UTAH DATA RESEARCH CENTER

Post-Secondary Enrollment and Migration in Utah

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Abstract

The demographic, geographic, and economic circumstances of students play a large role in determining students' post-secondary education choices. This research evaluates the demographic, geographic, and economic factors influencing enrollment in and migration to post-secondary public Utah institutions. For this research, migration is enrollment in an institution outside of the Utah System of Higher Education (USHE) service region where a student graduated from high school (HS). The post-secondary institutions included in this research are either degree-granting institutions (DGIs) or certificate-granting institutions (CGIs). First, logistic regression was used to predict which HS graduates enroll in post-secondary institutions. The logistic regression results indicated that graduation from a four-year high school program with a traditional diploma, as opposed to earning an equivalent certificate (General Educational Development certificate [GED]), was a strong predictor of post-secondary enrollment, along with having a high cumulative HS GPA. HS graduates had reduced odds of enrolling in post-secondary education if they were English language learners, enrolled in special education, or experiencing low-income economic disadvantage. Second, machine learning was used to understand the factors influencing student migration within Utah. Algorithm fits indicated post-secondary migration was largely influenced by the institution of choice and ACT composite scores. Lastly, urban HS graduates were very likely to remain in urban areas to attend either DGIs or CGIs, while rural or frontier HS graduates were more likely to attend a rural post-secondary institution. Approximately half of rural and frontier HS graduates chose to attend urban institutions, and half chose to attend rural or frontier institutions.

Keywords

Student migration, post-secondary education, higher education, technical college, career and technical education, student mobility

1 | Introduction

Following high school completion, students are faced with many difficult decisions. These decisions include whether or not to attend post-secondary school, and which post-secondary institution to attend. Post-secondary education decisions are critical for high school graduates. These decisions influence the types of jobs and the level of income graduates will obtain in their lifetimes. As students gain education, they tend to have higher earning potential (Martins & Pereira, 2004).

Many students in Utah may move across the state to college since many of Utah's rural regions do not have a college or technical school nearby. The decisions of high school graduates play major roles in the economies of both their home regions and the regions in which they migrate to attend college. If students return home after college, the student's home region may experience a workforce benefit in the form of increased skilled labor; however, students who permanently move away from their home region may cause a workforce deficit, or brain drain.

This research sought to understand factors influencing both students' decision to attend post-secondary programs and students' decision to migrate to attend post-secondary programs in the state of Utah. This research also specifically examines enrollment patterns of students originating from urban, rural and frontier counties in Utah. For the purposes of this research, post-secondary institutions may be either degree-granting institutions (DGIs) or certficate-granting institutions (CGIs).

This research hypothesizes that students living in rural regions with fewer post-secondary options choose to enroll in post-secondary programs less frequently than those who live in urban regions with more post-secondary options. This research also hypothesizes that students from rural, low income regions of Utah choose to migrate to other regions of Utah to attend post-secondary programs more frequently than students from urban areas. The results of this study add to current body of post-secondary enrollment literature by examining student migration and post-secondary attendance choices at a state and regional level, and by population density levels.

1.2 | Literature Review

The literature on student post-secondary attendance suggests that student choice to attend a post-secondary institution is largely influenced by the proximity of an institution to their home (Alm & Winters, 2009; Sa, Florax, Rietveld, 2003). Students who must travel to attend college likely face greater economic costs than those who can attend a college close to home. Therefore, regions with few or no options for post-secondary education may have reduced rates of educational attainment than regions with easier access to post-secondary education (Frenette, 2002). Furthermore, impacts of student migration on local economies may be positive or negative, so any major pipelines of student migration within the state should be understood. For example, the presence of a post-secondary institution within a student's home county has been found to influence their choice to remain close to home to attend college or post-secondary school (Frenette, 2002). Students are more likely to enroll in a post-secondary institution when they can stay close to home than those students who do not have an institution nearby (Frenette, 2002).

The economic welfare of a student's home region has the potential to impact college choice, but the patterns are not always statistically significant (McCann & Sheppard, 2002; McCann & Sheppard, 2001, Florax et al., 2014, Kyung, 1996). Economic activity in students' origins has been found to be correlated with the choice to move away to obtain post-secondary education. For example, a study of high school graduates in Scotland found that economic activity in a student's home region or county was negatively correlated with the decision to move away for post-secondary education, while economic activity in the destination was positively correlated with the choice to move away (McCann & Sheppard, 2001). However, a study of Welsh graduates found that both economic activity in a student's home region and destination were negatively correlated with the choice to move (McCann & Sheppard, 2002).

Other studies have attempted to model students' decisions to attend post-secondary institutions using econometric approaches (Manski & Wise, 1983). When making the decision to attend college or technical school, students must weigh perceived costs and benefits of obtaining a degree. These models assume that students will make the choice with the greatest net economic benefit. However, econometric approaches do not take into account the cultural and social factors that influence a student's choice to attend college, so their predictive power is low (Hossler, Braxton & Coopersmith, 1989). Therefore, there is a need to incorporate metrics of demographics, such as the student's home county and race/ethnicity, in the choice to attend (or not attend) college in predictive models of student choice to both attend and migrate to college.

Demographic factors, such as gender and race, may

also influence students' decision to migrate or to attend college. Gender may play a role in students' decision to migrate and/or attend college since males and females face different but ever-evolving societal and familial pressures as adults (Parker, Horowitz, Stepler, 2017). Further complicating the issue, socioeconomic status may interact with different genders' propensities to enroll in post-secondary education. Male high school graduates experiencing economic difficulties may be less likely to enroll in post-secondary education than males with high socioeconomic status, as individuals experiencing low socioeconomic status may perceive low economic returns of post-secondary education compared to those with high socioeconomic status (Kearney & Levine ,2016). In some studies, gender is related to a student's decision to move, but not all studies report a significant signal (Sa et al., 2003). For example, in a study of United Kingdom graduates, male students were more likely to move to attend college than female students (McCann & Sheppard, 2001).

Furthermore, individuals from minority races and ethnicities (Black, Hispanic, and Native American) continue to be underrepresented in degree recipients compared to White students in the United States (Perna, 2000). Gender, educational status of a student's mother and race may also interact to influence students' choices to attend college. For example, Black male students' decision to enroll in college may be especially influenced by the education attainment of their mother, where Black male students attend college at much higher rates if their mother attended college (Perna, 2000). This interaction between race and gender was not seen for Black female students (Lucia & Baumann, 2009).

Students' performance on standardized test scores may also be correlated with their decision to migrate out of their state region or service area to attend an institution of higher learning. Since all Utah public schools require students to take the ACT in the eleventh grade, this can be a useful metric of college-preparedness. In a survey of high schoolers from 1980, it was found that standardized test scores were positively correlated with student decision to attend either college or a vocational program (Ordovensky, 1995). Similarly, a study of students applying to a large land grant university found that the decision to apply to college was positively correlated with ACT score (Desjardins et al., 1997). The impact of ACT score on student decision to enroll in post-secondary education is examined in Objective 1.

In sum, there are many factors that play a role in post-secondary choices. Economic, demographic and geographic influences are all things that students must consider when making choices about if and where they will attend a post-secondary program. This research examines how many of these factors influence choice for Utah high school graduates who attend public Utah post-secondary programs.

2 | Methods

2.1 | Data

This research sourced data from USHE and the Utah State Board of Education (USBE) using the Utah Data Research Center (UDRC) database. Only students graduating from a USBE high school from 2013-2016 (or earning an equivalent high school level certificate during 2013-2016) were incorporated in this research. For DGI enrollment, the first enrollment after high school graduation was considered. For CGI enrollment, enrollment data was filtered to only include certificate-seeking non-secondary students. DGI and CGI enrollment for this high school graduate cohort was only captured from SY 2013-2020 due to data availability. Secondary data on median income for each county was sourced from the U.S. Census Bureau QuickFacts (U.S. Census Bureau, 2019). High school graduate service region of origin was determined using USBE high school graduation school district data. The district to which the student's graduating high school belonged to was used to identify their USHE service regions. Each county in Utah was sorted into population density categories (i.e., frontier, rural, or urban) using Utah Department of Health (UDOH) classifications (Table 1). Students' cumulative high school GPA was extracted from USBE data. Similarly, each post-secondary institution was categorized as urban, rural, or frontier depending on the physical location of the main campus. The UDOH rurality classification was assigned based on the county where the main campus of the post-secondary institution is located.

Distance traveled to post-secondary school by each post-secondary enrollee was calculated by determining the distance between the student's high school and post-secondary institution's respective latitudes and longitudes. Distance was calculated using the main campus location of each post-secondary institution, except for the Utah State University (USU) Eastern campus, which is located in Price, UT. Migration distances for students attending USU Eastern were based on the location of the USU Eastern campus in Price, UT. However, all summary statistics for the USU Eastern campus are reflected in the totals listed for USU. The distance calculated is a direct mileage calculation, and does not account for travel times or road distances. It should be noted that, for some post-

secondary institutions, students may be attending online classes and thus may not travel from home to attend post-secondary classes. However, this research does not examine online enrollment. Similarly, this study does not consider attendance at satellite campuses, so if a student attended a satellite campus (other than USU Eastern), their travel distance calculation may be misrepresented. Attendance at USU Eastern was based on enrollment institution coding in the USHE enrollment data.

All continuous independent variables (ACT composite score, cumulative high school GPA and median income data) were scaled to 0-1 in all analyses, where 0 and 1 were set to the minimum and maximum values in the dataset, respectively. Dummy variables were used in all analyses for race/ethnicity, rurality and English Language Learner (ELL) status (herein 'students learning English' or students 'formerly learning English'). To ensure low correlation between independent variables, a Pearson rank correlation matrix was also generated. All independent variables were below r=0.70.

2.2 | Data Analysis

2.2.1 | Objective 1

This objective determined predictors of student enrollment in a Utah post-secondary education institution following high school graduation. A generalized linear model (GLM) with a logistic response was employed in R (v 3.5.2) to determine correlates of enrollment in a public Utah post-secondary institution. The dependent variable for this analysis was enrollment in a USHE institution from 2013-2020 (0/1, no enrollment/enrollment). The independent variables included in this model were population density of students' home counties (frontier, rural, or urban), demographics (race, ethnicity, and gender), median income of home county, eligibility for free or reduced lunches (low income status, herein 'students experiencing economic disadvantage'), students receiving special education services, students learning English (ELL status, high school graduation type (certificate or federal four year graduate), and ACT composite score. For students learning English, only the categories 'Y' and 'F' (Y: student is learning English; F: student was formerly learning English) were included due to small numbers of students falling into the remaining categories (students who were eligible for ELL services but opted out and students who were tested but determined not in need of ELL services). Each resulting model parameter had 95% confidence intervals calculated. The final abbreviated model formula was:

Enrollment ~ Asian + Black + Pacific Islander + Native American + Other race + Hispanic + gender + median income of home county + population density of home county + low income status + special ed. status + ELL status ('yes' and 'former') + GED/HS certificate + HS grad codes + ACT composite score + HS GPA

Age was not included as a covariate, since the majority of individuals in this study were recent high school graduates and within four years of age. The rest of the individuals who earned high school equivalent certificates (such as a GED) were older students, which would create a correlated age grouping for certificate earners and recent high school graduates. The other high school graduate types include here are CT - Certificate of completion, GG - UT High School Completion Diploma (GED), and GC - Adult Secondary Education Diploma (Carnegie Units). GR - Basic high school diploma, was used as a reference variable.

Table 1: Rural vs. urban designations of each county (UDOH classification based on population density). Urban: > 100 people per square mile; Rural: < 99 people and > 6 per square mile; Frontier: < 6 people per square mile (UDOH 2019).

Urban	Rural	Frontier
Cache	Box Elder	Beaver
Davis	Carbon	Daggett
Salt Lake	Iron	Duchesne
Utah	Morgan	Emery
Weber	Sanpete	Garfield
	Washington	Grand
	Summit	Juab
	Tooele	Kane
	Washington	Millard
	Wasatch	Piute
	Uintah	Rich
		San Juan
		Wayne

2.2.2 | Objective 2

The goal of Objective 2 was to predict which students leave their county or service region of origin to attend a post-secondary institution. For DGI enrollees, migration was considered to be enrolling in a DGI outside of the student's home USHE service region where they graduated from high school. Similarly, for CGI enrollees, migration was considered to be enrolling in a CGI outside of their home service region. Note that for these analyses, rurality designations for each student are based on their county of high graduation, which are

smaller areas than USHE service regions. Machine learning algorithms were used to determine which factors (e.g., demographic, geographic, economic and student achievement) play the most important role in determining student migration. Parallel machine learning models were fit for CGI and DGI student data since different factors may play into students' decision to attend these different types of institutions. The dependent variable in these models was enrollment in a post-secondary institution outside of the student's home service region (0/1 - migrate no/yes). The independent variables were demographic variables (i.e., race, ethnicity, gender), median income of county of origin, graduation type (i.e., certificate or federal four-year cohort graduate), population density of student's home county, ACT composite score, Pell Grant eligibility/ recipient status, whether or not the student was learning English (ELL status), special education enrollment, low income status (i.e., eligibility for a free or reduced school lunch) and institution attended. Age was not included in this analysis for the same reasons that it was excluded from the Objective 1 analysis. For ELL students, only the categories 'Y' and 'F' (Y: student was learning English at graduation; F: student was formerly learning English) were included due to small numbers of students falling into the remaining categories (those categories being students who were eligible for ELL services but opted out, and students who were tested but determined not in need of ELL services). The final abbreviated model for this analysis was as follows:

Migration ~ Asian + Black + Pacific Islander + Native American + White + Other race + Hispanic + gender(F) + median income of origin county + HS graduate type + population density of home county + ACT composite score + Pell status + ELL status + Special ed. Status + Low income status + institution attended + HS GPA

Machine learning algorithms were fit using Sci-kit learn in Python (v 3.7.1). Dummy variables were created for variables with more than two factors (i.e., rurality, degree, type of high school completion, Pell recipient status or eligibility, and whether or not the student was learning English (ELL status). Data were split into a train and test set (70% and 30%, respectively). After testing four different algorithms for accuracy, precision, recall, and error (Decision Tree Classifier, K-nearest neighbors, logistic regression, and a gradient boosted decision tree), a classification decision tree algorithm was chosen to predict migration to a USHE institution. These algorithms performed the best out of the tested algorithms for both DGI and CGI migration. Each fitted algorithm was compared to baseline algorithms fit using stratified, most frequent, prior and uniform strategies using the dummy classifier function in Sci-kit learn. These baselines allow for assessment of fitted algorithms to baseline models that always predict the most frequent outcome or uniform outcome.

Lastly, the likelihood of urban, rural and frontier, and DGI and CGI migration were examined. This model examines migration propensity as a function of institution type and rurality (i.e., DGI or CGI). A logistic regression model was deployed, where the response was '0' if a student did not migrate, and '1' if the student did migrate from their home service region. High school graduates were only included in this analysis if they enrolled in a post-secondary institution. Non-enrolling high school graduates are not included here. High school graduates who enrolled in both a DGI and CGI were also omitted from this analysis. (There were 4,601 high school graduates captured in this study who enrolled in both DGIs and CGIs). Interactions for enrollment type and rurality were initially included in this model, but since they were non-significant they were not included in the final analysis. Parameter estimates for interactions can be found in Appendix

Table 2: Rurality designation for each post-secondary institution. Based on UDOH population density classifications.

Institution	Rurality
Bridgerland Technical College	Urban
Davis Technical College	Urban
Dixie State University	Rural
Dixie Technical College	Rural
Mountainland Technical College	Urban
Ogden – Weber Technical College	Urban
Salt Lake Community College	Urban
Snow College	Rural
Southern Utah University	Rural
Southwest Technical College	Rural
Tooele Technical College	Rural
Uintah Basin Technical College	Frontier
University of Utah	Urban
Utah State University	Urban
Utah State University - Eastern	Rural
Utah Valley University	Urban
Weber State University	Urban

Table 3: Count and percentages of high school graduates enrolling in and migrating to DGIs and CGIs by population density from 2013-2016.

	Number of graduates	**Percent of all Utah HS graduates**
Urban	116,779	78.73%
Rural	25,704	17.33%
Frontier	5,788	3.90%
Unknown	57	0.04%
Total	148,328	
	DGI Enrollees by population density	Percent of graduates per population density enrolling in DGIs
Urban	68,528	58.68%
Rural	14,325	55.73%
Frontier	3,226	55.74%
	CGI Enrollees by population density	Percent of graduates per population density enrolling in CGIs
Urban	7,661	6.56%
Rural	2,092	8.14%
Frontier	389	6.72%
	Number of graduates migrating to DGIs	Percent migrating to DGIs
Urban	25,608	37.37%
Rural	6,130	42.79%
Frontier	1,790	55.49%
	Number of graduates migrating to CGIs	Percent migrating to CGIs
Urban	873	11.40%
Rural	363	17.35%
Frontier	179	46.02%

A. The model formula was as follows:

Migration (0/1) ~ Rurality + Enrollment Type (DGI/CGI)

All logistic regression modeling was performed in R v 3.5.2 (R Core Development Team, 2018).

2.3 | Limitations

A major limitation of this research is that it does not include clearinghouse data. National Student Clearinghouse data could be used to determine if high school graduates attend private institutions in Utah or institutions outside of Utah. Private institutions in Utah that are not accounted for in this research include Brigham Young University, Westminster College, LDS Business College (now Ensign College) and Western Governors University. Second, due to data and scope limitations, this research also does not examine whether or not students return home after completing post-secondary school. Where students go after high school is an important variable that should be examined in future research. Third, high school graduates may enroll in post-secondary education beyond this study's minimum two years enrollment post-high school graduation. Students graduating from high school in 2016 could have enrolled in a post-secondary institution up to two years post-graduation, through 2018; whereas, those graduating high school earlier could have more than two years

to enroll in postsecondary school. Students in this study may also have been concurrently enrolled in high school and a post-secondary institution due to limitations of USBE graduation data. High school graduates could be included in analyses twice if they enrolled in both a CGI and a DGI. This research considers enrollment to be at main campus locations for CGIs. Therefore, some migration statuses may be misrepresented if a student enrolled at a satellite campus. Distance calculations may also be misrepresented if a student did attend main campus classes, as main campuses were used to determine travel distances for each student.

Students who are members of The Church of Jesus Christ of Latter-day Saints may delay enrollment in post-secondary education to serve ecclesiastical missions after high school. Each cohort of high school students had at least two years to enroll in post-secondary education following high school graduation and be captured in this study. Lastly, high school graduates from frontier counties will migrate to post-secondary institutions much more frequently than those originating from rural or urban counties because there are no main campus DGIs located in frontier areas and only one CGI located in a frontier county (Uintah Basin Technical College). This research does not take into account per capita density of service regions or proximity of post-secondary institutions.

3 | Results

3.1 | USBE High School Graduates

A total of 148,329 USBE high school graduates or equivalent certificate earners who completed their respective programs from 2013-2016 (herein 'high school graduates') were included in this study. The majority of these graduates were White students (78.5%, n=116,443), followed by Hispanic students (13.5%, n=20,025). Asians made up 2.0% (n=2,973) of the high school graduates. Black high school graduates (n=1745), Native American graduates (n=1,681), Pacific Islander graduates (n=2,291) and multiracial graduates (n=2,475) each made up less than 2% of the graduate population. High school graduates were 49.7% female, 49.8% male and 0.5% unspecified gender. The number of annual high school graduates increased between 2013-2016, from 35,260 in 2013, to 38,768 in 2016. For the remainder of the summary statistics reported in this research, high school graduates from 2013, 2014, 2015 and 2016 are grouped into a single body of students. (Years were initially included as covariates in the regression model but the removal of these variables did not impact coefficients of other variables, so they were left out of the final model. See Appendix B for model results where high school graduation year is included as a variable.) The number of graduates from each county was generally reflective of the total population in each county (e.g., Salt Lake County had the highest number of graduates, while counties such as Piute and Daggett had the fewest graduates). The DGI service region with the most graduates was the University of Utah (the U) and Salt Lake Community College (SLCC) service region, followed by the Utah Valley University (UVU) service region. The Southern Utah University (SUU) service region had the fewest high school graduates during the period of data capture in this study. Generally, the number of high school graduates originating from each region reflected the total population ranking of each service region. Mountainland was the CGI service region with the highest number of high school graduates, with 35,303 graduates, while the Uintah Basin service region had the fewest, with 2,698 graduates from 2013-2016. Similar to DGI service regions, the number of graduates from each CGI service region also reflected the total population of each service region.

The majority of high school graduates originated from urban counties (78.6%), followed by rural counties (17.3%) and frontier counties (3.9%). High school graduates from frontier counties had slightly lower average ACT composite scores (19.3) than those from rural counties (20.3) or urban counties (21.0). The high school graduate sample included 3,340 students learning English, and 1,544 reclassified ELL students (students who were once learning English but are now fluent in English). 11,404 high school graduates were enrolled in a special education program, and 39,190 students were eligible for free or reduced school lunch, or were low income students.

3.2 | DGI Enrollees

Of the high school graduates included in this study, 58%, or 86,101, enrolled in a DGI. 39% of those enrollees migrated to attend the institution they enrolled in, while 61% of students did not migrate or remained in their home service region to attend their chosen institution (Table 3). DGI enrollees were primarily White, followed by Hispanic (Table 4). High school graduates enrolling in USHE institutions were more often female (51.7%) (Table 4), which varies slightly from Utah's population as a whole, where 49.5% of the population is female (U.S. Census Bureau, 2019). The DGI enrollee sample included 0.1% students formerly learning English, 1.3% students learning English, 3.9% students receiving special education services and 21.6% students experiencing low-income economic disadvantage.

SUU and Snow College had the highest percentages of students originating from frontier counties, while Dixie State University (DSU) and SUU had the highest percentages of students originating from rural counties. UVU, SLCC and the U had the highest percentages of students originating from urban counties (Table 6). SUU and Snow College had the highest percentage of migrating enrollees — 75.3% and 71.0%, respectively. SLCC had the highest percentage of non-migrating enrollees, 82.1% (Table 7)

Similar rates of enrollment per population density were seen for DGI students, where 63%-66% of high school graduates enrolled per density category. Urban counties had the highest rate of enrollment in DGIs, while rural counties had the lowest, though the difference is negligible (Table 3).

3.3 | DGI Urban, Rural, and Frontier Movement Patterns

Frontier high school graduates generally traveled the farthest to attend DGIs However, some post-secondary schools in southern Utah, such as SUU and DSU, had students from urban areas that traveled long distances to enroll in them. These urban students who traveled long distances to post-secondary schools in Southern Utah likely originated from the Wasatch Front counties (Table 6). In general, rural high school graduates tended to enroll in rural DGIs, while urban high school graduates tended to choose urban DGIs (Table 8). Frontier high school graduates preferred to attend urban institutions, though a large number chose rural institutions (Table 8).

3.4 | CGI Enrollees

In total, 10,147 high school graduates enrolled in a CGI from 2013-2020. The enrollees were 53.5% female, 46.1% male and 0.4% unspecified gender (Table 9). 79.6% of CGI enrollees did not migrate from their service region of origin to attend a technical school, while 12.8% of enrollees migrated to attend a CGI. CGI enrollees were primarily white (82.6%), followed by Hispanic (13.3%) (Table 9). Most high school graduates enrolling in CGIs originated from urban areas. Southwest Technical College and Davis Technical College had the highest number of enrollees who migrated to attend technical school (22.0% and 19.4%, respectively) (Table 12). Mountainland Technical College and Bridgerland Technical College had the highest percentages of enrollees that did not migrate — 91.7% and 91.4%, respectively (Table 11).

Similar rates of CGI enrollment were seen across the three population density categories. Rural counties had the highest rate of high school graduate enrollment in CGIs (8.1%), while urban counties had the lowest rates of CGI enrollment (6.6%) (Table 3).

Table 4: Demographic summary of DGI enrollees. (Note: percentages may not add to 100% due to missing data).

	Count	Percentage
Gender		
Female	44,541	51.73%
Male	41,246	47.90%
Unspecified	314	0.36%
Race/Ethnicity		
Asian	2,115	2.46%
Black	1,022	1.19%
White	69,527	80.75%
Hispanic	9,817	11.40%
Native American	754	0.88%
Multiracial	1,498	1.74%
Pacific Islander	1,051	1.22%
Pell		
Eligible	1,104	1.14%
Received	9,081	9.38%
Non-Eligible	86,597	89.48%
Population Category		
Frontier	3,226	3.75%
Rural	14,325	16.64%
Urban	68,528	79.59%
Migration Status		
Migrated	33,540	38.95%
No migration	52,561	61.05%
Total	86,101	

Table 5: Service region designation for degree-granting institutions – used to determine migration status for each DGI enrollee (USHE 2020).

Institution	Main Campus Location	Service Areas (Counties)
Dixie State University	St. George	Washington, Kane
Salt Lake Community College	Salt Lake City	Salt Lake
Snow College	Ephraim	Sanpete, Sevier, Wayne, Piute, Millard, Juab
Southern Utah University	Cedar City	Iron, Garfield, Beaver
University of Utah	Salt Lake City	Salt Lake, Summit (Park City only)
Utah State University	Logan	Cache, Rich, Box Elder, Duchesne, Uintah, Daggett, Tooele, Carbon, Emery, Grand, San Juan
Utah Valley University	Orem	Utah, Wasatch, Summit
Weber State University	Ogden	Weber, Morgan, Davis

3.5 | CGI Urban, Rural, and Frontier Movement Patterns

Frontier students enrolling in CGIs tended to travel much larger distances compared to rural and urban CGI enrollees (Table 11). The exception to this pattern was Uintah Basin Technical College enrollees, where rural students traveled the farthest distance to attend. Uintah Basin Technical College is located in a frontier county. About half of rural high school graduates who chose to attend a CGI enrolled in rural CGIs, while nearly all urban high school graduates who enrolled in CGIs chose an urban institution. Frontier high school graduates were split most evenly in their enrollment patterns (Table 13).

Students attending Ogden-Weber Technical and Davis Technical Colleges originating from frontier counties traveled the farthest to attend. Conversely, students attending these two colleges and Tooele Technical College from urban areas traveled the fewest miles on average (Table 10). Students who did not migrate, but enrolled at Uintah Basin Technical College traveled the most on average out of non-migrating students (Table 11).

3.6 | Odds of Enrollment in Post-Secondary Education (Objective 1 Analysis Results)

Logistic regression was used to examine predictors of post-secondary enrollment. If an odds ratio and its 95% confidence interval for a group included in this analysis fall below one, that group experiences reduced odds of post-secondary enrollment. If the odds ratio falls above one, that group experiences increased odds of post-secondary enrollment in Utah. Odds ratios are interpreted differently above and below one because each model coefficient is on a log scale and then exponentiated to get an odds ratio. The intercept serves as a baseline odds ratio and each coefficient modifies the baseline odds ratio by the specified value.

The results of this logistic regression analysis indicated graduating with a high HS GPA was the strongest predictor of enrollment in a public post-secondary in Utah (used as a reference group in the regression analysis) (Fig. 1, Table 14). Being female increased students' odds of enrolling in a post-secondary public Utah institution as compared to being male after correcting for all other variables in the model.

For the racial and ethnic factors in this analysis, white high school graduates are used as the reference racial group as they represent the largest racial category in Utah. This means that the intercept represents whites high school graduates for racial comparisons. However, the intercept cannot solely be interpreted as white high school graduates, as it also represents the reference group for the factors included in the model (i.e., gender, ethnicity, special education, students learning English and students experiencing low income). Black and Asian high school graduates had increased odds of post-secondary enrollment, while Pacific Islander and Native American high school graduates had lower odds of post-secondary enrollment compared to white high school graduates (Fig. 1, Table 14).

Students who graduated with a standard high school diploma (i.e., federal four-year cohort graduates)

Table 6: USHE enrollment by institution and population category of high school graduation county of origin (SLCC Tech combined with SLCC). USU Eastern enrollee mileages were calculated using the Price, UT campus, but distances were averaged in with the USU main campus totals for this table.

Institution	Category	Count	Percentage	Average Distance Traveled (miles)
DSU	Frontier	349	5.91%	147.1
	Rural	3,422	57.99%	42.6
	Urban	2,130	36.10%	265.3
	Total	5,901		
Snow	Frontier	691	11.98%	65.6
	Rural	1942	33.66%	58.7
	Urban	3,136	54.36%	88.5
	Total	5,769		
SUU	Frontier	500	10.53%	118.1
	Rural	2,061	43.40%	63.2
	Urban	2188	46.07%	216.1
	Total	4,749		
SLCC	Frontier	95	0.54%	135.8
	Rural	893	5.04%	56.8
	Urban	16,731	94.42%	8.8
	Total	17,719		
The U	Frontier	91	0.88%	146.7
	Rural	1042	10.10%	76.5
	Urban	9,185	89.02%	15.4
	Total	10,318		
USU	Frontier	937	6.87%	215.4
	Rural	2,677	19.64%	112.5
	Urban	10,019	73.49%	55.7
	Total	13,633		
UVU	Frontier	489	2.82%	106.2
	Rural	1,516	8.73%	94
	Urban	15,354	88.45%	15.6
	Total	17,359		
WSU	Frontier	74	0.70%	177.1
	Rural	772	7.26%	58.6
	Urban	9,785	92.04%	12.3
	Total	10,631		

— not a GED or equivalent certificate — also had increased odds of USHE enrollment. Students receiving special education services had decreased odds of USHE enrollment, along with being a student learning English or a student experiencing low-income economic disadvantage (Fig. 1, Table 14). Frontier and rural students were less likely to enroll in a USHE institution than urban HS graduates.

3.6 | Factors Influencing DGI Migration (Objective 2 Analysis Results)

The decision tree classifier algorithm was the best performing algorithm to predict DGI migration, producing a fit with 99.9% accuracy, 99.9% precision and 99.9% recall. These metrics are frequently used in machine learning reporting to understand performance of the algorithm. Accuracy refers to the number of samples in a testing dataset that are accurately classified by the algorithm. Precision refers to the rate at which an algorithm predicts a false positive. In this case, a false positive would be classifying a test data point for a student who did not migrate as one who did. Recall refers to the number of correct positive predictions or the number of times the algorithm correctly predicted that a student in the test data sample migrated. The strongest predictor of whether or not a DGI enrollee migrated to attend their chosen institution was ACT composite score, followed by attending the U, attending Weber State University, attending SLCC, or originating from an urban county (Table 15). Model mean squared error was 0.01. Baseline dummy models at best predicted student migration with 58.6% accuracy.

Table 7: Student migration by DGI. Migration is considered to be enrollment in an institution outside of that student's service region. (See Table 5 for DGI service region categorizations).

Institution	Migration	Count	Percent by Institution	Distance Traveled
DSU	Did not migrate	2834	48.01%	6.6
	Migrated	3069	51.99%	242.5
	Total	5903		
SLCC	Did not migrate	14551	82.12%	6.4
	Migrated	3169	17.88%	37.2
	Total	17720		
Snow	Did not migrate	1671	28.96%	30.1
	Migrated	4100	71.04%	94.4
	Total	5771		
SUU	Did not migrate	1172	24.67%	9.9
	Migrated	3579	75.33%	145.1
	Total	4751		
The U	Did not migrate	6565	63.63%	10.4
	Migrated	3753	36.37%	44.3
	Total	10318		
USU	Did not migrate	5368	39.35%	66.5
	Migrated	8275	60.65%	85.2
	Total	13643		
UVU	Did not migrate	11404	65.68%	9.1
	Migrated	5958	34.32%	55.5
	Total	17362		
WSU	Did not migrate	8996	84.60%	8.9
	Migrated	1637	15.40%	60.7
	Total	10633		

Table 8: Movement of urban, rural and frontier students to urban and rural DGIs. As of 2020, there were no physical USHE campuses in frontier counties. Population density categorizations are based on the UDOH rurality classification scheme (UDOH 2020).

Movement Type	Percent by Rurality Origin
Rural High School -> Rural DGI	52.16%
Rural High School -> Urban DGI	47.84%
Urban High School -> Rural DGI	10.89%
Urban High School -> Urban DGI	89.11%
Frontier High School -> Rural DGI	48.30%
Frontier High School -> Urban DGI	51.70%

3.7 | Factors Influencing CGI Migration (Objective 2 Analysis Results)

For migration to CGIs, the decision tree classifier algorithm was the highest performing algorithm, with 98.7% accuracy, 100% precision and 89.5% recall. The most important features of this model were low income status, attendance at Davis Technical College, ACT composite score, attendance at Southwest Technical College, attendance at Ogden-Weber Technical College and attendance at Bridgerland Technical College (Table 16). Model mean squared error was 0.01. Baseline models at best predicted student migration with 50 to 86% accuracy.

The final analysis in Objective 2 examines propensity to migrate based on post-secondary institution type and rurality. Specifically, this analysis examines migration of students who enrolled in any post-secondary institution as a function of institution type (i.e., DGI vs CGI) and rurality. The coefficients resulting from this model suggest that students from a rural or frontier county who choose to attend a USHE institution are statistically more likely to migrate to their chosen institutions than those from urban counties (Fig. 2, Table 17). Similarly, high school graduates from rural and frontier counties are more likely to migrate than those originating from urban counties.

4 | Discussion

4.1 | Post-Secondary Enrollment

The first hypothesis of this research was that urban students enrolled in both DGIs and CGIs at higher rates than their rural and frontier counterparts. There was support for this hypothesis — urban high school graduates enrolled in USHE institutions more frequently than rural graduates (65.2% versus 63.8%, respectively), but frontier students enrolled in USHE institutions at slightly higher rates than rural graduates (65.0% versus 63.3%, respectively). In the enrollment logistic regression model, urban students were more likely to enroll in a USHE institution than both rural and frontier students (Fig. 1). Urban students are more likely to come from higher income regions and have easier access to educational institutions than their rural and frontier counterparts, simply because they live closer to educational institutions. Cultural norms in urban areas may also contribute to a higher frequency of enrollment by urban students — students from urban areas may feel greater expectations to attend college from their family and peers than students originating from rural and frontier counties. On the other hand, rural students could have easier access to out-of-state education opportunities than urban students, due to the geography of Utah and centralized location of many urban areas in the state.

Similar to other studies (Desjardins et al. 1997), a high school graduate's ACT composite score and cumulative high school GPA increased odds of enrollment in a post-secondary education institution (Fig. 1, Table 14). This result may be partially explained by students who have already decided to attend college by enrolling in different courses during high school than those who have chosen not to attend post-secondary school. The course-taking patterns of these students also likely increases their propensity to perform well on standardized tests — rigorous high school course-taking patterns have been found to increase post-secondary school readiness and high standardized test achievement more so than ACT preparatory courses (Briggs, 2001; Allensworth, Correa, & Ponisciak, 2008; Lane et al., 2008; Moss et al., 2012).

High school graduates basic high school diplomas, rather than GED earners, equivalent high school level certificate of completion earners, or Adult Secondary Education Diploma earners, were more

likely to enroll in Utah public post-secondary education institutions. Students who graduate as part of a traditional high school graduation cohort may be more prepared for post-secondary attendance due to rigors of course work and influence of their peers also enrolling in post-secondary institutions as compared to those graduating with equivalency certificates. Females were slightly more likely to enroll in college and technical degree programs than males, which reflects the national trend of more females enrolling in post-secondary education than males (IES, 2019).

Students enrolled in special education programs in USBE were less likely to enroll in post-secondary education (Fig. 1, Table 14). Students receiving special education services face varying levels of learning difficulty severities. However, young people with disabilities are well-documented to face difficulty in transitioning to post-secondary programs (Hasazi, Gordon & Roe 1985) and face challenges in obtaining full-time employment (National Organization on Disability 2004). High school graduates who were classified as low-income students were less likely to enroll in post-secondary education (Fig. 1, Table 14). This result likely reflects the struggles these students face at home due to low household income, cumulative impacts of poverty and exposure to toxic stress during childhood, thus impacting workforce outcomes later in life (McEwen & McEwen, 2017).

English language learners (ELL – Y and ELL - F) had reduced odds of enrollment in post-secondary education programs (though students reclassified as fluent had a non-significant odds ratio [Fig. 1]). This result has been found in other longitudinal studies. An analysis of data from the National Education Longitudinal Study of 1988 found that one eighth of students enrolled in English language courses earned a bachelor's degree, as opposed to one quarter of students not enrolled in ELL programs (Kanno & Cromley, 2013). It is theorized that ELL students do not have as much time to devote to college preparatory classes, since ELL classes take up space that would otherwise be allotted for college preparatory courses (Kanno & Cromley, 2013). Students learning English also face many other challenges at school, such as potential cultural and language barriers, than non-ELL students, which may ultimately make it more difficult for them to obtain post-secondary education. Students who were formerly learning English (ELL – F), or those considered to be fluent in English, fared slightly better than those students learning English who were not reclassified (Fig. 1, Table 14). This could be the result of reclassified students having more time to devote to college preparatory courses than students learning English who were not reclassified and, similarly, facing fewer language barriers in the classroom.

Table 9: Demographic summary of CGI enrollees. (Note: percentages may not add to 100% due to missing data)

	Count	Percentage
Gender		
Female	5,428	53.49%
Male	4,681	46.13%
Unknown	38	0.37%
Race/Ethnicity		
Asian	94	0.93%
Black	66	0.65%
White	8,382	82.61%
Hispanic	1,347	13.27%
Native American	69	0.68%
Multiracial	96	0.95%
Pacific Islander	54	0.53%
Pell		
Received	1,167	11.50%
Did not receive	7,843	77.29%
Unknown	1,137	11.21%
Population Category		
Frontier	389	3.83%
Rural	2092	20.62%
Urban	7661	75.50%
Migration		
Did not migrate	8075	79.58%
Migrated	1301	12.82%
Unknown	771	7.60%
Total	10,147	

Race and ethnicity undoubtedly play a role in post-secondary migration and enrollment. White students were used as the reference group for race/ethnicity categories. All of the odds ratios for race and ethnicity were statistically significant, which should be interpreted with care — the large portion of white high school graduates in Utah compared to racial minority high school graduates may prevent any strong patterns of race or ethnicity influencing migration or enrollment trends in either USHE or CGIs in a meaningful way. In other words, although

Table 10: CGI service regions, insitution names, and counties served.

Service Region	Technical College Name	City Location	Counties Served
Bridgerland	Bridgerland Technical College	Logan	Box Elder, Logan, Cache, Rich
Davis	Davis Technical College	Kaysville	Davis
Mountainland	Mountainland Technical College	Lehi	Summit, Wasatch, Utah
Southwest	Southwest Technical College	Cedar City	Beaver, Iron, Garfield, Kane
Tooele	Tooele Technical College	Tooele	Tooele
Uintah Basin	Uintah Basin Technical College	Roosevelt	Daggett, Duchesne, Uintah
Washington	Dixie Technical College	St. George	Washington
Weber	Ogden-Weber Technical College	Ogden	Weber

some odds ratios for racial groups are statistically significant, this significance may be an artifact of unbalanced sample sizes and thus irrelevant in the real world.

Asian and Black students were more likely to enroll in post-secondary education programs than white students, while Pacific Islander, Native American and multiracial high school graduates were less likely to enroll in post-secondary education compared to white high school graduates. Hispanic high school graduates were also less likely to enroll in post-secondary education than white high school graduates (Fig. 1, Table 14). The trend of Asian students enrolling at higher frequencies than white students reflects the national racial and ethnic trends (Hussar et al., 2020). Similarly, at the national level, Hispanic, Pacific Islander and multiracial students enroll in post-secondary education at lower rates than white students. However, at the national level, Black students tend to enroll in post-secondary education at lower rates than white students do (Hussar et al., 2020), which differs from results here. Our result, which does not reflect national trends, of increased odds of enrollment for Black high school graduates, as compared to white high school graduates, may be largely influenced by the small sample size of Black students in Utah (n=1,745 Black high school graduates, compared to n=116,443 white high school graduates). This trend for Black high school graduates as compared to white high school graduates may also result because of the higher likelihood of Black students to live in urban counties in Utah, where post-secondary education is more available compared to rural and frontier counties.

To reiterate, this research focuses on public post-secondary institutions in Utah. White high school graduates may have unequal access to opportunities, such as private post-secondary institutions or post-secondary institutions outside of Utah, when compared to racial and ethnic minority groups, which may skew the comparison to some minority groups in this research. Thus, white high school graduates' post-secondary education enrollment rates could be significantly higher than the rates represented in this research were private and out-of-state institutions included. Furthermore, unbalanced sample sizes in the racial and ethnic data may be producing results that are statistically significant, but not reflective of the truth in real world context.

4.2 | Post-Secondary Migration

There was not strong support for the second hypothesis of this research in the machine learning analyses — migration to Utah higher education institutions was not strongly influenced by the population density of a student's origin. For DGIs, urban origin was the fifth most important predictor of migration (Table 15). However, our secondary migration analysis using logistic regression (Fig. 2) indicated that rural and frontier-based high school graduates were more likely to migrate from their origin service region to either DGIs or CGIs than their urban counterparts. This may be partially due to necessity, as there are fewer DGI options for rural and frontier students near their homes when compared to urban students. Rural and frontier students frequently chose to attend post-secondary institutions in urban areas, as opposed to rural areas (Tables 8 & 13). A higher percentage of rural high school graduates attended a rural post-secondary institution when compared to urban high school graduates. These migration rates out of rural areas to urban areas suggest a workforce deficit in rural regions may occur due to migration out of those

Table 11: Average distance traveled by students enrolling in each CGI by their home rurality category.

Institution Name	Student's Home Rurality	Average Distance Traveled (miles)
Bridgerland Technical College	Frontier	132.2
	Rural	60.9
	Urban	37.6
Davis Technical College	Frontier	149.2
	Rural	64.5
	Urban	32.5
Dixie Technical College	Frontier	125
	Rural	51
	Urban	154.1
Mountainland Technical College	Frontier	79.5
	Rural	75.7
	Urban	36.8
Ogden-Weber Technical College	Frontier	182
	Rural	69.2
	Urban	24.2
Southwest Technical College	Frontier	105.9
	Rural	49
	Urban	186.9
Tooele Technical College	Frontier	30.2
	Rural	64.6
	Urban	60.5
Uintah Basin Technical College	Frontier	133.7
	Rural	147.3
	Urban	40.1

areas to urban areas (Tables 8 &13); though, this study did not assess whether students return home after graduating from their chosen institution.

There were a few general trends that emerged from distance analyses between a student's high school and their chosen post-secondary institutions. High school graduates originating from frontier counties traveled much larger distances to attend their chosen post-secondary institutions, on average. The distance measurement used in this study would likely increase were travel times or road mileage between a student's home and post-secondary institution taken into account. While this study does not take online enrollment into account, which students in remote areas may frequently use, travel distance is another barrier that frontier- and rural-based students face when accessing post-secondary education compared to their urban peers. Living far from home to attend college or commuting each day can be costly and time consuming. On the other hand, there were some rural institutions, such as DSU and SUU, that attract relatively large numbers of urban students from the Wasatch Front region to their campuses, reflected in the high averaged travel distances for urban students at these institutions (Table 11). This ability to travel far from home to attend these campuses likely reflects differences in family income in urban families that may allow for higher travel and rent requirements for these urban migraters.

Table 12: Migration status of enrollees by CGI. Migration is defined as enrollment at an institution outside of a student's home service region.

Technical School	Migration Status	Count	Percentage of Enrollees	Distance Traveled (miles)
Bridgerland Technical College	Did not migrate	1,226	85.44%	36
	Migrated	209	14.56%	70.8
	Total	1,435		
Davis Technical College	Did not migrate	1,895	80.64%	34.3
	Migrated	455	19.36%	42.1
	Total	2,350		
Dixie Technical College	Did not migrate	434	84.44%	42.3
	Migrated	80	15.56%	147.3
	Total	514		
Mountainland Technical College	Did not migrate	2,169	95.72%	35
	Migrated	97	4.28%	95.7
	Total	2,266		
Ogden-Weber Technical College	Did not migrate	1538	81.03%	21.8
	Migrated	360	18.97%	48.3
	Total	1,898		
Southwest Technical College	Did not migrate	248	77.99%	50
	Migrated	70	22.01%	125.4
	Total	318		
Tooele Technical College	Did not migrate	297	94.89%	65
	Migrated	16	5.11%	96.1
	Total	313		
Uintah Basin Technical College	Did not migrate	268	95.04%	141.7
	Migrated	14	4.96%	70.2
	Total	282		

Beyond ACT composite score and urban orgin, different post-secondary institutions were the most influential in determining if a student migrated. Each institution offers slightly different programs of study, which may influence students to remain close to home or their choice to move further to study their chosen field. For example, students who want to study in the agricultural field usually choose to attend USU, since that school has the most offerings available in the agricultural field. Migration to different DGIs may be heavily reliant on the presence of on campus dorms or suitable housing for students nearby. For example, SLCC has low migration, while institutions with on-campus dorms, such as USU, have higher migration. Other post-secondary institutions may cater more to students who are learning English, which will also influence institution choice for those students. High school graduates who chose a DGI instead of a CGI were more likely to migrate (Fig. 2). This may also result from lack of on campus living options at CGIs, or it may be that CGIs offer programs nearby that students are interested in, so there is no need to move away from home.

Race and ethnicity likely play a role in a student's propensity to migrate, though there was no large effect of either race or ethnicity found in our models. Based on the data summaries provided,

Table 13: CGI movement by rurality. Rural, urban, or frontier is based on student's county of high school graduation and the chosen post-secondary institution's physical, main campus. For example, Dixie Technical College is in Washington County, which is designated as 'rural,' so would be designated as a rural post-secondary institution.

Movement Type	Percent by Rurality
Rural High School -> Rural CGI	48.37%
Rural High School -> Urban CGI	43.21%
Rural High School -> Frontier CGI	8.41%
Urban High School -> Rural CGI	1.78%
Urban High School -> Urban CGI	97.96%
Urban High School -> Frontier CGI	0.26%
Frontier High School -> Rural CGI	29.82%
Frontier High School -> Urban CGI	42.93%
Frontier High School -> Frontier CGI	27.25%

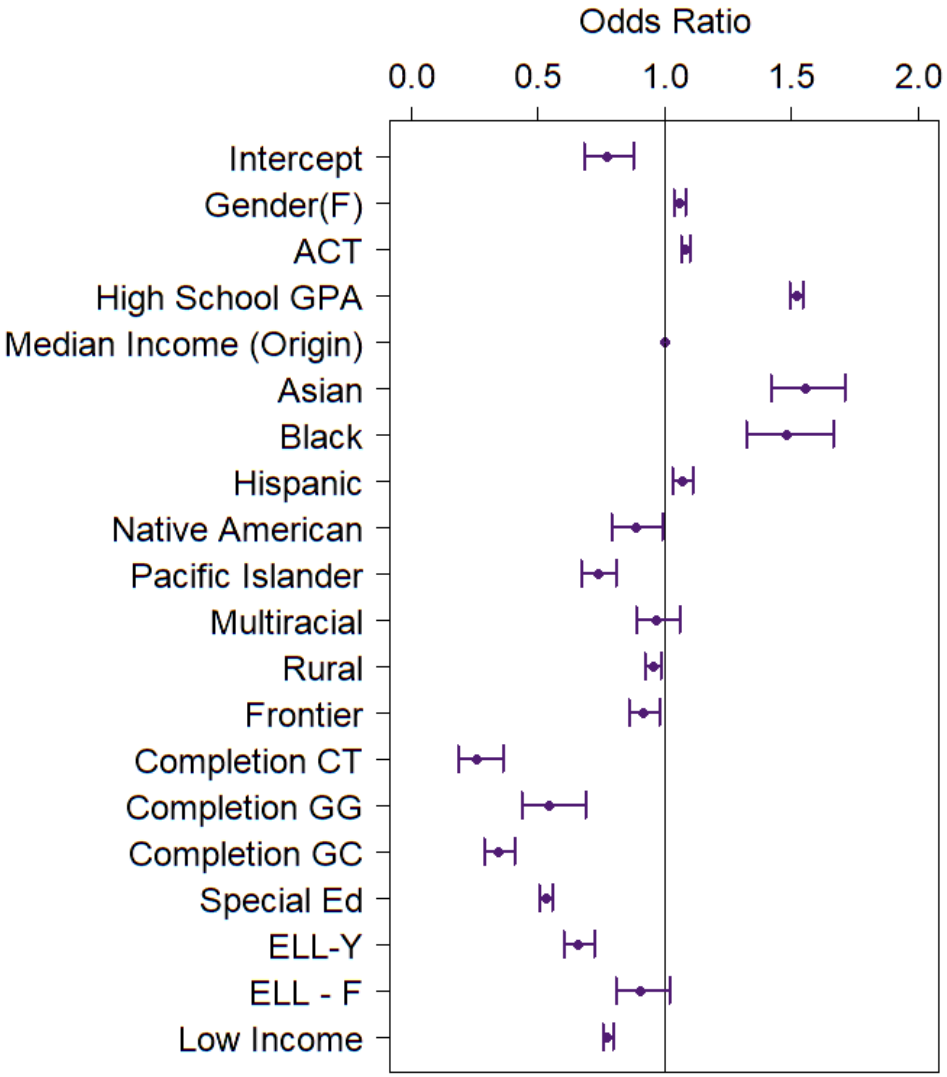

Figure 1: Odds ratios and 95% confidence intervals from the post-secondary enrollment logistic regression model (Objective 2). ELL – Y: English language learner student; ELL – F: Former English language learner student. High school completion codes: CT - Certificate of Completion, GG - Utah High School Completion Diploma (GED), GC - Adult Education Secondary Diploma

low migration in some minority groups may also be a function of where these groups primarily live in the state. For example, Hispanics are concentrated in urban areas of the state, so migration to post-secondary institutions is usually not required for them to enroll or attend. Different cultural norms linked to different groups may also explain disparities in student migration.

5 | Conclusion

In conclusion, graduating with a four-year high school cohort, as opposed to earning an equivalency certificate, was the strongest predictor of whether a high school graduate enrolled in a post-secondary institution following high school graduation. High performing high school students, such as those earning a high GPA or ACT score, were also more likely to attend post-secondary school. Results for race and ethnicity trends in post-secondary school enrollment should be interpreted carefully, since the sample in this study was largely White. Students who faced challenges during their high school career, such as those learning English, receiving special education services, or experiencing low-income economic disadvantages, were less likely to enroll in post-secondary programs. Secondly, ACT composite score and each student's chosen institution were influential in their decision to migrate. Different institutions have different areas where their curriculum excels, so students may be required to move away to attend if their chosen field of study is not offered near their home. High school graduates who chose to enroll in a DGI instead of a CGI were more likely to migrate.

It should be noted that ACT composite score is known to vary with income, where students testing from 2012 to 2016 from familes with annual incomes more than $80,000 had average scores of 23.4, and where students from families earning less than $80,000 a year had average scores of 19.5 (Mattern et al., 2016). For this research, that implies students from higher income families may be more likely to enroll in a USHE post-secondary institution than those from lower income families.

Future research should investigate differences in racial and ethnic minority post-secondary enrollment, migration and completion rates. The results of this portion of the research presented here may not be accurate due to unbalanced sample sizes of racial and ethnic groups. Proximity to or distance to the nearest post-secondary institution based on a student's home address should also be examined in the future, as this study only summarized this data and did not estimate its role in a student's likelihood to attend a post-secondary institution. Median county income was used as a proxy for student income in this research.

Table 14: Parameter estimates and 95% confidence intervals from logistic regression on post-secondary institution enrollment. (* p<0.05, ** p<0.01, *** p<0.001).

Model Term	Estimate	95% Confidence Interval
Gender(F)	1.06***	(1.03, 1.08)
ACT Score	1.08***	(1.07, 1.10)
High School GPA	1.52***	(1.49, 1.55)
Median Income (HS Origin)	1.00***	(1.00, 1.00)
Asian	1.56***	(1.42, 1.71)
Black	1.48***	(1.32, 1.66)
Hispanic	1.45***	(1.32, 1.60)
Native American	0.89*	(0.79, 0.99)
Pacific Islander	0.74***	(0.67, 0.81)
Multiracial	0.97	(0.89, 1.06)
Rural	0.96**	(0.92, 0.99)
Frontier	0.92**	(0.86, 0.98)
HS Completion CT	0.26***	(0.18, 0.36)
HS Completion GG	0.55***	(0.44, 0.69)
HS Completion GC	0.34***	(0.29, 0.41)
Enrolled in Special Education	0.53***	(0.51, 0.56)
ELL - Y	0.66***	(0.60, 0.72)
ELL - F	0.91	(0.81, 1.02)
Low Income	0.78***	(0.75, 0.80)
Intercept	0.77***	(0.68, 0.88)
Observations	131,167	

Since students experiencing hardship associated with low-income were found less likely to enroll in post-secondary education programs, it is also recommended that the impact of each student's individual household income be investigated, as it likely plays a large role in determining post-secondary enrollment. However, at the time of publication, this grain of income data was not available. Finally, if National Student Clearinghouse data becomes available to UDRC in the future, the questions addressed in this research should be re-examined, since a portion of post-secondary students from Utah are not included in this study — those enrolling in private institutions or in out-of-state institutions — due to data limitations.

The factors that predict high school graduates' choices to attend and migrate to a post-secondary

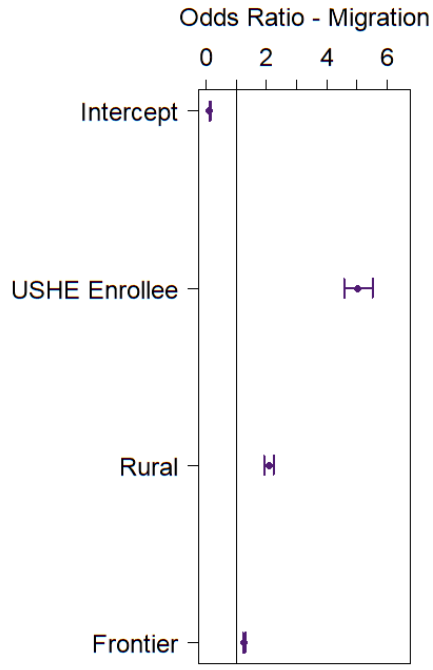

Figure 2: Figure 2: Model estimated coefficients and 95% confidence intervals of the effects of rurality and institution type on migration out of a high school graduate's home service region.

Table 15: Top five important features for USHE migration decision tree classification algorithm (decision tree classifier).

Feature	Importance for model prediction
ACT Composite Score	63.85%
The U	13.11%
WSU	5.36%
SLCC	4.86%
Urban Orgin	4.31%

Table 16: Top five important features for CGI migration decision tree classification algorithm (decision tree classifier).

Feature	Importance for model prediction
Davis Technical College	47.54%
ACT Composite Score	38.35%
Southwest Technical College	3.20%
Ogden-Weber Technical College	3.00%
Bridgerland Technical College	2.46%

Table 17: Coefficients and 95% confidence intervals from the logistic regression model examining post-secondary migration as a function of chosen insitution type (DGI or CGI) and rurality of the high school graduates' counties of origin. (* p<0.05, ** p<0.01, *** p<0.001).

Model Term	Estimate	95% Confidence Interval
DGI Enrollment	5.02***	(4.57, 5.51)
Frontier	2.08***	(1.93, 2.24)
Rural	1.25***	(1.21, 1.30)
Intercept	0.12***	(0.11, .013)
Observations	85,045	

institution are complex. No one or two factors can adequately explain a student's decision to attend a post-secondary institution or to leave their home region to attend an institution. However, some factors are correlated and provide insight to what motivates students in their post-secondary choices.

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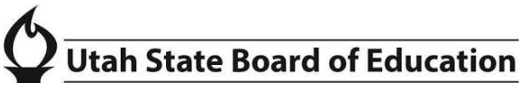
Data Partners



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Appendix A

Table A1: Results from Migration ~ Rurality * Institution type model. This model examines the interactions between rurality and chosen institution type. (* p<0.05, ** p<0.01, *** p<0.001).

Model Parameter	Estimate	95% Confidence Interval
USHE Enrollment	5.25***	(4.69, 5.89)
Frontier	2.54***	(1.62, 3.88)
Rural	1.43***	(1.16, 1.77)
USHE Enrollee*Frontier	0.81	(0.53, 1.29)
USHE Enrollee*Rural	0.87	(0.70, 1.08)
Intercept	0.11***	(0.10, 0.13)
Observations	85,045	

Appendix B

Table B1: Results of the enrollment model with high school graduation year included as a variable. Students graduating in earlier years are slightly more likely to enroll in post-secondary education than those graduating in later years. Earlier high school graduates have had more time to enroll in post-secondary education than those that graduated more recently. (* p<0.05, ** p<0.01, *** p<0.001).

Model Term	**Estimate**	**95% Confidence Interval**
Gender(F)	1.06***	(1.03, 1.08)
ACT Score	1.08***	(1.06, 1.09)
High School GPA	1.53***	(1.50, 1.55)
Median Income (HS Origin)	1.00***	1.00, 1.00)
Asian	1.56***	(1.43, 1.71)
Black	1.48***	(1.32, 1.66)
Hispanic	1.08***	(1.04, 1.13)
Native American	0.88***	(0.79, 0.99)
Multiracial	0.99	(0.91, 1.08)
Rural	0.95***	(0.92, 0.99)
Frontier	0.91***	(0.85, 0.97)
HS Completion CT	0.26***	(0.19, 0.37)
HS Completion GG	0.55***	(0.44, 0.68)
HS Completion GC	0.35***	(0.29, 0.41)
Enrolled in Special Education	0.53***	(0.51, 0.56)
ELL - Y	0.65***	(0.60, 0.72)
ELL - F	0.90	(0.80, 1.01)
Low Income	0.78***	(0.76, 0.80)
HS Grad 2014	0.92***	(0.89, 0.95)
HS Grad 2015	0.79***	(0.76, 0.81)
HS Grad 2016	0.72***	(0.70, 0.74)
Intercept	0.92	(0.81, 1.04)
Observations	131,167	