	67.5% – 84.9%	66.2% – 84.0%
Not Hawaiian/Pac. Islander	86.7% – 88.6%	54.4% – 57.5%	71.2% – 74.0%	75.1% – 77.7%
ME Range	-6.3 – 3.9	-12.7 – 8.9	-5.1 – 12.3	-10.1 – 7.5
Hispanic	85.2% – 88.4%	51.4% – 57.2%	68.2% – 73.4%	73.1% – 78.0%
Not Hispanic	86.8% – 88.8%	54.5% – 57.7%	71.4% – 74.2%	75.2% – 77.8%
ME Range	-2.4 – 0.4	-4.4 – 0.9	-4.4 – 0.3	-3.2 – 1.2
Multi-Racial	83.2% – 87.7%	41.2% – 51.4%	62.5% – 71.7%	65.5% – 73.7%
Not Multi-Racial	86.8% – 88.8%	54.7% – 57.8%	71.4% – 74.2%	75.4% – 78.0%
ME Range	-4.4 – -0.2	-15 – -4.9	-10.1 – -1.2	-11 – -3.2
Native American	81.5% – 87.7%	37.1% – 50.8%	59.8% – 71.2%	62.6% – 73.2%
Not Native American	86.8% – 88.7%	54.5% – 57.7%	71.3% – 74.1%	75.3% – 77.9%
ME Range	-6.1 – -0.2	-18.8 – -5.4	-12.8 – -1.7	-13.9 – -3.5
International ⁸	88.0% – 94.7%	42.6% – 57.9%	69.7% – 81.4%	73.0% – 84.9%
Not International	86.7% – 88.7%	54.3% – 57.5%	71.3% – 74.1%	75.2% – 77.8%
ME Range	0.4 – 6.9	-13.1 – 1.7	-2.8 – 8.5	-3.3 – 8.3

¹ The predicted probability confidence interval of the specified persistence/graduation outcome assumes an urban, CO resident, non-racially minoritized, female, with a HS/Transfer GPA of 3.53 (the average) who is not first generation nor a Pell recipient nor an ASSET student unless otherwise indicated. The prediction intervals tell us where we can expect to find a predicted probability of persisting/graduating by student attribute based on the distribution of data in our sample. The

confidence interval range around the marginal effect tells us the likely location of the “true” numerical association between a student attribute and a success outcome.

² Includes first-time, full-time FTFT who started in cohorts FA19, FA18, and FA17.

³ Includes first-time, full-time FTFT who started in cohorts FA16, FA15, and FA14.

⁴ Includes first-time, full-time FTFT who started in cohorts FA15, FA14, and FA13.

⁵ Includes first-time, full-time FTFT who started in cohorts FA14, FA13, and FA12.

⁶ Predicted probabilities and marginal effects for the disaggregated racially minoritized variables are calculated from separate logistic regression models using a dichotomous variable, where identifying as the race/ethnic category (e.g., Asian American) equals 1 and not identifying as such equals 0 (e.g., Not Asian American). All other assumptions about the student’s attributes remain the same (e.g., urban, CO resident, female, etc.) as in the other logistic regression models.

⁷ Though not a racially minoritized category, we also run separate logistic regression models using a dichotomous variable where International equals 1 and non-International equals 0 to produce predicted probabilities for each outcome. All other assumptions about the student’s attributes remain the same.

Table 4. 95% confidence intervals of predicted probabilities and marginal effects¹ of outcomes for transfers

Transfers				
	2nd Fall Persistence ²	4-Year Graduation ³	5-Year Graduation ⁴	6-Year Graduation ⁵
<i>N</i>	4,026	4,010	3,848	3,694
CO Resident	87.0% – 90.7%	76.4% – 81.3%	78.6% – 83.5%	79.9% – 84.7%
Nonresident	83.2% – 88.5%	72.2% – 78.9%	75.0% – 81.8%	76.7% – 83.6%
Marginal Effect (ME) Range	0.6 – 5.3	0.3 – 6.3	-0.4 – 5.8	-0.9 – 5.4
Rural	84.9% – 90.4%	75.2% – 81.9%	76.7% – 83.4%	77.8% – 84.5%
Not Rural	87.0% – 90.7%	76.4% – 81.3%	78.6% – 83.5%	79.9% – 84.7%
ME Range	-3.6 – 1.3	-3.4 – 2.8	-4.1 – 2.1	-4.2 – 1.8
Female	87.0% – 90.7%	76.4% – 81.3%	78.6% – 83.5%	79.9% – 84.7%
Male	86.9% – 90.7%	72.9% – 78.2%	78.3% – 83.2%	78.7% – 83.6%
ME Range	-1.8 – 1.9	0.8 – 5.8	-2 – 2.8	-1.2 – 3.6
First Generation	86.0% – 90.8%	70.2% – 77.2%	75.4% – 81.9%	74.0% – 81.0%
Non-First Generation	87.0% – 90.7%	76.4% – 81.3%	78.6% – 83.5%	79.9% – 84.7%
ME Range	-2.4 – 1.5	-8 – -2.3	-5.1 – 0.3	-7.7 – -2
Pell or ASSET	83.1% – 88.6%	71.9% – 78.7%	72.2% – 79.4%	75.2% – 82.0%
Not Pell or ASSET	87.0% – 90.7%	76.4% – 81.3%	78.6% – 83.5%	79.9% – 84.7%
ME Range	-5.3 – -0.6	-6.4 – -0.7	-8.3 – -2.4	-6.5 – -0.9
HS/Transfer GPA 3.78	87.4% – 91.2%	78.5% – 83.5%	80.5% – 85.4%	81.6% – 86.4%
HS/Transfer GPA 3.53	87.0% – 90.6%	76.4% – 81.3%	78.6% – 83.5%	79.9% – 84.8%
ME Range of 0.25 GPA point	0.1 – 1	1.8 – 3.1	1.5 – 2.8	1.3 – 2.6
Racially Minoritized ⁶	85.0% – 90.4%	71.1% – 78.9%	75.9% – 83.4%	76.3% – 84.0%
Non-Minority	87.0% – 90.7%	76.4% – 81.3%	78.6% – 83.5%	79.9% – 84.7%
ME Range	-3.3 – 1.1	-7.2 – -0.5	-4.7 – 1.8	-5.5 – 1.1
Asian American	89.3% – 95.5%	82.6% – 91.4%	84.9% – 93.6%	83.2% – 92.9%
Not Asian American	86.5% – 90.2%	75.3% – 80.3%	78.0% – 82.9%	79.3% – 84.2%
ME Range	1 – 7.1	4.8 – 13.6	4.4 – 13.2	1.6 – 11.1
African American	78.2% – 89.6%	63.4% – 80.7%	63.8% – 81.9%	63.5% – 82.2%
Not African American	86.9% – 90.5%	75.9% – 80.9%	78.6% – 83.4%	79.8% – 84.6%
ME Range	-10.1 – 0.4	-14.5 – 1.9	-16.8 – 0.5	-18.2 – -0.4
Hawaiian/Pac. Islander	83.9% – 99.7%	55.0% – 93.0%	78.9% – 104%	47.0% – 107%
Not Hawaiian/Pac. Islander	86.8% – 90.4%	75.9% – 80.8%	78.4% – 83.3%	79.6% – 84.4%
ME Range	-4.6 – 11.1	-23.1 – 14.5	-1.9 – 23	-34.9 – 25.1
Hispanic	84.1% – 90.6%	69.8% – 79.1%	74.2% – 83.5%	75.8% – 84.9%
Not Hispanic	86.9% – 90.6%	76.1% – 81.1%	78.6% – 83.5%	79.7% – 84.6%
ME Range	-4.1 – 1.3	-8.3 – -0.1	-6.3 – 1.9	-5.8 – 2.1

Multi-Racial	82.7% – 91.3%	64.7% – 80.5%	64.1% – 81.6%	63.6% – 81.9%
Not Multi-Racial	86.9% – 90.6%	76.0% – 81.0%	78.8% – 83.6%	79.9% – 84.7%
ME Range	-5.8 – 2.4	-13.5 – 1.7	-16.8 – 0.2	-18.5 – -0.7
Native American	79.5% – 92.0%	64.1% – 81.3%	65.5% – 83.9%	65.4% – 84.6%
Not Native American	86.8% – 90.5%	76.0% – 80.9%	78.6% – 83.4%	79.8% – 84.6%
ME Range	-8.8 – 3.1	-14 – 2.6	-15.2 – 2.5	-16.5 – 2.1
International ⁷	89.8% – 97.7%	89.9% – 96.6%	93.7% – 98.4%	94.6% – 99.0%
Not International	86.8% – 90.4%	75.9% – 80.8%	78.3% – 83.2%	79.4% – 84.2%
ME Range	1.3 – 9	11.4 – 18.6	12.2 – 18.3	12 – 17.9

¹ The predicted probability confidence interval of the specified persistence/graduation outcome assumes an urban, CO resident, non-racially minoritized, female, with a HS/Transfer GPA of 3.53 (the average) who is not first generation nor a Pell recipient nor an ASSET student unless otherwise indicated. The prediction intervals tell us where we can expect to find a predicted probability of persisting/graduating by student attribute based on the distribution of data in our sample. The confidence interval range around the marginal effect tells us the likely location of the “true” numerical association between a student attribute and a success outcome.

² Includes first-time, full-time transfers who started in cohorts FA19, FA18, and FA17.

³ Includes first-time, full-time transfers who started in cohorts FA16, FA15, and FA14.

⁴ Includes first-time, full-time transfers who started in cohorts FA15, FA14, and FA13.

⁵ Includes first-time, full-time transfers who started in cohorts FA14, FA13, and FA12.

⁶ Predicted probabilities and marginal effects for the disaggregated racially minoritized variables are calculated from separate logistic regression models using a dichotomous variable, where identifying as the race/ethnic category (e.g., Asian American) equals 1 and not identifying as such equals 0 (e.g., Not Asian American). All other assumptions about the student’s attributes remain the same (e.g., urban, CO resident, female, etc.) as in the other logistic regression models.

⁷ Though not a racially minoritized category, we also run separate logistic regression models using a dichotomous variable where International equals 1 and non-International equals 0 to produce predicted probabilities for each outcome. All other assumptions about the student’s attributes remain the same.

Colorado Residency

After controlling for rural status, ethnicity, gender, HS/Transfer GPA, first generation, and Pell/ASSET status, Colorado residents have higher odds of persisting to their 2nd fall semester and graduating in 4, 5, or 6 years compared to nonresidents. This is true for both FTFT and transfer students, alike, but is especially so for FTFT. For example, FTFT resident students have 1.51 the odds of persisting to their 2nd fall compared to nonresidents ([Table 5](#)). The 51% higher odds translate into higher predicted probabilities of persistence. All else equal, a Colorado freshman resident has a predicted probability of persisting to the second fall that is between 3.8 and 6.2 percentage points (PP) higher than an identical student who is a nonresident. Similarly, resident transfer students have a predicted probability of persisting to the second fall that is 0.6 to 5.3PP higher than an identical nonresident transfer student.

In terms of graduation, Colorado FTFT residents have between 1.31 and 1.50 the odds of graduating in 4 to 6 years compared to FTFT nonresidents. Transforming these odds ratios into predicted probabilities, we find that – all else equal – FTFT residents are between 4.7 and 9.8PP more likely to graduate within a 6-year timeline compared to FTFT nonresidents. Meanwhile, transfer residents have 1.21 the odds of graduating in 4 years compared to their otherwise similar nonresident peers. This translates into their being between 0.3 and 6.3PP more likely to graduate in 4 years compared to nonresidents.

Rural/Urban Status

All else equal, full-time students hailing from rural communities are no more or less likely to persist or graduate than their urban peers, whether they are FTFT or transfer students.

Gender

Female FTFT have about the same odds of persisting to 2nd fall as male FTFT, although they have higher odds of graduating in 4, 5, and 6 years – especially graduating in 4 years (1.68 the odds of male). All else equal, female FTFT are 11.1 – 14.6PP more likely to graduate in 4 years. Meanwhile, female transfers have 1.21 the odds of graduating in 4 years compared to male transfers, though the 95% marginal effect range is much wider and encompasses smaller values than the range for FTFT. All else equal, female transfers are 0.8 – 5.8PP more likely to graduate in 4 years. Female FTFT are also slightly more likely to graduate in 5 and 6 years compared to their otherwise similar male peers (0.2 – 4.1PP), while female transfers have about the same odds of 5- and 6-year graduation compared to male transfers.

First Generation

FTFT first-generation students have 25% lower odds (0.75 odds ratio) of persisting to 2nd fall compared to non-first-generation students. These odds translate into a 1.9 – 4.8PP lower likelihood of persisting, all else equal. Among both FTFT and transfer students, first generation students have lower odds of graduating as well. First-generation FTFT have between 0.67 and 0.75 the odds of graduating in 4 to 6 years. Translated into marginal effects, this means first-generation FTFT are 4.4 – 9.8PP less likely to graduate within a 6-year timeline compared to non-first-generation FTFT. First-generation transfers have about 0.75 the odds of graduating in 4 years and 6 years. Holding all else equal, first-generation transfers are 2 – 8PP less likely to graduate in 4 years and 6 years, compared to non-first-generation transfers.

Pell or ASSET

Among both FTFT and transfers, Pell recipient and/or ASSET status is associated with statistically significant lower odds of persisting and graduating, all other student attributes held constant. FTFT Pell/ASSET students have 26% lower odds (0.74 odds ratio) and transfer Pell/ASSET students have 23% lower odds (0.77 odds ratio) of persisting to 2nd fall. These odds ratios translate into similar marginal effect ranges; FTFT Pell/ASSET students are 2.1 – 5PP less likely to persist and transfer Pell/ASSET students are 0.6 – 5.3PP less likely to persist compared to non-Pell/non-ASSET students. FTFT Pell/ASSET students are between 6.2 and 10.9PP less likely to graduate in 4 and 5 years, and 4.9 – 8.9PP less likely to graduate in 6 years relative to their non-Pell/non-ASSET peers. Among full-time transfers, Pell/ASSET students also have lower odds of graduating on a 6-year timeline; however, these odds translate into wider marginal effect ranges that encompass smaller values compared with FTFT Pell/ASSET students. For instance, Pell/ASSET transfers are 0.7 – 6.5 PP less likely to graduate in 4 years and 6 years, and 2.4 – 8.3PP less likely to graduate in 5 years compared with non-Pell/non-ASSET transfers.

HS/Transfer GPA

All else equal, HS/Transfer GPA is positively associated with persistence and graduation for both FTFT and transfer students. Still, as with other attributes like first generation and Pell/ASSET status, the marginal effect of HS/Transfer GPA on persistence and graduation outcomes is smaller in magnitude for transfers than for FTFT. For every 0.25 increase in GPA (such as moving from the sample mean GPA of 3.53 to 3.78), we would expect a FTFT student would be about 2.1PP more likely to persist to 2nd fall. For transfer students, we would expect this same GPA increase to yield about a 0.5PP greater likelihood of 2nd fall persistence. For FTFT, every 0.25 increase in GPA is associated with a 4.6 – 6.5PP greater likelihood of graduating in 4, 5, and 6 years. Meanwhile, a 0.25 increase in GPA for transfers is associated with a 1.9 – 2.4PP greater likelihood of graduating in 4, 5, and 6 years.

Race/Ethnicity

All else equal, FTFT of racially minoritized identities have lower odds of persisting to 2nd fall and graduating in 4, 5, and 6 years compared to non-minoritized FTFT (i.e., White, International, and no response students). Racially

minoritized FTFT have 18% lower odds (0.82 odds ratio) of persisting to 2nd fall and 0.88 – 0.91 the odds of graduating within 6 years compared to their otherwise non-minoritized peers. These odds translate into a Racially minoritized being 1.1 – 3.5PP less likely to persist to 2nd fall and about 0.5 – 4.9PP less likely to graduate in 4 years and 6 years. Among transfer students, racially minoritized students have similar odds of persisting to 2nd fall and graduating in 5 to 6 years but have 20% lower odds (0.80 odds ratio) the odds of graduating in 4 years. This translates into racially minoritized student transfers being 0.5 to 7.2PP less likely to graduate in 4 years compared to non-minority transfers who are identical along other attributes.

In separate logistic regression models, we estimate the relationship between disaggregated racial/ethnic identities and student success outcomes. In these models, instead of an overall racially minoritized variable, we use a dichotomous variable equal to 1 if a student identifies as the racial/ethnic identify of interest (e.g., Asian American) and 0 otherwise (e.g., non-Asian American). Students are given a 1 for each dichotomous race/ethnic variable for all race/ethnicities that they identify. As in the main model, all other assumptions about the student’s attributes remain the same (e.g., urban, CO resident, female, etc.) when we estimate predicted probabilities and marginal effects of persisting and graduating.

[Figure 3](#) in the [Appendix](#) displays counts of FTFT and transfers identifying as each racial/ethnic category by logistic regression outcome sample. These small counts in certain racial/ethnic categories often mean our models predict fairly large 95% confidence interval ranges for where the “true” marginal effect of each racial/ethnic identity on persisting/graduating lies. For example, African American FTFT are between 0.5 and 5.4PP less likely to persist to 2nd fall than their non-African American identifying peers. This 6PP range is marginally significant because the lower bound is close to zero; yet, it remains substantively significant due to the observed drop in 2nd fall persistence among African American students at CSU by 25 points over the last 10 years.

Asian American

Among FTFT, Asian American students have similar odds of persisting and graduating compared to students who do not identify as Asian American, all other attributes held equal. However, among full-time transfers, Asian American students have higher odds of persisting and graduating compared to non-Asian American students. Asian American transfers have 22% higher odds (1.22 odds ration) of persisting to 2nd fall, or between a 1 – 7.1PP greater likelihood of persisting. They also have between 1.65 and 2.01 the odds of graduating in 4 to 6 years to compared to non-Asian transfers. These odds translate into statistically significant marginal effects. Asian American identifying transfers – all else equal – are 4.4 – 13.6PP more likely to graduate in 4 years and 5 years relative to non-Asian transfers. They are also 1.6 – 11.1PP more likely to graduate in 6 years. These ranges are wide in magnitude, given that the number of Asian American identifying students in each regression hovers around 70 per cohort ([Figure 3](#)).

African American

FTFT African American students have 22% lower odds (0.78 odds ratio) of persisting to 2nd fall compared to non-African American FTFT, all else equal. This translates into about a 0.5 – 5.4PP lower predicted likelihood pertaining to roughly 236 students per cohort. African American FTFT have slightly lower odds of graduating than their non-African American identifying peers, holding other attributes constant. However, the marginal effect ranges estimating the association between African American status and graduation are vast in size and contain zero. Among transfers, African American students have 34% lower odds (0.66 odds ratio) of persisting to 2nd fall and between 0.58 and 0.71 the odds of graduating in 4 to 6 years compared to their otherwise similar non-African American peers. Despite these lower odds being statistically significant ([Table 6](#) in the Appendix), they do not translate into statistically significant marginal effects ([Table 4](#)) due to the small count of African

American identifying students among the transfer population (roughly 30 students per cohort). Only the marginal effect for 6-year graduation is marginally statistically significant, ranging anywhere from 0.4 to 18.2PP, which is still a vast range.

Hawaiian/Pacific Islander

Among both FTFT and transfer groups, Hawaiian/Pacific Islander students are no more or less likely to persist or graduate in 4, 5, or 6 years. In interpreting these results, bear in mind the low counts of Hawaiian/Pacific Islander students in each logistic regression model, which average about 33 per cohort for FTFT and about 7 per cohort for transfers ([Figure 3](#)).

Hispanic

All else equal, Hispanic FTFT are about as likely to persist and graduate as their non-Hispanic peers, although there is some suggestive evidence that they have statistically lower odds of graduating on a 5-year timeline (about 0.91 the odds of a non-Hispanic student). Still, we do not find a statistically meaningful difference in the marginal effect of being Hispanic on the likelihood of graduating in 5 years (i.e., the marginal effect range of -4.4 to 0.3 in [Table 3](#) includes zero). Among transfers, Hispanic-identifying students – all else equal – have about 0.79 the odds of graduating in 4 years compared to non-Hispanic students. This translates into Hispanic students being between 0.1 – 8.3PP less likely to graduate in the 4-year timeline compared to their otherwise similar non-Hispanic peers. The number of students identifying as Hispanic comes second to that identifying as White – averaging about 646 per FTFT cohort and 144 per transfer cohort. Still, these relatively larger counts among minoritized students represent only about 4.6% and 3.7% of each FTFT and transfer cohort, respectively, which helps contribute to larger marginal effect ranges for some outcomes.

Multi-Racial

Among FTFT, multi-racial students have statistically significantly lower odds of persisting to 2nd fall and graduating in 4, 5, and 6 years compared to non-multi-racial students, holding all other student attributes fixed. Multi-racial FTFT have 0.82 the odds of persisting to 2nd fall, which translates into their being 0.2 – 4.4PP less likely to persist compared to non-multi-racial FTFT. The odds of graduating for multi-racial students compared to non-multi-racial students are even lower, ranging from 0.71 to 0.76. However, given the relatively small counts of multi-racial-identifying FTFT (averaging about 160 per cohort), the marginal effect ranges estimating the association between multi-racial status and graduation are large. For instance, multi-racial FTFT are between 4.9 – 15PP less likely to graduate in 4 years, 1.2 – 10.1PP less likely to graduate in 5 years, and 3.2 – 11PP less likely to graduate in 6 years compared to non-multi-racial FTFT, all else equal. Multi-racial students do appear less likely to graduate within 6 years, but our best guess for how much less likely encompasses an array of values.

Among transfers, multi-racial students only have statistically significant lower odds of graduating in 5 years compared to their non-multi-racial peers at 0.79. However, when we translate the odds ratios for each logistic regression into predicted probabilities and marginal effects, we find that we cannot say multi-racial transfers are less likely to graduate in 5 years compared to non-multi-racial students, holding all else constant. We also find no statistically significant difference in their likelihood of persisting to 2nd fall or graduating in 4 years. Though, we do observe a marginally statistically significant difference in their 6-year graduation rates compared to non-multi-racial students; they appear 0.7 – 18.5PP less likely to graduate in 6 years. However, this marginal effect range spans nearly 18PP (while the other, non-statistically significant ranges 8 to 17PP), due to the small counts of multi-racial-identifying students per cohort (about 44 per year overall).

It is important to bear in mind that the multi-racial identity captures the overlapping identities in other racial/ethnic categories. Among FTFT, about 41% of Asians, 32% of African Americans, 71% of Hawaiian/Pacific

Islander, and 61% of Native Americans also identify as Multi-Racial. For transfers, 51% of Asians, 35% of African Americans, 51% of Hawaiian/Pacific Islander, and 60% of Native Americans also identify as Multi-Racial. (Only about 5-6% of Hispanic FTFT and transfers identify as Multi-Racial as well.) In this way, the estimates of the odds ratios, predicted probabilities, and marginal effects of being “multi-racial” represent the mixed and partially aggregated effects across these separate racial and ethnic identities.

Native American

Native American FTFT have 0.77 the odds of persisting to 2nd fall and between 0.62 and 0.71 the odds of graduating in 4, 5, and 6 years compared to non-Native American FTFT. Translated into marginal effects, being Native American – all else equal – is associated with a 0.2 – 6.1PP lower likelihood of persisting to 2nd fall, and a lower, yet wider-ranging, likelihood of graduating. Compared to non-Native American FTFT, Native Americans are 5.4 – 18.8 PP less likely to graduate in 4 years, 1.7 – 12.8PP less likely to graduate in 5 years, and 3.5 – 13.9PP less likely to graduate in 6 years. Again, these wide marginal effect ranges are related to the small count of Native American students in each cohort, averaging about 115. Despite the uncertainty surrounding the “true” association value, it does appear that Native American FTFT are less likely to persist and graduate compared to their otherwise similar non-Native peers. As for Native American transfers, we do observe slightly statistically significant lower odds of them graduating in 6 years, but these odds do not translate into statistically significant differences in the marginal effect. The number of Native American transfers averages 32 per cohort.

International

Although not considered a racially minoritized student in our main regression model, we do estimate the relationship between International student status and success outcomes, especially given the higher relative representation of these students among the transfer student population at CSU in [Figure 3](#) (about 100 per cohort). International FTFT may be slightly more likely to persist to 2nd fall by 0.4 – 6.9PP relative to non-International FTFT. Meanwhile, International transfer students have 1.93 the odds, or are about 1.3 – 9PP more likely to persist to 2nd fall compared to non-International transfers. They also have notably higher odds (3.84 – 6.68) of graduating in 4, 5, and 6 years relative to non-International transfers, all else equal. These high odds translate into International transfers being between 11.4 – 18.6PP more likely to graduate on a 4-, 5-, and 6-year timeline.

Conclusions

Persistence and graduation patterns vary across student attributes at CSU. Among both FTFT and transfer students, Colorado residents, females, and students with higher prior academic achievement (HS/Transfer GPA) have higher odds of persisting to 2nd fall and graduating in 4, 5, and 6 years. On the other hand, first generation and Pell/ASSET students have lower odds of persisting and graduating. We also observe variation in the association between certain student attributes and success outcome among FTFT and transfer population, separately. FTFT of racially minoritized identities have lower odds of persisting and graduating relative to their non-racially minoritized peers, particularly among Multi-Racial and Native American students. Transfers of Asian American and International identities have higher odds of persisting and graduating compared to their non-Asian American and non-International peers, all else equal.

Appendix

Figure 3. Number of students by racial/ethnic identities by logistic regression outcome and entry status



The separate, disaggregated racially minoritized student variables are equal to 1 for students who identify as that racial/ethnic status (e.g., Asian American) and 0 otherwise (e.g., Not Asian American). Students can identify as multiple racial/ethnic identities and are counted as part of each identified racial/ethnic category.

Table 5. Odds ratios¹ for persistence/graduation for FTFT

	FTFT			
	2 nd Fall Persistence ²	4-Year Graduation ³	5-Year Graduation ⁴	6-Year Graduation ⁵
CO Resident	1.507***	1.307***	1.446***	1.501***
Rural	1.047	0.935	0.957	0.929
Rural Status Missing	1.085	0.935	0.953	0.983
Female	1.019	1.676***	1.135***	1.091**
First Generation	0.748***	0.765***	0.719***	0.670***
Pell of ASSET	0.738***	0.711***	0.667***	0.702***
HS/Transfer GPA	2.300***	3.073***	3.278***	2.949***
Racially Minoritized ⁶	0.817***	0.897**	0.913*	0.881**
Asian American	0.969	0.892	0.990	0.934
African American	0.779**	0.957	0.901	0.856
Hawaiian/Pac. Islander	0.899	0.928	1.208	0.930
Hispanic	0.914	0.931	0.905*	0.949
Multi-Racial	0.818**	0.671***	0.763***	0.696***
Native American	0.766**	0.615***	0.712***	0.646***
International	1.481*	0.788	1.153	1.154
Observations	15,370	13,975	13,481	13,244
Model Chi ²	477	1162	943.5	774
Model Degrees Freedom	8	8	8	8
Pseudo R ²	0.0361	0.0698	0.0605	0.0514

¹ *P<.05, ** P<.01, *** P<.001

² Includes first-time, full-time FTFT who started in cohorts FA19, FA18, and FA17.

³ Includes first-time, full-time FTFT who started in cohorts FA16, FA15, and FA14.

⁴ Includes first-time, full-time FTFT who started in cohorts FA15, FA14, and FA13.

⁵ Includes first-time, full-time FTFT who started in cohorts FA14, FA13, and FA12.

⁶ Odds ratios for the disaggregated racially minoritized and International variables are calculated from separate logistic regression models using a dichotomous variable where identifying as the race/ethnic category (e.g., Asian American) equals 1 and not identifying as such equals 0 (e.g., Not Asian American).

Table 6. Odds ratios¹ for persistence/graduation for transfers

	Transfers			
	2 nd Fall Persistence ²	4-Year Graduation ³	5-Year Graduation ⁴	6-Year Graduation ⁵
CO Resident	1.307**	1.208**	1.181*	1.156
Rural	0.892	0.986	0.940	0.922
Rural Status Missing	1.536**	2.045***	2.027***	2.326***
Female	1.004	1.210***	1.028	1.084
First Generation	0.957	0.750***	0.859*	0.739***
Pell of ASSET	0.765***	0.817**	0.728***	0.789***
HS/Transfer GPA	1.224**	1.683***	1.654***	1.613***
Racially Minoritized	0.898	0.804**	0.911	0.866
Asian American	1.602**	1.905***	2.007***	1.645**
African American	0.662**	0.707*	0.626**	0.582**
Hawaiian/Pac. Islander	1.446	0.788	2.522	0.739
Hispanic	0.874	0.792**	0.872	0.886
Multi-Racial	0.852	0.725	0.623**	0.572**
Native American	0.772	0.731	0.691	0.650*
International	1.925**	3.842***	5.740***	6.683***

Observations	15,370	13,975	13,481	13,244
Model Chi ²	477	1162	943.5	774
Model Degrees Freedom	8	8	8	8
Pseudo R ²	0.0361	0.0698	0.0605	0.0514

¹ *P<.05, ** P<.01, *** P<.001

² Includes first-time, full-time transfers who started in cohorts FA19, FA18, and FA17.

³ Includes first-time, full-time transfers who started in cohorts FA16, FA15, and FA14.

⁴ Includes first-time, full-time transfers who started in cohorts FA15, FA14, and FA13.

⁵ Includes first-time, full-time transfers who started in cohorts FA14, FA13, and FA12.

⁶ Odds ratios for the disaggregated racially minoritized and International variables are calculated from separate logistic regression models using a dichotomous variable where identifying as the race/ethnic category (e.g., Asian American) equals 1 and not identifying as such equals 0 (e.g., Not Asian American).